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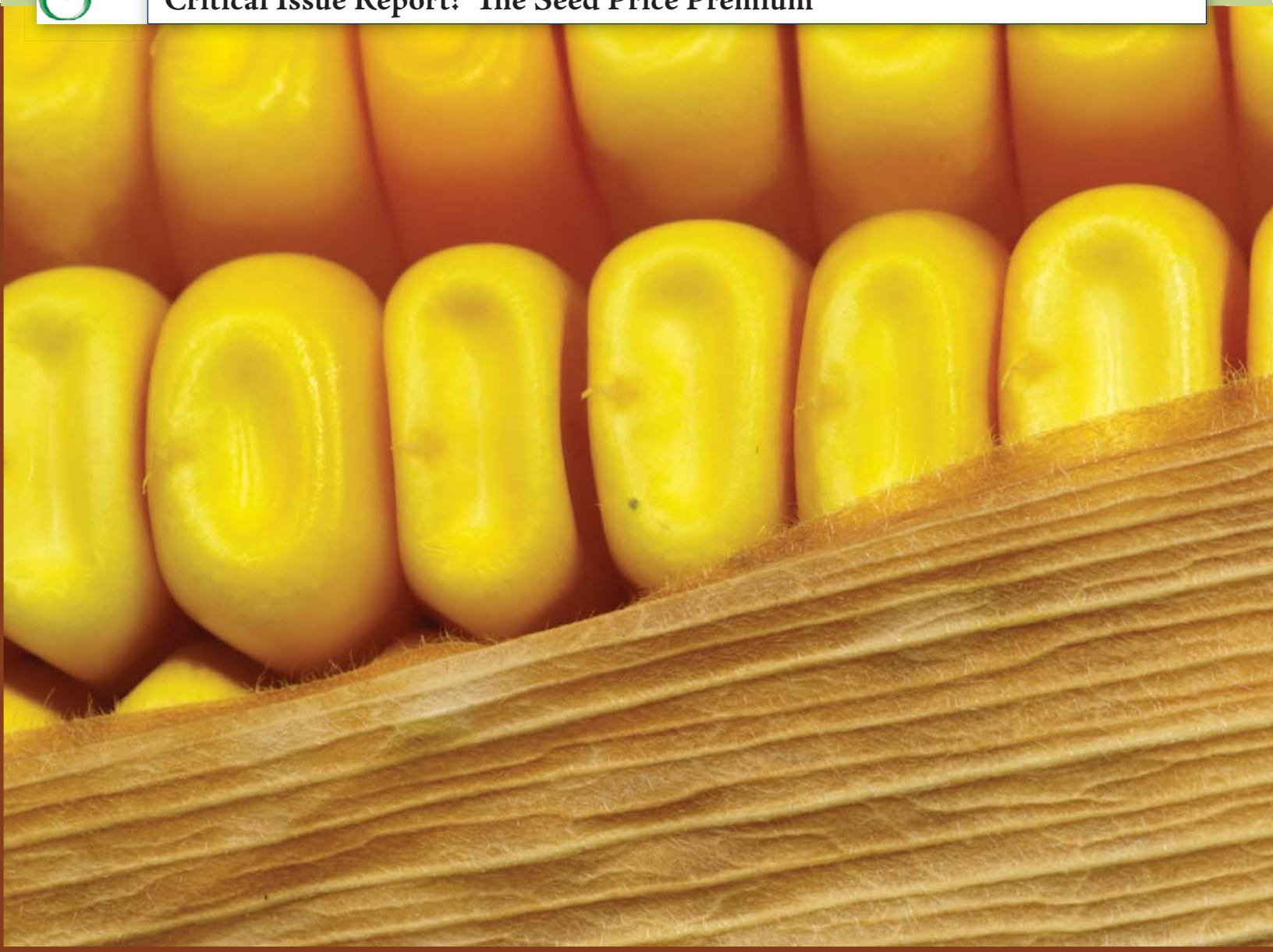
Critical Issue Report: The Seed Price Premium



The Magnitude and Impacts of the Biotech and Organic Seed Price Premium

by Charles Benbrook

December 2009

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The "Seed Premium-Farm Income Database" is accessible on The Organic Center's website at – http://www.organic-center.org/reportfiles/Seed%20Premium-Farm%20Income%20Database.pdf

FOREWORD

The Organic Center recently issued a "Critical Issue Report" on the impacts of genetically-engineered (GE) corn, soybean, and cotton varieties on pesticide use in the United States from 1996 through 2008. This 69-page report is called "Impacts of Genetically Engineered Crops on Pesticide Use: The First Thirteen Years," and is accessible on The Organic Center website (http://www.organic-center.org/science.pest.php?action=view&report_id=159).

During the research phase of the "First Thirteen Years" report, information surfaced on the steep upward trajectory in the price of GE seeds, especially in recent years. Recently announced GE seed price increases for the 2010 crop season have triggered discussion, often spirited, among farmers growing GE crops. The basic issue boils down to whether the high and rising prices of GE seeds are justified by either increased yields, lower pest management costs, or some combination of both.

Opinions differ and are likely to remain divided for some time, until sufficient, trustworthy, independent field trial data emerges to settle core questions about differences in GE crop yields and production costs compared to their closely related, but non-GE conventional seed counterparts.

Similar questions abound about the premiums paid for production inputs used by organic farmers, including seed, not to mention the premium prices paid for organic animal feeds and human foods.

