GM Crops: Not Needed on the Island

Recommendations of the National Farmers Union to the Prince Edward Island Legislature's Standing Committee on Agriculture, Forestry, and the Environment

Charlottetown, PEI September 14, 2005

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Introduction

Over the past decade, corporate and government managers have spent millions trying to convince farmers and other citizens of the benefits of genetically-modified (GM) crops. But this huge public relations effort has failed to obscure the truth: GM crops do not deliver the promised benefits; they create numerous problems, costs, and risks; and Canadian consumers and foreign customers alike do not want these crops.

It would be too generous even to call GM crops a solution in search of a problem: These crops have failed to provide significant solutions, and their use is *creating* problems—agronomic, environmental, economic, social, and (potentially) human health problems. Prince Edward Island does not need GM crops. PEI should ban the cultivation of GM crops and then work to capitalize on its GM-free status. Such a move would create tremendous economic advantages, and would avoid huge actual and potential risks.

This report examines the benefits claimed by GM crop proponents—higher yields, lower costs, increased farm profitability, lower pesticide use—and this report demonstrates that these claims are either wildly overstated or outright false. This paper then shows that the risks and costs of GM crops have been greatly *understated* by corporate and government proponents. Finally, this paper demonstrates that GM crop agriculture is incompatible with other forms of farming—non-GM and organic, for instance—because GM crops contaminate and because segregation is impossible.

The choice for PEI is either to embrace GM crop technology with its many risks and costs and its few benefits, or to forgo this defective, damaging, third-rate technology and embrace the numerous economic benefits of becoming North America's first GM-crop-free zone. The NFU strongly recommends the latter course for the Island, our people, our environment, and our economy.

1. The benefits of GM crops

Monsanto, other seed and gene corporations, media pundits, and many government representatives tout the alleged benefits of GM crops. This paper looks at each benefit in turn and shines a critical light on the claims of GM-crop advocates.

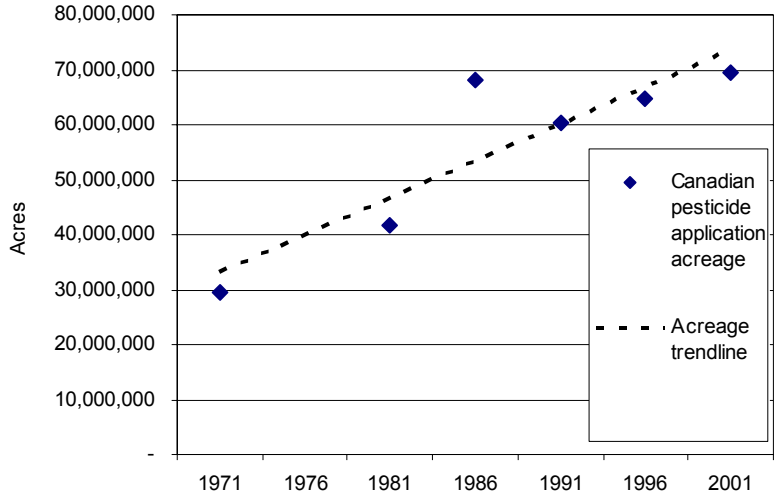
A. Decreased pesticide use

> *[B]iotechnology offers a useful tool to help farmers control pests more efficiently using less pesticide. . . .*
>
> —AgCare August 5, 2004, news release[1]

The key environmental benefit claimed by GM-crop promoters—namely, reduced pesticide use—is almost certainly false. Proving or disproving this claim, however, is complicated by lack of data. Public data on pesticide quantities applied in Canada is sparse. In a recent OECD (Organization for Economic Cooperation and Development) survey on pesticide use, two countries responded that they did not collect such data: Canada and the Slovak Republic.[2] That Canada today still has not begun collecting pesticide data is astounding, 43 years after Rachel Carson's *Silent Spring* so publicly raised the issue of pesticide toxicity.

Nevertheless, we do have some public data, and that data raises doubts about industry claims that raising GM crops results in lower pesticide use. Figure 1, below, graphs the area (acreage) of Canadian farmland that farmers sprayed with pesticides in each of the recent Censuses of Agriculture years. The trendline points sharply upward. On the basis of this data, it would be challenging for GM-crop companies to prove their assertions of lower pesticide use.

Figure 1: Canadian herbicide application area: 1971-2001



Source: Statistics Canada, Census of Agriculture, various years.

However, Figure 1 actually *under-reports* increases in pesticide use. Farmers are spraying more acres, but they are also spraying each acre *more times*. Before the mid-90s, a grain

[1] AgCare is an Ontario organization dedicated to furthering farmers' access to pesticides and GM seeds.
[2] Alberta Department of Environment, *Overview of 1998 Pesticide Sales in Alberta*, June 2000, p. 1.

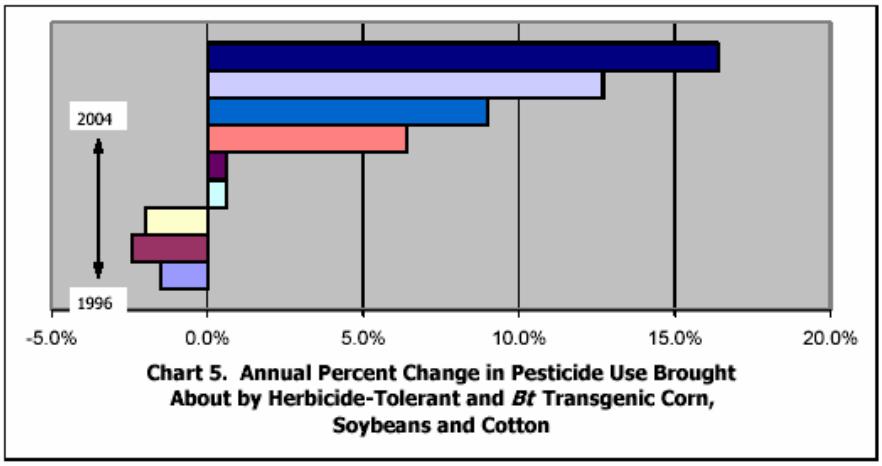
farmer might have sprayed a field once in a year. Now, it is not uncommon for a grain farmer to spray before seeding, to spray once or twice in the weeks after a crop emerges, and sometimes to spray again just before harvest. Farmers who grow potatoes and other vegetables spray numerous times.

Despite a shortage of public data, it is easy to predict that Canadian pesticide usage is up, not down. This is because, over the past decade, chemical herbicides have increasingly displaced tillage as the main means of weed control. Roundup Ready (RR) and other glyphosate-tolerant canola, soybean, and corn varieties are designed to be sprayed. These seeds facilitate a form of agriculture—"minimum til" or "direct seeding"—that replaces tillage with herbicides for weed control. It is only logical to see that—on their own, and as part of a chemical-intensive, tillage-minimizing production system—glyphosate-tolerant GM crops will *increase* herbicide use.

Some GM crops—for example, corn and cotton, which are modified to produce insecticides internally—do have the *potential* to reduce the amount of insecticide applied externally. But any decrease in insecticide use associated with these crops is overwhelmed by larger *increases* in herbicide use associated with Roundup Ready and other herbicide-tolerant GM crops. The overall effect of GM crops—intertwined with the intensive, chemical-dependant production systems they are designed to facilitate—seems to be to *increase* pesticide use.

In the US, the most recent examination of pesticide use can be found in Dr. Charles Benbrook's *Genetically Engineered Crops and Pesticide Use in the United States: The First Nine Years*. Benbrook finds that since 1996 "GE crops . . . have increased corn, soybean, and cotton pesticide use by 122.4 million pounds, or about 4%." Further, the rate of increase is increasing—peaking at over 16% in 2004 (see Figure 2, below). Benbrook attributes such increases to the proliferation of glyphosate-resistant weeds.

Figure 2: Benbrook's analysis of pesticide use related to GM crops



From *Genetically Engineered Crops and Pesticide Use in the United States,* p. 36.

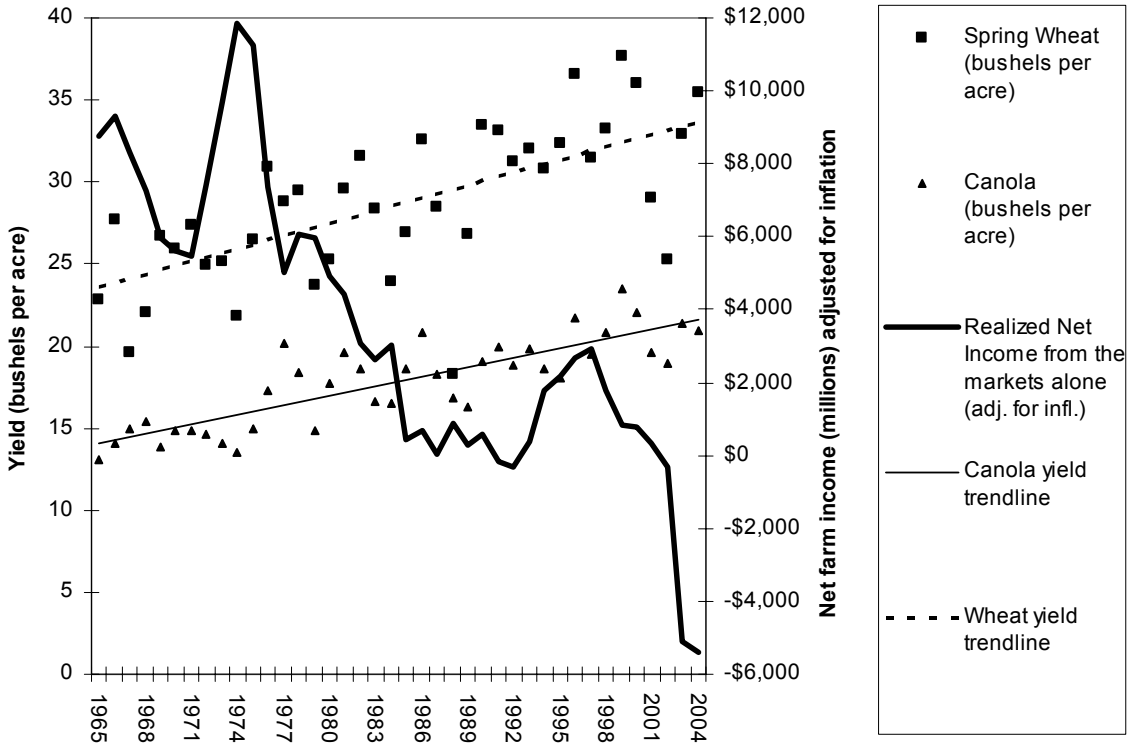
While Benbrook's analysis is highly credible, the NFU is not intent on asserting the veracity of his claim: that GM crops lead to *increased* pesticide use. As farmers, we are aware that small swings in pesticide use might be affected by crop prices, weather, and other factors. But the NFU strongly asserts that Dr. Benbrook's data, like similar data from other sources, refutes the claim by GM crop proponents that GM seeds lead to *decreased* pesticide use. The data shows that with GM crops, pesticide use is (at best) unchanged or indeterminate or is increased.

B. Higher net farm income

GM seed proponents—corporate and government alike—assert that their technologies, their "products of innovation," will benefit farmers through higher yields and/or lower costs, both of which will combine to create the ultimate benefit to farmers: higher net farm income.

While at present the data is lacking to prove definitively that such claims are false, the following graph raises serious doubts. Figure 3, below, charts 40 years of increases in per-acre yields brought about through conventional and GM seed breeding; changes in farming systems; and increased use of fertilizers, chemicals, irrigation, and other technologies.

Figure 3: Seed yield and Canadian net farm income: 1965-2004



Source: Yield data provided by Agriculture and Agri-Food Canada. Income data from Statistics Canada.

Figure 3 also charts realized net farm income from the markets, adjusted for inflation. There is no positive correlation between per-acre yield, on the one hand, and realized net farm income from the markets, on the other. A determined pessimist might even point out a negative correlation. The NFU is not asserting, however, that higher yields lead to *lower* net income. Although those inside and outside of government who continually (and falsely) argue that the farm crisis is caused by oversupply may have to make exactly that assertion.

Figure 3 must give pause to all those who simplistically assume that the farm crisis can be tempered by increasing the yield or other performance characteristics of our seeds. The data is simply not on the side of those who make this claim.

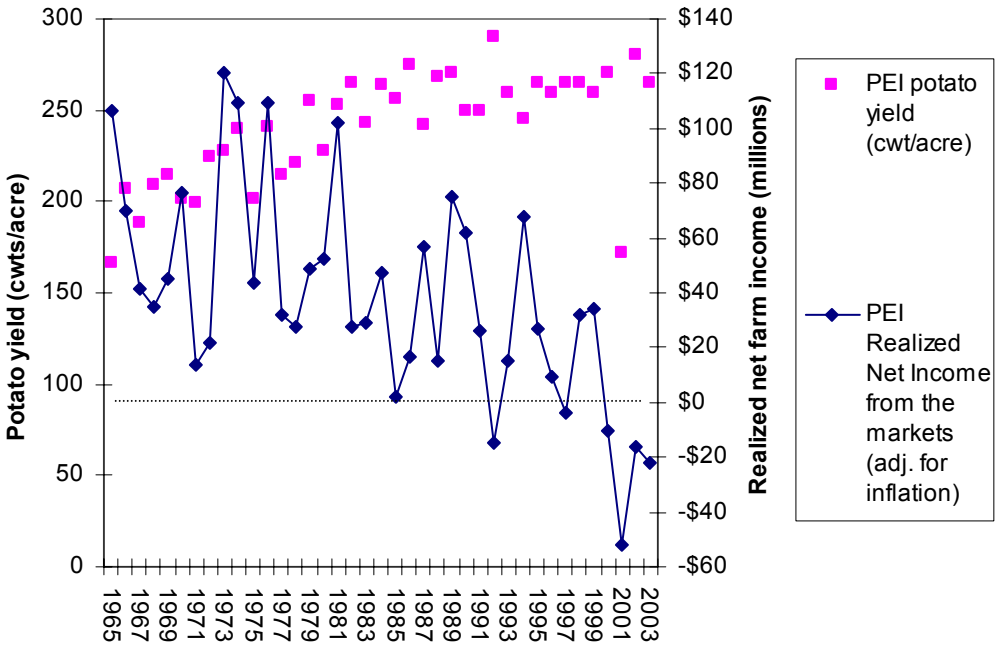
One reason that net income and yield may be going in opposite directions is this: While increased seed performance and yield may increase gross revenue, these increases will lead to