This report is a first step in placing into perspective the magnitude and significance of the premiums now paid by biotech and organic farmers for GE and organic seed. The size of these premiums are analyzed and compared, relative to the cost of conventional corn and soybean seeds. The impacts of the premiums on farm income and operating costs are also placed in perspective.

One thing is certain. The markets for GE and organic seeds are volatile and an important debate is underway, worldwide, about the nature of value embedded in each.

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1. Executive Summary

The novel traits embedded in newly introduced seed varieties are a vital source of innovation on the farm that has traditionally served the collective interests of farmers and consumers, and hence society as a whole. But now, a handful of privately held seed companies control the critical biotech patents and supplies of seed germplasm, and decide, for the most part, how seed breeding technology is used, and critically, for what purpose.

Since the early 1990s, corn, soybean, and cotton breeders in the U.S. have focused predominantly on the incorporation into elite germ plasm of proprietary pest management-related traits, using the tools of biotechnology. GE seeds now account for the vast majority of the new seed varieties offered for sale by the major seed companies each year. Other important goals traditionally pursued by plant breeders have taken a back seat.

This report highlights the seed price and farm income consequences of this historic shift in control over plant breeding from the public sector, and goals advancing public welfare, to the private sector and its basic goal, which is, by law, maximizing return to shareholders' equity through expanding market share and profit margins.

All the data and calculations in this report are derived from the "Seed Premium-Farm Income Database" compiled by The Organic Center. Appendix A in this report briefly describes the data elements and sources of data incorporated in this database. The full database is available free of charge via the The Organic Center's website (http://www.organic-center.org/reportfiles/Seed%20Premium-Farm%20Income%20Database.pdf).

A. The Biotech and Organic Seed Price Premiums

In the case of soybeans, farmers have traditionally paid about a two-fold premium for purchased soybean seed, compared to the price of soybeans. The ability of farmers to plant last year's soybeans to produce the next year's crop has kept a lid on soybean seed prices, at least until the GE era.

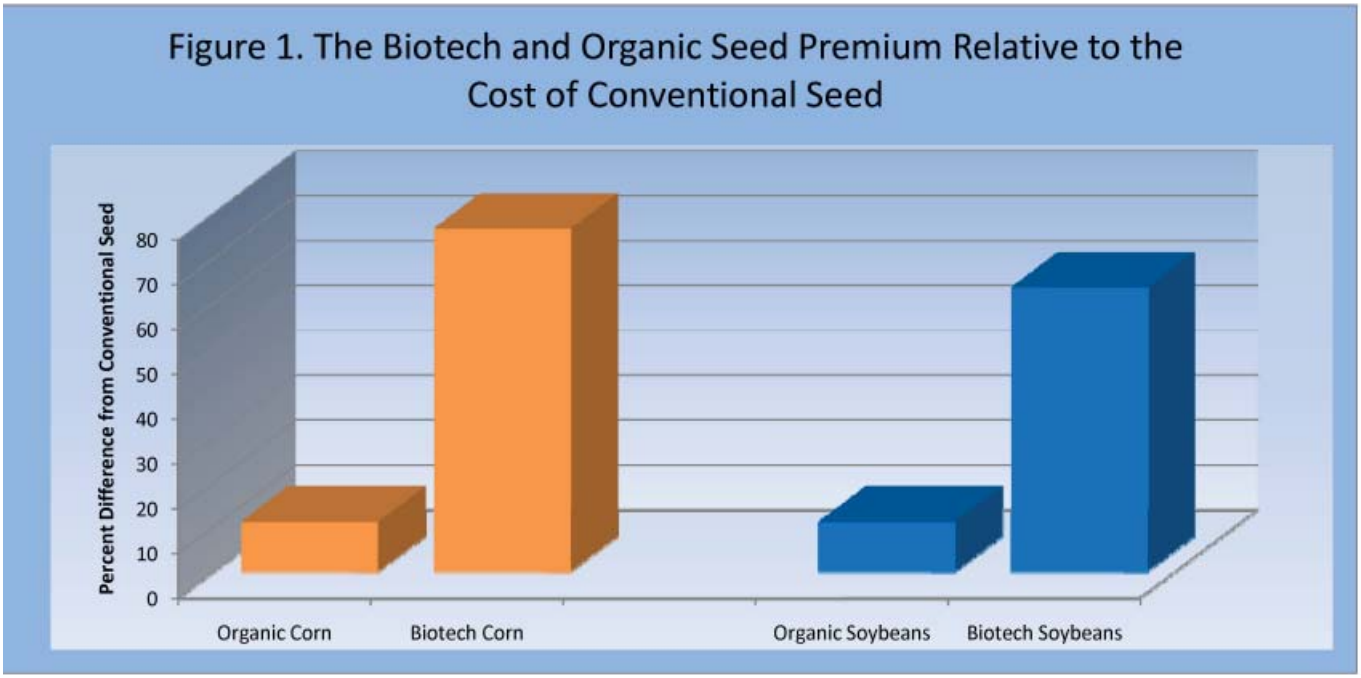
In 2006, the GE soybean seed price premium, relative to the price of soybeans, had reached 5.5. The conventional seed-to-soybean price premium was 3.7.

Farmers purchasing the most closely followed new soybean seed product in 2010 – Monsanto's Roundup Ready (RR) 2 soybeans – will pay 42% more per bag than they paid for RR soybeans in 2009. The RR 2 soybean seed-to-soybean price ratio will be around 7.1, over three times the historic norm.