increased net income only if farmers are able to hold onto some of that revenue. GM seeds technology may increase yields—just as conventional plant breeding has done for decades—and better seeds and higher yields may drive gross farm revenue up. But fewer, larger, less-competitively-disciplined, and more powerful seed companies will interact with similarly-dominant corporations in other agri-food sectors to drive *net* farm income *down*. Our governments' failures to distinguish between policy effects on gross revenue versus the effects on net income—and the simplistic and unempirical assumption that these two financial measures will move in parallel—is a spinal cause of our farm income crisis. While gross farm revenue may be dependant on seed yield or performance, net farm income is determined by market power. Net farm income is determined, not by who generates the profits, but by who has the power to capture and retain those profits.

The balance of market power within the agri-food chain determines the allocation of profits. And a move to GM seeds means thrusting farmers into the arms of ferociously-powerful gene and seed companies.

To reinforce the national data presented for cereal and oilseed crops in Figure 3, Figure 4 graphs PEI potato yields and realized net farm income from the markets (adjusted for inflation). Again, those who wish to equate increased seed performance or crop yield with higher net income will be disappointed.

Figure 4: Potato yield and PEI net farm income: 1965-2003

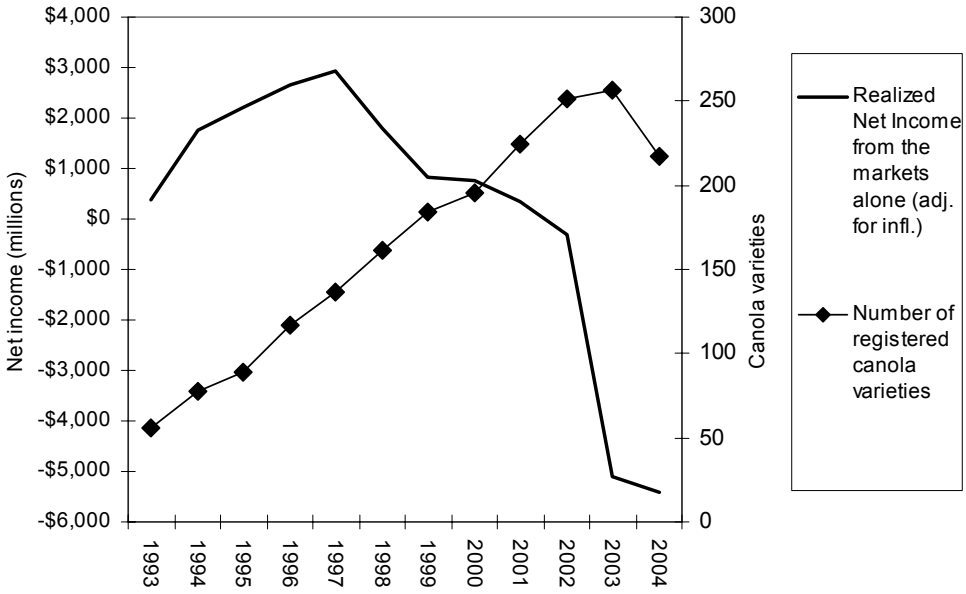


Sources: Statistics Canada, *Potato Historical Series 1891-1997*, with updates from www.statcan.ca/cgi-bin/downpub/freepub.cgi?subject=920#920; and Statistics Canada, *Agriculture Economic Statistics*, Cat. No. 21-603E, with updates from same source.

But perhaps we've missed the point. Perhaps it is not seed yield that is the main benefit of the proliferation of GM crops; perhaps the main benefit is access to a wider range of new varieties of seeds; perhaps it is choice, options. Figure 5, however, fails to indicate a correlation between a proliferation of new seed varieties and rising net income. To the contrary, Figure 5

demonstrates an *inverse* relation between the number of canola varieties available to farmers and farmers' net income. Over the 11 years depicted, the number of varieties available quintuples, and net farm income from the markets falls from positive $3 billion to negative $5 billion. While the net income numbers in Figure 5 represent farmers in general (not just canola farmers), the net income trend is representative of the experience of canola farmers. If anything, the trend is optimistic, because, if it were available, data on net income from canola production would produce a graph line that would fall much more precipitously than the line in Figure 5. The profitability of canola production, like that of crop production in general, has crashed over the past decade.

Figure 5: Availability of canola varieties and net farm income: 1993-2004



Sources: Variety number data from CFIA. Income data from Statistics Canada, *Agriculture Economic Statistics*, Cat. No. 21-603E, with updates from www.statcan.ca/cgi-bin/downpub/freepub.cgi?subject=920#920

No one should be surprised if GM crops fail to deliver on promises of increased profitability. Such a failure would simply repeat a long-established pattern. Fertilizer was supposed to make our farms profitable. So were weed sprays, large tractors, multi-row potato diggers, airseeders, bigger barns, high-tech milkers, and computers. Farmers have embraced all these technologies and the most common result is not increased profit, but a global farm crisis. Now we are told that GM seeds will make our farms profitable. The experience of the past 50 years shows that farmers should be very skeptical of corporations peddling products and promising profits. There are profits all right, but the profits almost always go to the corporations, not to farmers.

New technologies *can* make farming more profitable. New technologies did just that for much of the past century. Farmers, and western civilization in general, are much more prosperous today than we would be if most of the population still had to hoe the fields to raise our food.[3] Plows, tractors, combine harvesters, and trucks all increased the

[3] The NFU acknowledges a myriad of other factors in creating our prosperity—from increased access to fossil fuels to the theft of Native lands. Nevertheless, while not assigning a unique role to agricultural technology in creating prosperity, that prosperity would seem impossible if the majority had to work the fields. Some level of ag. technology is a necessary, but certainly not a sufficient, condition of prosperity.

profitability of farming and reduced the hardship. These particular technologies, however, left farmers relatively free and autonomous and did not bring ever-increasing input bills each year. GM seeds do the opposite—requiring annual repurchase and ensnaring farmers in a thicket of patents, contracts, and technology use agreements.

In addition, until a generation ago, input suppliers, machinery companies, and other technology sellers were relatively numerous and they faced real, price-disciplining competition. The change over the past 30 years is enlightening. When grain prices tripled in the mid-1970s, net farm income increased dramatically. When grain prices doubled in the mid-1990s, net farm income barely rose because input manufacturers moved like a pack to hike input prices and snatch away farmers' increased revenue.

If farmers should be skeptical about the promises of profit enhancement from technologies in general, farmers should be uniquely skeptical about such promises when it comes to GM crops. These crops are sold by some of the most powerful and profitable companies in the world. These companies use contracts, patents, and aggressive legal prosecution to force farmers, completely unnecessarily, to pay for new seeds each year. To some extent, the whole project of patent-protected GM seeds is a scheme to transform a farm input that was previously very low cost and usually supplied by the farm itself, into a *product* that the farmer was compelled purchase each year, usually at a relatively high cost. As US Ag. Economist Richard A. Levins quips: "the shortest possible economic history of . . . agriculture during the twentieth century would be this: nonfarmers learning how to make money from farming"[4] GM seeds are an example of powerful corporations inserting themselves into the food system and finding a way to extract money that formerly stayed on our farms.

Those who assert that GM seeds increase farmers' net income need to produce some data. And, as we stand ten years after the introduction of these seeds, and as we stand mired in the worst farm income crisis in Canadian history, it is probable that such data will be hard to produce. The claim that GM seeds make our farms more profitable is false.

[4] Richard A. Levins, *Willard Cochrane and the American Family Farm*, University of Nebraska Press, Lincoln, Nebraska, 2000, p. 8.

C. Higher yields

If, as the previous section shows, increased yields fail to translate into increased farm prosperity, then the question of whether GM crop technologies contribute to higher yields is essentially moot—whether yields improve or not, farmers will be no better off. Nevertheless, it is interesting to touch on some of the discussions now swirling around regarding GM seeds and their effects on yields.

First, it is important to remember that no commercially-grown crop has been genetically modified for higher yield. The two most common modifications are resistance to glyphosate (often called "herbicide tolerant" or "HT"; or "Roundup Ready," after the most popular brand of glyphosate) and the expression of the *Bacillus thuringiensis* (Bt) insecticide. Neither of these modifications directly increases yield. The implication is that they can increase yield *indirectly*—by reducing weed or insect pressures. There is no evidence, however, that GM seeds increase yields, either directly or indirectly.

In August 2004, Ron Eliason and Lynn Jones made a presentation entitled *Stagnating National Bean Yields* to the Midwest Soybean Conference in Des Moines, Iowa. Their presentation showed that, after two decades of consistent yield increases, soybean yields ceased rising in the mid-1990s.

Their presentation showed that, between 1972 and 1994, US soybean yields rose by nearly half a bushel per acre per year—increasing from about 27 bushels per acre in the early 1970s to nearly 39 bushels per acre in 1994. Since 1995, however, US soybean yields have not increased at all. The soybean yield trendline since 1995 is flat. It was in 1995 that GM soybeans were first introduced into commercial production in the US, and some commentators are speculating that there is a link between these flat yields and a defect in the performance of GM soybeans.[5] But one need not accept that the flat yields are caused by changes brought on by the genetic modification process. What is important to understand, however, is that for the most important commercial crop in the US, and the crop that represents the highest planted acreage of any GM crop in the world, it is not possible to demonstrate any positive effect on yields. And it is easy, if one wishes, to demonstrate a negative effect.

The situation with corn is only slightly different. For the 21 years between 1972 and 1993, corn yields increased by 1.56 bushels per acre per year. Between 1994 and 2003, that yield increase was 1.62 bushels per acre—a difference of just six one-hundredths of a bushel per acre per year. Eliason and Jones comment that "For corn, there is no statistical difference in trend yield gains for any time period." Essentially, yield increases are constant. Again, it is hard for GM-crop proponents to point out yield gains resulting from the introduction of GM corn varieties. Even if Monsanto and other GM corn seed sellers were to claim that a 0.06 bushel per acre per year yield gain was statistically significant and that all that gain was attributable to their products, they would be taking credit for an accumulated gain of just 24¢ (Cdn$) per acre. Monsanto's technology use fee for US corn is about $15.00 (Cdn$) per acre.[6] This high fee—relative to yield changes that seem either disappearingly

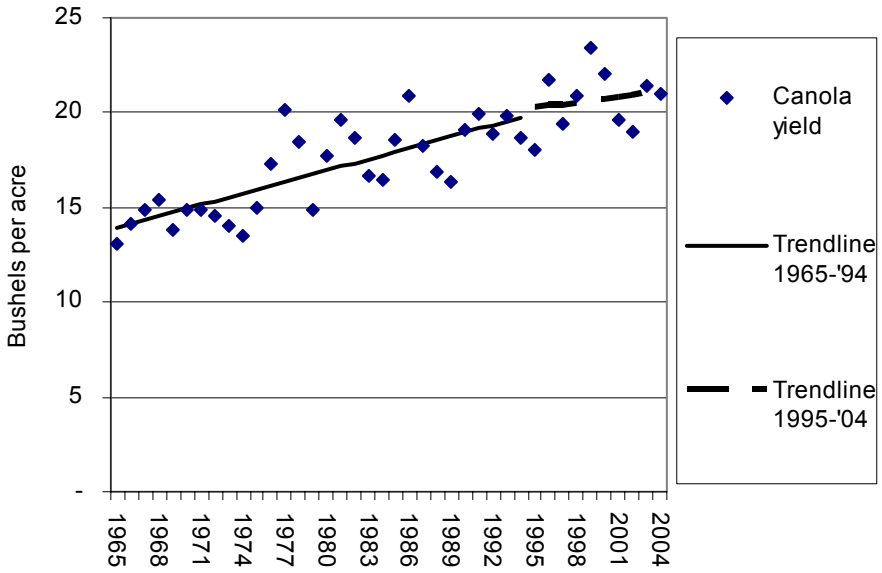
[5] For example, see: Dan Sullivan, "Is Monsanto's patented Roundup Ready gene responsible for a flattening of US soybean yields…?" www.newfarm.org/features/0904/soybeans/index.shtml

[6] The fee is $30 to $36 (US$) per 80,000 kernel bag. Assuming 3 acres per bag, the fee is $10 to $13 per acre (US$).

small, or negative—may help to explain why GM crops have not had the salutary effect on farmers' net income that technology promoters promised.

The story of canola is similar to those of corn and soybeans: Increased yields attributable to GM varieties are hard to find. Figure 6, below, graphs Canadian canola yields using Agriculture and Agri-Food Canada data. That data shows that yields from 1965 to 1994 increased on a trendline average of 0.2 bushels per acre per year. From 1995 to 2004, yield increases on a trendline were just 0.1 bushel per year.

Figure 6: Canadian canola yields, 1965-2004



Source: Agriculture and Agri-Food Canada data obtained by request.

So as to avoid charges of "voodoo" trendline manipulation, the NFU will readily admit that prairie droughts in several recent years will have affected yields and trendlines. But the point remains: Those who claim that GM crop technologies positively contribute to yield—either directly or indirectly—have no data to prove that assertion. If the data is taken at face value, it proves only that GM seed varieties reduce yields.

D. Bigger farms

The primary benefits claimed for GM crops—reduced chemical application, increased net farm income, increased yields—are either false or dramatically overstated. GM crops provide no benefits, or benefits that are completely negated by the costs and risks these crops create.

But such a contention flies in the face of widespread adoption of GM varieties by farmers—GM crop acreage is high and it continues to rise.. A rational observer would ask: If GM crops provide no real benefits, why are farmers adopting them so readily? The answer is that GM crops do provide one indisputable benefit: GM crops—especially those modified to resist glyphosate—make it much easier for farmers to farm vast acreages. Direct seeding coupled with large sprayers, satellite navigation systems, and GM glyphosate-resistant seeds make it possible for farmers to seed and spray vast acreages in a short time. This is the main advantage of GM seeds and their attendant technologies. And when per-acre net returns are plummeting, technologies that allow a farmer to cover more acres are attractive.