For conventional farmers planting saved soybean seed – an option precluded by purchase of GE seeds – the seed-to-soybean price premium will be about 1.2 in 2010.

In the 25 years from 1975 through 2000, soybean seed prices rose a modest 63%. Over the next ten years, as GE soybeans came to dominate the market, the price rose an additional 230%. The $70 per bag price set for RR 2 soybeans in 2010 is twice the cost of conventional seed and reflects a 143% increase in the price of GE seed since 2001.

The organic soybean seed price premium, compared to conventional seed, is much smaller and will stand at about 11.2% in 2010. The GE seed price premium is projected at 63.5%. Accordingly, the biotech seed price premium exceeds the organic seed price premium by 5.7-fold, as shown in Figure 1.



The story is similar in the case of conventional and GE corn seed. In 2009, the GE corn-to conventional corn seed premium was 69%, with GE seeds costing $235 per unit. Conventional corn seed prices were less than $100 per unit through 2007.

Corn growers planting the first-ever, eight-trait, stacked GE variety – so-called "SmartStax" corn – will pay 2.1-times more per unit than farmers planting conventional seeds, and almost four-times more than conventional farmers just ten years earlier.

Organic corn seed is much cheaper than GE seed, with the 2010 organic price premium at about 11%, as in the case of organic soybeans. The biotech seed price premium is 6.9-times bigger than the organic seed price premium in the case of corn hybrids.

GE cotton seed price inflation has dwarfed the pace of increases in the price of GE soybean and corn. From 1975 through 1996, the price of cotton seed only doubled, but in the GE cotton era, it has risen from $73 to $589 per CWT. Today, GE cotton seed costs $700 per CWT, an amazing 5.9-fold more than conventional cotton seed.

B. Impacts on Farm Income

By any measure, the steeply upward trajectory in the price of GE seeds in the last few years has started to cut into average net farm income. From 1975 through 1997 soybean farmers spent 4% to 8% of crop income on purchased seed. In 2009, farmers planting GE soybean seeds spent 16.4% of soybean cash market income per acre on seed – twice the historic norm. Farmers planting RR 2 soybeans in 2010 will commit a projected 22.5% of gross income per acre to the purchase of these GE seeds, as shown in Table 1, on page 3.

Corn growers spent 4% to 11% of gross market income per acre on seed from 1975 through the beginning of the GE era in 1996, and 12% to 15% of operating costs per acre. Since 1996, the price of conventional seed has risen just marginally above historic levels as a percent of gross income and operating expenses.

GE corn seed, on the other hand, has become much more expensive as a percent of gross income and operating costs. In 2009, GE corn seed accounted for 19% and 34% of gross income and operating costs per acre, about twice historic norms.

Table 1. Impacts in 2010 of Conventional and Biotech Seed Expenditures per Acre on Farm Production Costs and Income

	Percent Gross Crop Income per Acre	Percent Operating Costs per Acre	Percent Net Returns per Acre*
CORN			
Conventional Seed	11%	19%	24%
Biotech Seed	19%	34%	43%
SmartStax Corn Varieties	23%	41%	51%
SOYBEANS			
Conventional Seed	12%	33%	18%
Biotech Seed	19%	54%	29%
Roundup Ready 2 Seed	22%	64%	35%
COTTON			
Conventional Seed	5%	4%	-15%
Biotech Seed	32%	23%	-88%

* There is a projected $127.98 net loss per acre of cotton production in 2010. Hence, seed expenditures per acre in 2010 are expressed as a negative number.

The cost of GE cotton seed has helped drive net farm income on cotton farms into the red since 2008, the year when net returns equaled just $31.05 per acre. In the GE era, average net returns on cotton farms have dropped by roughly $200 per acre and the cost of GE cotton seed has increased almost $100 per acre.

Obviously, many factors have contributed to the declining profitability of cotton production, but two of the most important are increases in seed costs and the need to apply, and pay for more herbicides in an effort to control glyphosate-resistant weeds, particularly in the Southeast.

If these GE seed price and income trends continue, the consequences for farmers will be of historic significance, as dollars once earned and retained by farmers are transferred to the seed industry.

As farm income falls, less money will be available for investing in the sustainability of America's farms and farm families. If and as GE-related seed industry profits continue to rise, the ability and determination of the industry to continue exploiting biotechnology to increase GE trait penetration and seed profit margins will be strengthened, as will the industry's control, economically and politically, over the goals driving investments in plant breeding.

In a September 15, 2009 speech, Monsanto CEO Hugh Grant reaffirmed the company's goal of doubling gross profits in 2012, from 2007 levels.[1] He stated that increases in the price of new RR 2 soybeans and "SmartStax" corn hybrids will create about one-third of the company's gross profit growth in 2012. Net farm returns are likely to be the primary source of these new profits.

The sizable difference in the GE and organic seed premiums, and their vastly different impacts on net farm returns, are sure to invite closer scrutiny of the productivity and profitability of organic farming systems compared to farms planting GE-seeds. The need is acute for more independent data and unbiased, credible assessments of how organic and biotech-based farming systems can best contribute to global progress toward food security for all.

1 Yahoo! Finance, September 16, 2009, http://finance.yahoo.com/news/Monsanto-reaffirms-goal-to-apf-391777231.html?x=0&.v=1

At the present time there is a massive disconnect between the sometimes lofty rhetoric from those championing biotechnology as the proven path toward global food security and what is actually happening on farms in the U.S. that have grown dependent on GE seeds and are now dealing with the consequences.