But the benefit of bigger farms has an inescapable converse: fewer farms. Farming more acres is perverse survival strategy for farmers, because it requires that fewer and fewer farmers survive. This clearly is a two-edged sword, with the sharp and cutting edge being applied to family farmers.

If our farm crisis is defined, at least partly, as the loss of farmers, then GM crops and the larger farms that they make possible cannot be a cure for that crisis. Because, by helping to increase farm size, these crops also help to *decrease* farm numbers. Cannibalism may be a tolerable survival strategy during a famine, but it is surely not a positive or preferred strategy. GM-crop-facilitated farm cannibalism cannot be a solution to the farm crisis.

2. The costs and risks of GM crops

The following section outlines the magnitude of the problems, costs, and risks created by GM crops.

A. Human health risks

> *[GM crops] are the most tested crops in the history of agriculture.*
>
> —David T. Dennis, "Clearing Up Points on GM Crops," *Summerside Journal Pioneer*, August 20, 2002[7]
> http://archives.foodsafetynetwork.ca/bioednet/2002/8-2002/bioednet_august_26.htm#CLEARING%20UP%20PO

> *[B]iotech foods may be safer than conventional foods in that they're more thoroughly tested.*
>
> —Council for Biotechnology Information, "GAO Report: Biotech Foods As Safe as Conventional Foods"[8]
> http://whybiotech.com/index.asp?id=2098

> *[G]enetically enhanced foods . . . are among the most thoroughly tested research products in history.*
>
> —Dennis Avery, "Growing More Per Acre Leaves More Land For Nature," Centre for Global Food Studies
> www.cgfi.org/materials/articles/2003/apr_24_03.htm

Our governments constantly tell us that they make decisions regarding the introduction of new GM foods on the basis of "sound science." So Canadians should ask: How sound is the science on human health risks posed by GM foods? How many peer-reviewed papers on the health effects of GM foods have been published in academic journals?

As of 2003, there existed only ten such papers. And only five of those studies are independent (not "performed more or less in collaboration with private companies"). And all five of these independent studies report adverse effects from feeding GM foods to lab animals. These are the findings of a 2003 study by Dr. Ian Pryme and Dr. Rolf Lembcke published in the journal *Nutrition and Health*.[9]

Pryme and Lembcke's literature survey found zero studies on the safety of some GM crops, for example, GM canola. This, in 2003, eight years after the introduction of GM canola into the global food supply.

To reiterate, as of late 2003, eight years after we began feeding GM crops to nearly every human on Earth, only a tiny number of independent, peer-reviewed papers had appeared in academic journals, and every one of them found potential health risks for humans. At one

[7] Mr. Dennis is a professor of biology at Queen's University, a Fellow of the Royal Society of Canada, and president of biotech company Performance Plants.

[8] Council members include BASF, Bayer, Dow, DuPont, Monsanto, and Syngenta.

[9] Pryme and Lembcke, "In Vivo Studies On Possible Health Consequences Of Genetically Modified Food And Feed—With Particular Regard To Ingredients Consisting Of Genetically Modified Plant Materials," *Nutrition and Health*, 2003, Vol 17, pp.1-8. Available at www.soilassociation.org/web/sa/saweb.nsf/0/80256cad0046ee0c80256d66005ae0fe/$FILE/NutritionHealthstudy.pdf

point, Pryme and Lembcke comment on the studies that find adverse health effects, saying that "It is remarkable that these effects have all been observed after feeding for only 10 – 14 days."

Pryme and Lembcke conclude: "[M]uch more scientific effort and investigation is necessary before we can be satisfied that eating foods containing GM material in the long term is not likely to provoke any form of health problems. It will be essential to adequately test in a transparent manner each individual GM product before its introduction into the market."

Since 2003 there have been additional studies published, but it appears that the number of peer-reviewed papers on the human health effects of GM crops published in academic journals remains well below 20.[10] And the number of *independent* studies probably remains below 12.

As with claims regarding farm profitability, yield increases, and pesticide reduction, GM proponents are on extremely shaky ground when they claim that GM foods have been tested and proven safe. And those who claim that these foods are "the most thoroughly tested products in history" would seem to lack either credibility or integrity.

[10] Dr. Christopher Preston claims that the number of such studies is as high as 42. While 42 is an unimpressive number given the magnitude of the risks, it is also an incorrect number: it was generated by lumping together studies on health effects with studies of livestock performance—weight gain and milk production. Many of the studies that Preston cites are animal production studies, some as simple as feeding cattle and chickens feed with GM ingredients and then weighing them against a control group. Not surprisingly, livestock gain weight on feed with GM ingredients at about the same rate as they do on similar feed without such ingredients. Critics of GM foods don't claim that we won't get fat eating sweeteners derived from GM corn (that's exactly what is happening today); critics simply ask if we're sure that there won't be other adverse health effects from eating GM foods.

B. Environmental risks

Proceeding in the dark

As is the case regarding human health risks, there are few peer-reviewed studies regarding the environmental risks of GM crops. GM-crop proponents and salespeople are proceeding largely in ignorance, denying new potential risks as such concerns are raised, even as they grudgingly admit that risks previously identified are real and growing.

When GM crops were first introduced, environmental advocates and others raised the prospect of contamination and "gene flow." Monsanto and other technology developers said that this could never happen. Now it is universally recognized that GM plants outcross promiscuously (see following section on contamination).

And even when GM seed companies first admitted that their GM crops do outcross and contaminate, these companies claimed that outcrossing and contamination occurred only over a limited range. Where companies admitted the need for buffer strips, they advocated buffers of just a few yards.[11] Now we understand that GM pollen travels dozens of kilometres (see following section on contamination). At every turn, and without any data, GM-seed sellers and promoters have recklessly claimed to have knowledge of the environmental safety of GM crops when in fact they were completely ignorant of how such crops will actually act in the biosphere. Even today, both they and we remain ignorant.

GM seeds contaminate the environment

The Mexican state of Oaxaca rolls up from the Pacific coast into the mountains of south-central Mexico. The state contains a rich diversity of corn varieties, both ancient and relatively modern. Mexico is the place where corn was developed as a food crop for humans. Over the past 10,000 years, the women and men who live in the area we now call Mexico worked to created many, many varieties of corn: corn varieties tailored for Mexican climate and geography, including corn varieties designed to be planted at sea level and other varieties designed to be planted above 3,000 metres. Today, the corn in Oaxaca (and indeed in most of Mexico) is contaminated by GM varieties marketed by Monsanto and other transnational seed and gene corporations.