2. Trends in Seed Prices and Seed Price Premium

One of the worrisome issues associated with GE crops among conventional farmers in America is the growing share of corn, soybean, and cotton income required to cover the cost of GE seeds. Here, USDA data is analyzed on trends in the price of "all seeds", conventional seed, and GE, or what USDA labels "Biotech" seeds.

The category "all seeds" encompasses all sorts of seeds sold in a given year. From 1975 through 2000, seed price data from USDA is reported only for "all seeds," but since 2001, the Department reports average prices for all seeds, conventional (non-GE), and biotech seeds. Corn seed price data is based on a "unit" containing about 80,000 seeds. Soybean seed is sold by the 60 pound bushel, containing approximately 150,000 seeds. Cotton seed is sold by hundred weight (CWT), with each CWT containing about 425,000 seeds.

A. Soybeans

Traditionally, farmers have saved soybeans from one year's harvest for cleaning and planting the next year, a practice often referred to as "brown bagging" seed. This is why for many years the price of soybean seed has not risen appreciably above the price of a bushel of soybeans, plus seed cleaning costs.

Every third or fourth year, farmers would purchase some new soybean seed, particularly if a promising new variety had been recently released, to grow on a portion of their land. If the variety performed well, the farmer would save some or all of the harvest for seed the next year, or purchase additional seed to plant the new variety on all fields. According to an Ohio State University soybean expert, Jim Beuerlein, each acre devoted to soybean seed production will plant about 30 acres the next year. [1]

The Seed-to-Soybean Price Ratio

In the 1980s, soybean prices averaged about $6.00 per bushel, and soybean seed cost about $12 per bushel. Accordingly, there was about a 2-fold premium paid for soybean seed relative to the cash price paid for soybeans. "Brown bag" seed cost farmers about $8.00 per bushel of usable seed, taking into account the cost of cleaning seed and the loss of some cracked, too small, or miss-shaped seeds in the cleaning process.

In 1995, the year before the first GE varieties were marketed, soybean seed cost $13.60 per bushel, and soybeans sold for $6.72 per bushel, for a seed-to-soybean premium of 2.02, still consistent with the historic norm.

1 Candace Pollack, (2009) "Interest in Non-Genetically Modified Soybeans Growing," Ohio State University Extension, April 3. Access at: http://www.ag.ohio-state.edu/~news/story.php?id=5099

Dramatic inflation in the GE seed-to-soybean premium occurred in step with the adoption of Roundup Ready (RR) soybeans. By 2001, the first year USDA reports the average price of GE soybean seeds, the GE seed-to-soybean premium was 5.4, based on average GE soybean seed prices of $23.90 and the relatively low average soybean market price of $4.38 that year. For farmers planting conventional soybeans, the conventional seed-to-soybean ratio was 4.1, elevated because of the low yields, but not as much as in the case of GE soybeans.

By 2005, the seed industry had introduced the RR trait into nearly all soybean varieties and 87% of national soybean acres were planted to RR seeds. The industry took advantage of the lack of alternatives and the popularity of the RR weed management system by escalating the pace of increases in GE soybean seed prices.

The 2005 GE seed-to-soybean price ratio was 6.1, while the conventional seed-to-soybean price ratio was 3.4, a level close to the historic norm.

Four years later in 2009, the cost of GE soybean seed had risen to $49.60 a bushel. That year, soybeans fetched $9.00 in the market, resulting in a GE seed-to-soybean price ratio of 5.5. The conventional seed-to-soybean ratio was 3.7.

Monsanto recently announced a major increase in GE soybean seed prices in 2010.[2] RR 2 soybean seed will cost around $70.00 per bushel in 2010, 42% above the price for RR seeds in 2009. Assuming no change in the soybean market price in 2010, the GE seed to soybean ratio next year will be round 7.1.

Farmers that plant purchased, conventional soybeans in 2010 will have a seed-to-soybean price ratio of about 3.6, taking into account the average $1.00 per bushel premium paid for non-GE soybeans.

2 http://www.bloomberg.com/apps/news?pid=20601103&sid=aLW8VZBkP3PA#

Farmers planting "brownbag" conventional seed from their 2009 harvest will have a seed-to-soybean ratio of about 1.2. Farmers planting GE soybeans forego the right to plant "brown bag" GE seed as a consequence of signing the technology agreements required by all companies selling GE seeds.

Seed Price Changes

In the 25 years from 1975 to 2000, the all soybean seed price rose about 63%. In the next ten years, the price rose another 230%. Over the full 35 years (1975-2009), the average all soybean seed price rose from $10.50 to $48.30 per bushel.

Since 2001 when the NASS started reporting the price of conventional and biotech seed separately, GE soybean seeds have risen in price 72%, from $28.80 to $49.60, while conventional soybean seeds have risen 88%, from $17.90 to $33.70.

At $70.00 per bag, RR 2 soybean seed in 2010 will cost farmers twice as much as conventional seeds, and reflect a 143% increase in the price of GE soybean seed since 2001.

Organic soybean seed, on the other hand, is 30% to 50% cheaper than GE seeds. The projected average cost of organic soybean seed in 2010 is $40.46, a level that reflects just an 11% premium over the $36.40 price of conventional seeds.

The GE seed premium that year, compared to conventional seeds, is 64%. Accordingly, in 2010, the GE-to-organic price premium differential is 5.7 (63.5 divided by 11.2). If the price of RR 2 seed were used in this calculation, the GE-to-organic price premium differential would be 8.5.

Given the much steeper upward trajectory in GE seed prices compared to organic seed prices, this differential is likely to grow larger in the years ahead.

B. Corn

Unlike soybeans, most corn farmers purchase new hybrid corn seed every year. They do so because of strong evidence that hybrid corn yields exceed yields in fields planted to what is called "open-pollinated" corn. In recent years in some trials, some open-pollinated varieties have performed well, producing yields nearly as high as the top-yielding hybrids in some yield trials.

In fact, under equally ideal growing conditions, including little pest pressure, yields are often nearly the same between the best open-pollinated and hybrid varieties adapted to an area. The hybrids tend to perform more consistently, however, in years with less than ideal conditions, when plants are subjected to moderate to serious drought, weed, insect, or plant disease pressure.

For the most part, corn yields have risen in step with increases in the number of seeds planted per acre. The "Seed Premium- Farm Income Database" includes a line reporting the average pounds of corn harvested per seed planted from 1975 through 2010. Each corn seed produced 0.22 to 0.32 pound of corn from 1975 through 2010. The highest production per seed (0.32) occurred in 2004, a year with record-high corn yields. About one-third of a pound of corn was harvested per seed planted in three other years: 1982, 1985, and 1994. Over the past 35 years, the average pounds of corn harvested per seed planted is essentially unchanged, despite some fluctuation from year to year as a result of weather-driven changes in yields. There is no evidence yet that GE seeds have shifted this trend line one way or the other.

By breeding hybrid varieties that thrive in denser plantings, the seed industry has steadily increased average corn yields – but not corn yield per plant. Moreover, in most well designed trials with comparable seeding rates per acre, there is little or no difference between the yield per plant grown from an open-pollinated versus hybrid seed, a GE versus conventional seed, or a conventional versus organic seed.

Over the last 35 years, the average "all corn" price of seed has risen 4.9-fold, from $36.50 per unit (80,000 seeds) in 1975 to $217.00 per unit in 2009. The USDA started surveying and reporting the cost of biotech seeds in 2001. In that year, the average price of GE seed was $110.00, compared to $85.30 for conventional seed. The GE corn seed-to-conventional seed premium was therefore 29%.

In 2009, the GE corn-to-conventional corn seed premium had shot upward dramatically to 69%, with GE seeds averaging $235.00 per unit and conventional seeds, $139.00.

Corn growers planting the new, eight-stack "SmartStax" corn hybrids in 2010 will be paying even more -- $320.00 per unit. SmartStax corn will cost 2.1-fold more than conventional seeds, and nearly four-times more than conventional corn seed just 10 years earlier.

Just as the case with soybeans, organic corn hybrids are much cheaper than GE seeds. On average in 2010, organic corn will cost about $170 per bag, while GE corn will cost, on average, $270.25 per bag.

The GE-corn seed premium in 2010, compared to conventional seed, will be 76.7%, while the organic corn seed-to-conventional premium will be just 11.2%. As a result, the GE seed-to-organic seed price premium differential will be 6.9 in 2010.

C. Cotton

Over the last 35 years, the average price of one hundred pounds of cotton seed has risen from $33.60 to $589, or 17.5 fold. But from 1975 through 1996, the year GE cotton was first sold, the price had nearly doubled. In the GE era from 1996 through 2010, the price skyrocketed from $73 to $589 per CWT.

Cotton seed price inflation has been driven largely by GE trait "technology fees." In 2001 when the average GE cotton variety included about 1.5 traits, GE cotton seed cost $217 per CWT, compared to $87 for conventional seed (i.e., 2.5-fold higher). By 2010, GE trait penetration had reached nearly three traits per cotton seed variety and seed prices had escalated to $700 per CWT, while conventional seeds had risen more incrementally to $119, resulting in a remarkable 5.9-fold premium for GE cotton seed, compared to conventional seed.

There is very little organic cotton seed sold commercially in the United States, and hence no basis to calculate an organic cotton seed premium.

3. Impacts of Rising Seed Costs on Farm Income

Market prices for corn and soybeans approached or exceeded historic highs in 2008 and were more than double the recent 10-year average. Price-driven euphoria among corn and soybean growers buffered the shock of also record-high fuel, fertilizer, and crop input prices, including high and rising GE seed prices.

The cotton market, however, was relatively stable. The $0.55 per pound average cotton price in 2008 was good, but not as good as 2003 ($0.62).

The rising volatility in most crop and input prices in recent years has produced wider swings up and down in net farm income. The consequences of the steeply rising cost of GE seeds for American farmers in the last few years can only be understood in the context of this heightened economic variability – and vulnerability – down on the farm.

There are three widely used ways to assess changes over time in the cost of an input like seeds relative to crop income and other farm expenses:

1. The cost of a single input, or class of inputs like seeds and pesticides, expressed as a percent of gross income.

2. The cost of an input, or class of inputs, as a percent of operating costs.

3. The cost of an input, or class of inputs, relative to net returns from crop production (gross crop income minus operating costs).

Clearly, farmers are better off when all three measures are headed downward. When costs of an input are rising relative to others and gross and net income, farm level profit margins are usually squeezed. Exceptions can arise when the input increases yields, and hence income. Installation of an irrigation system is an example. Water pumping costs will rise as a percent of total operating costs and net and gross income, but both net and gross income will hopefully rise more than enough to offset the added costs of irrigation.