For years, Mexican activists and farmers called on that country's government to test corn to determine the extent of contamination. The government refused. So environmental and civil society organizations undertook the tests themselves in 11 Mexican states; they found widespread contamination in 9. They also found that some corn plants contained more than one modified gene. In extreme cases, an individual plant would contain three separate modified genes: a gene for resistance to the chemical glyphosate (commonly called the "Roundup Ready" gene), a gene that causes the plant to produce its own biological insecticide (the "Bt" gene), and a gene referred to as "Starlink." Starlink corn is genetically engineered to produce a variant of the Bt insecticide, but because the Starlink variant has a

[11] In Canada, for instance, between 2001 and 2004, the Canadian Food Inspection Agency increased the buffer strip requirements around GM wheat test plots from 3 metres to 10 metres then to 30 metres and, following this, the researchers and experts who make up the Prairie Region Recommending Committee for Grains (PRRCG) passed a motion to extend the buffer zone to *300* metres.

dramatically increased potential to trigger allergic reactions in humans, Starlink corn was approved in the US for use in animal feed, but not for human consumption.

Around the world, GM varieties are cross-pollinating with non-GM plants and are creating a very real, and largely unresearched, environmental risk.

GM seeds and seed supply concentration threaten biodiversity

Traditional agriculture rests on two pillars:

1. a rich base of indigenous knowledge about plant varieties and their traits; and
2. crop and seed diversity with varieties tailored to climate, geography, and local needs.

Biodiversity and an encyclopaedic knowledge of that diversity form the basis of a rich, complex, resilient, adaptable, and secure food production system. Diversity in seeds and crops ensures that no one disease or frost or drought will leave a village destitute. Detailed knowledge allows traditional farmers to constantly improve the performance of their seeds and to select seeds appropriate for shifting conditions.

This knowledge and diversity is also a bounty for farmers in PEI, in North America, and around the world. The hundreds of traditional corn varieties in Mexico form a vast pool of traits that can rescue "modern" agriculture from a disease outbreak or an insect problem. In Asia, wheat breeders can find wheats with stems that resist sawflies. Potato breeders can find potatoes in the high Andes that grow or process or resist disease in specific ways.

But we are choosing to destroy these invaluable pools of biodiversity. By concentrating the world's seed supply in the hands of a tiny number of seed transnationals and by working to replace the myriad of traditional crops and "landrace" varieties with a relatively small number of "world seeds," we are ensuring that the vast store of biodiversity—that is the basis for our agriculture and for our commercial seed development system—will be swiftly and irrevocably lost. This loss of biodiversity is creating immense environmental, social, and economic costs.

Irreversibility

We know little about the environmental effects of GM seeds and their introduction around the planet. Proceeding in ignorance, however, is not always unwarranted. In some cases, it is better to act now, especially when risks are low and our actions can be easily reversed. However, such is not the case with the release of GM crops. GM technology is unique because it is self-replicating in the environment. Thus, its introduction is largely irrevocable.

Once a new GM crop is released, it cannot be gathered back in. To give one example: Imagine being the employee put in charge of gathering up all the genetically-modified salmon that have escaped into the oceans. Imagine being asked to find every last GM canola plant in Canada—they are growing in the cracks in our sidewalks. Once a life form is in the environment, it is likely there forever.

Each time we introduce a new GM crop, we are taking an irreversible step. We are doing so even though we admit that we cannot control their spread. We are doing so in near-complete ignorance of their environmental risks and ecosystem effects. And we are claiming that we are proceeding on the basis of sound science. We are delusional. We should be stopped.

C. Corporate control of the food system

We remain largely ignorant of the potential human health effects and environmental effects of GM crops. The NFU believes that Canadians and policy makers also remain ignorant of the likely effects of increasing corporate control of the food system. The negative effects of increasing corporate control will be felt by all Canadians—farmers and non-farmers alike.

The chain

To understand our food system, try thinking of it as a chain. Take potato production as an example. At one end of the chain, let's say the left end, are the energy companies—the companies that produce oil, diesel, gasoline, and natural gas. Next come the fertilizer companies that turn natural gas into nitrogen fertilizer. Next come chemical companies, seed and gene companies, and machinery companies, then the banks that provide farmers' credit. In the middle of the chain sits the farmer who grows potatoes and other crops. Downstream from the farmer are the processors, the exporters, the food retailers, and the restaurants. In a very real way, our potatoes are produced by a chain that reaches from the oil and gas wells, at one end, to the drive-through window of McDonald's where the fries are served.

Something is happening within that chain. The players are getting much larger and less numerous. Where 30 years ago there might have been dozens of seed companies, now mergers and acquisitions and patents may mean that there are now only a handful. Where there were six or eight tractor companies, now there may only be three. Where there were companies once making millions in profits, now those companies may make billions. Where those companies once were local or regional, they are now transnational. Even as the size and reach of agribusiness corporations have expanded, the competition that previously disciplined them has receded.

To give but one example of corporate concentration and dominance that is very relevant to this discussion: as of 2001, Monsanto's GM seed technology accounted for 91% of the total world area devoted to commercial GM crops.[12] It is possible that Monsanto's share has fallen since then. But it is equally probable that they maintain an overwhelming dominance of the sector.

Around the world, academics, citizens, and civil society organizations are raising concerns about a global food system increasingly controlled by Cargill, Wal-Mart, and Monsanto. And if corporate control of our food supply is something to be concerned about, control of seed is a key concern. Monsanto and a tiny number of other companies are tightening their grip, not merely of our seeds, but of the genes—the building blocks of life. In effect, we are turning control of our seed supply over to a tiny number of global transnationals, in return (it is implied) for the benefits we will reap from the improved seeds that they will sell us. But since such benefits are nearly absent, we may want to reconsider our deal with these seed developers.

[12] ETC. Group, *Ag Biotech Countdown: Vital Statistics and GM Crops*, June 2002.

D. Farmer persecution

Allowing Monsanto and other GM-seed companies into a country, province, or state also means inviting them to set up an invasive, aggressive, and well-funded farmer-persecution system. Monsanto spends over $10 million (US$) annually[13] investigating, intimidating, pressuring, and suing farmers. The company has a staff of 75 employees devoted to these pursuits and Monsanto also contracts dozens of lawyers from outside firms.

So far, in North America, Monsanto has sued 147 farmers and 39 small businesses for patent infringement and other alleged misuses of its seeds. It has sued for, and won, judgements as high as $3 million (US$), and several more over $1 million. The median amount of a judgements is $75,000 (US$), with farmers' legal costs (sometimes in the hundreds-of-thousands) coming over and above these amounts. Some Monsanto Technology Use Agreements include provisions entitling Monsanto, in the event of a violation, to "120 times the applicable Technology fee." This amounts to well over $1,000 per acre. When Monsanto goes to court, it goes looking for farm-destroying amounts of money.

But the lawsuits are just the visible tip of a much larger iceberg. Monsanto investigates roughly 500 farmers every year. These invasive investigations allegedly sometimes include private investigators' entering farmers' fields without permission and taking samples. Sometimes Monsanto's agents have local police officers escort them onto farmers' properties. Allegedly, Monsanto's agents have used entrapment, have posed as new members of the community or as land surveyors, have harassed customers and neighbours of suspected patent infringers, and, it is alleged, broken into one farmer's office. Monsanto has set up "snitch" lines so that farmers can report their neighbours for suspected patent infringement.