For this reason, several measures of farm level input costs and returns, like the three listed above, should be monitored collectively to produce more reliably judgments on whether a given investment or input "penciled out" (i.e., increased per acre profit).

A. Three Measures of Seed Expenditures

Soybeans

Soybean farmers spent about $8.32 per acre in 1975 when they purchased soybean seed. That year, gross soybean crop income averaged $141.70 per acre. Accordingly, soybean seed expenditures accounted for 5.9% of gross income per acre. From 1975 through 1997, the cost of soybean seed accounted for 4% to 8% of gross soybean crop income per acre.

In 1998 GE soybeans were planted on 44% of national soybean acreage. Soybean seed expenditures averaged $20.46 and crop income was $191.78. The cost of soybean seed as a percent of gross income was 10.7%, well above the historic range of 4% to 8%.

Crop year 2001 was the first year for which NASS reports seed expenditures separately for GE and conventional seeds. Conventional and GE seed costs per acre were $19.53 and $26.08 respectively, or 11.3% and 15% percent of gross soybean income

per acre. In short, seed expenditures were taking a much larger slice out of the gross income "pie."

In 2009, average national soybean yields were relatively high (41.4 bushels per acre) and average prices were very strong, at $9.00 per bushel, producing average gross market returns of $372.60 per acre. Conventional soybean seed cost $41.56 and GE seed $61.17 per acre, accounting for 11.2% of gross crop income in the case of conventional seed, and 16.4% for GE seeds.

In the 2001-2010F time period, the cost of conventional soybean seed per acre returned close to historic levels, ranging from 8% to 12% of gross income per acre. The cost of biotech seeds, however, accounted for 14% to 19% of gross income. Well above the historic norm for conventional seeds.

Farmers purchasing RR 2 soybeans in 2010 will pay an estimated $84.52 per acre of seed, an expenditure equivalent to a remarkable 22.5% of gross crop income.

The recent upward trend in the share of operating costs accounted for by soybean seed expenditures is dramatic. All seed expenditures as a percent of operating costs fluctuated between 13% and 23% in the pre-GE seed era (through 1996), but then the share rose to 35% to 36% from 2002 through 2008. In 2009 and 2010, all soybean seed costs account for 46% and 51% of operating costs per acre – more than double their historic share.

The cost of conventional seeds as a percent of operating costs rose marginally from 1996 through 2008, ranging from 19% to 29%, and will reach an estimated 33% in 2010F. Biotech seed expenditures accounted for 32% to 54% of operating costs from 2001 through 2010F.

Seed expenditures per acre as a percent of net soybean crop income are also following a precipitous trajectory for soybean farmers. From 1975 through 1997, all seed costs per acre accounted for 4% to 13% of net crop income per acre. Conventional seed costs per acre ranged from 11% to 18% from 1998 through 2010F, while biotech seeds accounted for 17% to 29% of net farm income in this same period.

The soybean income forecast for 2010 is based on relatively high per acre yields (41.8 bushels) and strong prices ($9.00 per bushel). In the last decade, average soybean yields have been lower than 41.8 bushels in seven years and the market price has been below $9.00 per bushel in all years except 2008. The price has been below $5.00 per bushel in four years since 1998.

If soybean yields and prices are just average in 2010, gross income per acre would drop from the forecasted $376.20 per acre to around $234 per acre (36 bushels at $6.50 per bushel). Under those conditions, the cost of biotech soybean seed will account for 19% of gross income per acre and 70% of net return from crop sales.

Corn

Corn farmers spent between 4% and 11% of gross income per acre on seed from 1975 through 1996 and the beginning of the GE-seed era. For farmers purchasing conventional seeds from 2001 through 2010F, seed costs ranged from 7% to 11% of gross income per acre, while farmers planting GE seeds spent the equivalent of 10% to 19% on seed.

All seed costs accounted for 12% to 15% of corn operating costs per acre from 1975 through 1996. From 1997 through 2010F, conventional seed expenditures were 14% to 20% of operating costs per acre, just slightly above the historic norm. The cost of biotech seed, on the other hand, rose to represent 23% to 34% of operating costs per acre.

From 1975 through 1997, all corn seed costs accounted for 7% to 20% of net corn crop income per acre (except for 1986, a year when low prices drove down net returns per acre to far below the historic norm). In the biotech era, this all-seed percent has ranged from 11% to 35% as a percent of net farm income. Conventional corn seed costs per acre have accounted for 14% to 19% of net crop income from 2001 through 2010F, and biotech seed costs have ranged from 17% to 44% in the same period.

Based on recent USDA forecasts, gross corn income per acre in 2010 is expected to be $550 per acre, based on yields of 157 bushels per acre and average cash prices of $3.50 per bushel. Cash operating costs will be around $305 per acre, resulting in net returns of $245 per acre of corn. This pool of net earnings must cover several other fixed operating costs including land, labor, management, and taxes and insurance, and still hopefully provide the farmer a profit margin.

But if yields are only average for the last decade (about 145 bushels) and market prices slip to $3.00 per bushel, gross income will fall to $435 per acre and net income over operating costs will drop to around $130 per acre. Under these conditions, the cost of biotech corn seed per acre will account for 81% of net returns per acre. This will leave only around $26 per acre to cover all other fixed costs, clearly far short of what is required.

Growers planting "SmartStax" corn seed in 2010F will be even more dependent on relatively high yields and prices to turn a profit. "SmartStax" corn hybrids will cost about $20 more per acre than other GE seeds. The $124 per acre cost of SmartStax seed per acre will account for one-half of net return per acre, even with good yields and prices. Under the moderate yield and price scenario, the cost of SmartStax corn seed alone will about equal net returns per acre.

Cotton

Expenditures on all cotton seed ranged from 2% to 4% of gross income per acre through 1998. Since 2001, conventional cotton seed has accounted for 3% to 10% of gross income per acre, and just 5% in 2010F. Biotech seeds take a bigger slice of gross cotton crop income per acre, ranging from 11% to 32% in the 2001-2010F period.

All seed expenditures accounted for 3% to 6% of cotton operating costs per acre from 1975 through 1996. This share remained essentially unchanged through the biotech era, and is projected at 4% in 2010F. Biotech cotton seed prices spike upward rapidly throughout the biotech era. In 2001, GE cotton seed accounted for 19% of operating expense per acre, a share that rises to 23% in 2010F.

Conventional cotton seed accounted for 4% to 11% of net farm income through 1998. The economics of cotton production entered a volatile period in 1999, a year when conventional seed accounted for 66% of net farm income.

The cost of biotech cotton seed has risen sharply compared to conventional seed. In 2001, GE seed cost 2.5-times the price of conventional seed per CWT. In 2006, the ratio reached 3.8. In 2007, cotton farmers spent 5.9-times more for GE cotton seed, compared to conventional seed. The increase in seed costs since 1996 for GE cotton farmers has been around $100 per acre planted. GE seed price inflation has clearly contributed to the changing economics of cotton production, resulting in negative returns on the order of $128 per acre in 2009-2010F.

B. The Organic Seed Price Premium

Like biotech seeds, organic corn and soybean seeds are sold at a premium above the price of conventional seeds. The purchase of organic seed is a gateway to the higher prices paid for organic corn and soybeans, whereas farmers planting biotech seeds receive open market prices for conventional corn and soybeans.

Data was compiled from the major companies offering organic corn and soybean seeds. Multiple organic corn varieties were sold in 2003, and prices for two or more organic soybean varieties were available from 2004 through 2010F.

In 2003, organic corn seed varieties ranged in price from $85 to $120 per unit, and averaged $107.48. Conventional seed sold for an average price of $90.90 per unit that year, resulting in an average premium for organic seed of 18.2%. From 2003 through 2010F, the organic seed premium, relative to the price of conventional seed, ranged from 11% to 25% and averaged 20%.

Organic soybean farmers also paid a modest price premium for organic seed, compared to conventional seed. From 2004 through 2010F, the premium ranged from 11% to 32%, and averaged 19%.

C. The GE and Organic Price Premium in Perspective

In the case of corn, the organic seed premium, compared to conventional seed, averaged 20% from 2003 through 2010F. The biotech seed premium relative to conventional seed averaged 51% in the same period and is projected to reach 77% in 2010F. Accordingly, the biotech seed premium has been about 2.5-fold larger than the organic seed premium in recent years.

The organic soybean seed premium averaged 19% from 2004 through 2010F relative to conventional soybean seed, while farmers planting biotech seeds paid an average premium in this period of 66% compared to conventional seeds. So, the biotech soybean seed premium has been, on average, 3.5-fold larger than the organic seed premium in this time period.

The biotech seed premium is clearly much larger than the organic seed premium and it is likely to grow larger still, in step with the steep upward trajectory in GE seed prices. The rising cost of GE seeds is also cutting into net farm income per acre. In years when crop growing conditions are favorable and prices are strong, the added cost of GE seeds are not a dominant factor driving net returns on a per acre basis, but in years with average or lower yields and/or low prices, the GE seed premium can substantially cut into net farm income, and can help push farmers into the red.

Many farmers remain loyal to GE seeds, despite their markedly higher costs and little or no impact on crop yields and income per acre in most years. The two major reasons why are the simplicity and effectiveness of weed management in fields planted to herbicide-tolerant crops, and second, the added protection against insect feeding damage in the case of *Bt* corn and cotton.

Incrementally though, the emergence and spread of glyphosate-resistant weeds is undermining the RR system's simplicity and effectiveness, and driving herbicide use and weed management costs upward. For GE cotton and soybean farmers in the Southeast, the RR system has become complicated, costly, and much less effective than the case in the first few years of commercial adoption.

No one knows whether resistant weeds in the Midwest will become as serious, and costly to deal with, as they have become in the Southeast, but current trends in the number of resistant weeds found on Midwestern farms, as well as the number of fields and acres infested, are worrisome. In short, the biotech seed premium is growing larger despite the eroding efficacy and higher costs of the RR system.

The organic seed premium, on the other hand, helps farmers gain access to the higher prices typically paid for organic corn and soybeans. In a special survey of both conventional and organic soybean farmers in 2007, the USDA's Economic Research Service found that conventional soybean farmers harvested, on average, 46 bushels per acre and organic farmers produced 30 bushels per acre. The conventional soybeans were sold for an average price of $5.53, earning $254.38 per acre.

The organic soybeans were sold for a much higher price -- $14.47 per bushel – resulting in gross income from the market of $434.10 per acre, 71% more than the gross receipts on conventional soybean farms.

Operating costs on the organic soybean farms averaged $86.88 per acre, about 7% less than the $93.42 average operating costs on the conventional soybean farms. The organic farms reported an average net return per acre (gross receipts minus operating costs) of $347.22, while the conventional farmers earned net returns of $160.96 per acre.