Many Monsanto investigations lead to confidential settlements. The scenario might be this: Monsanto sends a registered letter to a farm family alleging an infringement of a Monsanto patent and requesting a financial settlement to avoid legal prosecution. For most farmers, this is an offer they can't refuse: the alternative is a costly and lengthy legal battle that, win or lose, could bankrupt their farms (Percy Schmeiser spent approximately $400,000 defending himself). Monsanto's settlements are often confidential—farmers are made to sign "gag orders." In North America, the number of such settlements probably reaches into the hundreds.

Monsanto is aggressive and relentless. One Arkansas farmer, Ray Dawson, reported on Monsanto's treatment of him and his wife: "They [Monsanto] pushed me as hard as they could. . . . If you're looking for a bully story, I don't know a worse case than what I went through. . . . We had to end it."[14] Monsanto threatened Luetta Dawson with jail time, claiming she had lied on her deposition. The Dawsons finally wrote Monsanto a cheque.

Monsanto has damaged farms, sown dissension in communities, and harassed families. It has done these things to protect its profits and patents and to deny farmers their millennia-old right to save and re-use their seeds. Considering the small benefits that GM crops create and the large costs and risks they generate, one would wonder why governments would give Monsanto the power to terrorize farm families. By accepting and proliferating GM seeds, PEI will accept and proliferate the broad range of farmer punishment tools that comes with those seeds.

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[13] Unless otherwise stated, numbers and facts in this section are taken from The Center for Food Safety, *Monsanto vs. U.S. Farmers*, 2005.

[14] As cited in *Monsanto vs. U.S. Farmers,* p. 45.

E. Market loss

For many of the reasons listed above, governments and consumers outside of Canada do not want GM crops and foods. Because of this, Canadian farmers already have lost markets and stand to lose additional ones if the introduction of new GM crops is not averted.

Canola

In the early- and mid-1990s, before the widespread introduction of GM canola, Canada sold much of its canola crop to European Union (EU) countries. In 1993, the EU took 16% of total Canadian exports. In 1994, the EU took 32%. In 1995, it took 25%.

Then, following the introduction of GM varieties in the mid-'90s, Canadian canola exports to the EU dropped to near zero. Over the past decade, China has become a major buyer of our canola. The EU, however, was a premium-price market while China is a low-price market.

Today, canola prices, adjusted for inflation, are at a record low. Because of the introduction of GM varieties and attendant market loss, canola prices have fallen.

Corn and soybeans

The American Farm Bureau estimates that because of EU markets lost as a result of US introduction of GM corn, US farmers are losing $300 million per year.[15] The US State Department says that if the EU continues to tighten its labelling and tolerance standards, lost sales to the EU could cost US farmers "as much as $4 billion in annual agricultural exports to the EU."[16]

Wheat

In response to a Canadian Wheat Board survey, the customers who purchase 87% of the Canadian wheat crop said that they will stop buying Canadian wheat if we introduce GM varieties. Our customers are clear: Not only will they refuse to buy GM wheat from Canada, they will cease buying *all* wheat from us, because they simply do not believe that the GM wheat can be segregated from the non-GM.

In the face of this overwhelming market rejection of GM wheat, several agricultural economists have attempted to quantify the potential dollar losses to farmers. One estimate, relatively conservative but very credible, puts the potential market loss that would result from the introduction of GM wheat at over $423 million per year.[17]

In addition to market loss costs, agronomic costs—mostly attributable to increased spraying costs to deal with glyphosate-tolerant GM wheat volunteers—would add approximately

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[15] Pew Initiative on Food and Biotechnology, *U.S. vs. EU: An Examination of the Trade Issues Surrounding Genetically Modified Food*, August 2003, p. 4.
[16] Pew Initiative on Food and Biotechnology, August 2003, p. 12.
[17] Furtan, Gray, and Holzman, *Regulatory Approval Decisions in the Presence of Market Externalities: The Case of Genetically Modified Wheat*.

$400 million more to the losses from the introduction of GM wheat.[18] Losses due to the possible spread and intensification of the disease fusarium—caused by increased use of glyphosate—would add hundreds of millions of dollars in additional costs. Market losses specific to organic growers would be over and above the numbers listed above. And increased seed and technology fees would create further costs for wheat farmers.

In total, the losses for Canadian farmers that will result if GM wheat is introduced add up to over $1 billion per year.[19] Further, these losses will accrue to all farmers, even those who choose not to grow GM wheat. And most of these losses will be triggered even if only a very small minority of farmers choose to use GM wheat varieties.

Market loss: Conclusion

Given that GM crops provide no real economic benefit to farmers, given the $15 per acre Technology Use Fee that Monsanto charges, and given the billions in market losses that GM crops have triggered and the billions more that new GM crops threaten to trigger, it is virtually certain that the introduction of this technology has been, is, and will continue to be a money-losing proposition for North American farmers.

[18] Ed White, "Researchers place dollar value on GM contamination," *Western Producer*, November 14, 2002.

[19] For more on this, see "The Costs of Genetically Modified Wheat: National Farmers Union Fact Sheet," March 2004.

F. The threat to organic, sustainable, low-input, and alternative agriculture

Despite the claims of the corporations that market GM seeds and the governments that support these corporations, GM crop technology is expansionist, contaminating, and incompatible with non-GM crop agriculture. Talk of co-existence is a ruse, and (as we will show in the next section) segregation is impossible.

Organic farmers and farmers trying to remain free of contamination by GM varieties are facing the most direct and damaging effects of the proliferation of GM crops.
It is now nearly impossible to grow organic canola in most of Canada. The proliferation of GM canola, uncertainty over seed supply purity, and the risk of contamination from windblown pollen mean that organic farmers have little certainty that their canola will be free of GM seeds. If these farmers try to grow organic canola, they face huge risks that their products may be rejected by buyers, possibly when those products reach overseas ports. Corn farmers face a similar dilemma. Many organic farmers have given up trying to grow organic canola and corn. If we proceed to introduce GM wheat, GM vegetables, and other GM crops, we may well make organic agriculture in Canada impossible.

GM seed technology is unique: its very existence threatens to deprive farmers far distant from the GM fields of the ability to farm in the way they choose and to serve high-value markets. Once a crop is modified, farmers' only choices are to grow the GM crop, to grow a GM-contaminated crop, or to not grow the crop at all.

By excluding other ways of producing a crop, GM agriculture forecloses farmers' options and locks them into a system designed and controlled by the seed/gene/chemical companies. The termination of our ability to grow organic products is too high a price to pay for the option of growing GM varieties.

3. Segregation and contamination

Attempts to segregate GM and non-GM varieties will not avert market loss. And such attempts cannot begin to solve the many other problems created by GM seeds, including the damages inflicted on both organic farmers and the environment. Segregation is costly and risky in the short term, and is almost certain to fail in the long term.

Segregation advocates point to organic growers who successfully segregate their crops from the rest of the food supply. But such comparisons fail to appreciate how segregation systems work. True, these systems can keep the general pool of product from contaminating a small subset; organic farmers can segregate relatively small amounts of high-value organic grains from the larger, commercial stream. But it is a much different task trying to keep grains separate within the commercial system, with its huge bulk-handling facilities, intermixing, railcar pooling, port blending, sketchy paperwork, and numerous delivery points (never mind pollen drift and seed contamination).