Accordingly, at this time, the organic seed premium is modest and serves as a gateway to a production system that increases net returns per acre, and dramatically so on organic farms that have mastered the art and achieve crop yields close to those on neighboring conventional farms. The biotech seed price premium, on the other hand, has risen steeply during an era when the benefits of herbicide-tolerant technology have slipped.

The steep price increases recently announced for RR 2 soybeans and "SmartStax" corn seeds in 2010 have triggered a long overdue assessment of the fairness of the pricing structure for GE seeds. Farmers are both participating actively in this debate and closely watching its outcome.

Appendix A. The Seed Premium-Farm Income Database

A database was compiled in order to track trends in the price of conventional, genetically engineered (GE), and organic corn, soybean, and cotton seed per bag or unit and per planted acre, as well as to place expenditures on different types of seed in perspective relative to gross and net farm income, and farm production expenses.

The database runs from 1975, the first year for which USDA reports seed prices, through forecasted values for 2010. In 2001, the USDA began to survey, and report separately, prices for conventional and biotech corn, soybean, and cotton seeds. Sufficient data on the cost of organic corn and soybean seed is available beginning in 2003 for corn and 2004 for soybeans to establish average organic corn and soybean prices. There is very little organic cotton seed sold in the United States at the present time, and hence no basis to establish an average price.

A section of the database covers each of the three primary GE crops: corn, soybeans, and cotton. The data elements within each of these sections are similar and are described herein, and data sources are identified.

Seed Prices per Bag/Unit/CWT

Average annual seed prices per bag or "unit" for "all seeds" are recorded from 1975 to 2009, and are from the National Agricultural Statistics Service (NASS) agricultural prices reports or industry reports. Prices in 2010 are forecasted and/or are based on industry reports and recent trends. The basis for changes in seed prices are recorded by type of seed in the "Notes" column in the database.

In the case of corn, a bag/unit of seed contains approximately 80,000 seeds. For soybeans, seed is typically sold by the bushel, and so a bag, or unit, contains about 60 pounds of seed, or about 150,000 seeds, based on an average of 2,500 seeds per pound. Cotton seed is sold per hundred pound unit, so prices are reported per one-hundred weight (CWT). Each CWT contains about 425,000 seeds.

NASS began differentiating the price of "all seeds", conventional seeds, and biotech seeds in 2001, and so beginning in 2001, the database records three different prices per bag/unit/CWT of seed. The 2010 forecasted prices for SmartStax corn and Roundup Ready 2 soybean seed are based on multiple Monsanto announcements regarding 2010 seed pricing.

The organic seed prices are reported from 2003 to 2010(f) for corn, and 2004 to 2010F for soybeans, and are derived from an industry averages for major corn lines sold by the three top producing seed manufacturers. Details are presented in the "Organic Seed Prices" worksheet in the database.

Ratios are then computed by year to compare the cost of the four seed types in relation to each other. In the case of corn, the ratios are: biotech seed to conventional seed; organic to conventional; biotech to organic; and, "SmartStax" seed to conventional in 2010F only. These ratios show how the differentials between different categories of seed have changed over time.

Seeding Ratings

In order to estimate the costs of seed per acre, it is necessary to calculate the number of acres planted per bag/unit/CWT. The number of seeds planted per acre must be known, or calculated, to determine seed costs per acre.

For most years, the database hence records the number of seeds per bag, seeds planted per acre, and acres planted per bag. In general, the acres planted per bag/unit/CWT is calculated by dividing the cost of the seed by the seed cost per acre, as reported by the USDA's Economic Research Service (ERS) and described in the next section.

The average number of seeds planted per acre is then calculated by dividing the number of seeds per bag/unit/CWT by the number acres planted per bag/unit/CWT (see "Notes" for details on how rates were calculated for 2008-2010F when ERS data was not available).

Seed Costs per Acre

The average cost of the seeds needed to plant an acre is recorded in the database. Costs per acre for "all seeds", conventional, biotech, and organic seeds are reported. Except for the organic seed prices and the exception noted below, all data comes from the ERS Costs and Returns Data tables.

Data for 2008-2010F in the case of corn, and 2007-2010F for soybeans and cotton, are calculated based on estimated cost of seed

per bag/unit/CWT, plus estimated seeding rates.

Crop Production per Acre

Average annual, national crop yields in bushels per acre in the case of corn and soybeans, and hundred weight for cotton are included in the dataset, and based on NASS's Annual Crop Production Summary. The yield in pounds per acre is calculated by multiplying the number of pounds in a bushel/CWT by the number of bushels/CWT. Next, crop yield per pound of seed is reported and provides an interesting measure of changes in productivity.

Crop Income and Operating Costs

The average annual national prices received per bushel/CWT is then added to the dataset and are derived from NASS's Annual Crop Values Summary through crop year 2009. Prices are assumed to remain unchanged in 2010.

The average gross income from the market per acre is calculated by multiplying the yield per acre by the average price per bushel. The gross value of production as reported by the ERS is listed as a second measure of gross income from crop production. This ERS estimate includes government payments, crop insurance payments, and other incidental payments.

The average operating costs per acre in the database are taken from the ERS Farm Production Cost and Returns data series, with the exception of years 2009-2010 which are forecasted. The net return over operating costs per acre is the difference of the gross income from market minus the operating costs per acre.

Seed Expenditures

Each crop-specific section in the database concludes with various perspectives on the magnitude of conventional, GE, and organic seed expenditures per acre relative to:

- Gross income from the market;
- Average crop operating costs; and
- Net return over operating costs.