Further, it is virtually guaranteed that a GM/non-GM segregation system will fail, and it will fail at the vital first link, the seed supply, because the seed supply is already contaminated. Canadian researchers tested 33 samples of certified non-GM canola seed and found that 32 samples were contaminated with GM varieties—and three of those samples had contamination had levels above 2%.[20] (Certified seed is required to have contamination levels, of all kinds, below 0.25%. Thus, 2% is very high.) A US study found that virtually all samples of non-GM corn, soybeans, and canola seed were contaminated by GM varieties.[21] Keeping GM and non-GM crops separate is impossible because they are mixed even before the seed goes into the ground.

Widespread contamination is not surprising. A recent US Environmental Protection Agency (EPA) study found that pollen from GM bentgrass plants travels at least 13 miles.[22] A recent UK study found that GM canola cross-pollinated with non-GM canola more than 16-miles (26 km) away.[23] Given the small size of PEI—150 miles long and 30+ miles wide—a 16 mile radius of contamination means that it would only take six fields in PEI seeded to GM crops to effectively blanket the whole Island with contaminating GM pollen.

With segregation likely to fail, segregation advocates must consider the huge costs of that failure. There is simply no precedent for a segregation system whose failure might cost *all* farmers billions of dollars in lost sales. A single contaminated organic shipment may cost one farmer tens-of-thousands, but other farmers will not be penalized. But one or two incidents of GM contamination in shipments that were warranted GM-free might cost Canada its premium-priced grain markets for years to come and cost farmers billions.

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[20] Lyle Friesen, Alison Nelson, and Rene Van Acker, "Evidence of Contamination of Pedigreed Canola (Brassica napus) Seedlots in Western Canada with Genetically Engineered Herbicide Resistance Traits," *Agronomy Journal* 95, 2003, pp. 1342-1347.

[21] Margaret Mellon and Jane Rissler, *Gone to Seed: Transgenic Contaminants in the Traditional Seed Supply*, Union of Concerned Scientists, February 2004.

[22] Lidia S. Watrud et al., "Evidence for landscape-level, pollen-mediated gene flow from genetically modified creeping bentgrass with CP4 EPSPS as a marker," *Proceedings of the National Academy of Sciences of the United States of America*, October 5, 2004, v. 101, no. 40, pp. 14533-14538.

[23] Gavin Ramsay, Caroline Thompson, and Geoff Squire, *Quantifying landscape-scale gene flow in oilseed rape*, Scottish Crop Research Institute and the UK Department for Environment, Food, and Rural Affairs (DEFRA), October 2004, p. 4. www.defra.gov.uk/environment/gm/research/pdf/epg_rg0216.pdf

In terms of segregation system failures, we need not speculate: GM/non-GM segregation has been tried, and has failed. The most notorious of these failures is the StarLink fiasco. GM StarLink corn was approved only for animal feed, not for human consumption. Officials were confident that StarLink could be segregated and kept out of the human food supply. The segregation system failed almost immediately. Though planted on less than one-half of one percent of US corn acreage, StarLink has contaminated 25% of the US seed-corn supply. Today, Canadian citizens are eating GM StarLink corn that regulators believe poses a health risk. Even this small amount of product—one two-hundredth of the US corn crop—could not be segregated.

Just last month, Syngenta Corporation revealed that, over the past four years, it had mistakenly distributed corn seed with an unapproved gene, a gene for resistance to the antibiotic ampicillin. Syngenta had meant to distribute an approved corn variety called Bt11 that contains a gene that causes the corn plant to express the Bacillus thuringiensis (Bt) insecticide. But the company mistakenly distributed Bt10 corn, corn that contains the Bt gene, but that also contains another gene, one that can confer resistance to ampicillin. As a result of Syngenta's error, tens-of-thousands of acres of unapproved Bt10 corn have been planted and harvested. Some of the unapproved corn is almost certainly now in the human food system. And it is likely that the entire North American corn seed supply is now contaminated by this unapproved GM variety.

If the corporations that make these GM varieties—corporations with their state-of-the-art labs and phalanxes of PhD biologists—cannot keep their genes separate, sorted, and contained, why would we believe that grain workers—overworked and untrained in genetics—will succeed in running a impregnable segregation system?

In an attempt to dispel the fuzzy thinking that premises the success of a GM/non-GM segregation system on the success of our organic/non-organic segregation system, Table A, below, summarizes the vast differences between those two systems.

Table A: A comparison of organic/conventional and GM/non-GM segregations systems

Organic/conventional segregation	Proposed GM/non-GM segregation
Small quantities	Very large quantities
Separate handling systems	Share a handling system
Careful handling and little mixing	Commercial bulk handling
High value differential→high motivation for success	Low value differential
Consequences of failure small relative to size of system	Consequences of failure huge
Consequences of failure fall mainly on one farmer	Consequences of failure fall on all farmers
Surety of seed supply	Seed supply contaminated

Finally, even if we assume that a segregation system can work, we should at least admit that the system will cost a great deal of money, money that will probably not be recovered through higher grain prices and money that will come out of the pockets of all farmers—GM seed adopters and non-adopters alike. There will also be higher on-farm costs for farmers—more bins and bookwork. There will be the costs of facilities to segregate the grain and instruments to test it, and all of these costs will be passed back to farmers. Monsanto will bear none of these costs; our grain buyers will bear none; farmers will bear them all.

Conclusion

The benefits of GM seeds go almost exclusively to the corporations that sell them. Farmers enjoy neither higher yields nor incomes. The profits go to the seed and gene corporations, and the risks are borne by all—society must shoulder considerable human health risks, and the entire planet must bear the environmental risks posed by GM crops.

The NFU realizes that the government of PEI must be experiencing incredible pressure from the companies that profit from selling GM seeds, as well as from these companies' numerous allies inside and outside of our governments. The NFU understands that huge amounts of money and energy are being expended to ensure that the province of PEI does not follow its own interests—in other words, that it does not declare itself GM-crop-free. The NFU urges the government and public servants of PEI to nevertheless display the courage to do what is best for our citizens and our environment: ban the cultivation of GM crops.

The world is losing biodiversity. GM seed contamination of heritage varieties is becoming a growing problem. GM contamination is making organic production of many foods impossible. Because it is an island, if it bans the production of GM crops, PEI could become a major centre for plant development and research, for the propagation of a huge variety of new crops and heritage varieties, and for organic production. While other Atlantic provinces pursue "call centres," PEI could create "grow centres"—beautiful, sustainable, and commercial centres where North American scientists could grow plants and do research without having to guard against contamination from GM plants. In addition to commercial potato, dairy, meat, and crop production that will always be important to the PEI economy, the province could become a North American centre for plant propagation, research, and the preservation of biodiversity, making PEI a genuine garden province.

The National Farmers Union recommends that the government of Prince Edward Island declare itself a GM free zone and that it work with farmers and other citizens toward ending the cultivation of GM plants on the Island within the next 12 months.

The NFU further recommends that the PEI government encourage and help farmers and other citizens to take advantage of the numerous economic opportunities that GM-free status presents.

On behalf of its farm family members in PEI,
Respectfully submitted by the National Farmers Union.