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Genetically modified crops: Steady growth in Ontario and Quebec

By Bernard Hategekimana and Martin Beaulieu

Since their introduction in the mid-1990s, genetically modified seeds have become increasingly popular among Eastern Canadian corn and soybean producers who have used them to limit insect damage to crops, or to allow their crops to resist herbicides that would normally kill them.

Statistics Canada has collected data on genetically modified soybeans and corn in Quebec and Ontario for the past three years. In its field crop surveys, the Agency has tracked plantings, harvestings, production and expected yields for soybeans and corn grown from genetically modified seeds.

Data show clearly that seeded area, the number of producers and the production of genetically modified soybeans and corn are on the rise in both Quebec and Ontario.

The semi-annual print version of Vista on the Agri-Food Industry and the Farm Community, catalogue no. 21-004-XPB, consists of the content or a summary of the previous issue/s of the Internet version (Catalogue no. 21-004-XIE).

It contains articles highlighting statistical insights on themes relating to agriculture, food and rural issues. In addition, there are current indicators of agricultural activity, a list of subject matter contacts and a schedule of upcoming statistical releases.

Furthermore, among the operators who adopted genetically modified crops, farmers with smaller operations allocated a greater share of their soybeans and corn acreage to genetically modified crops. However, the adoption of genetically modified crops by operators of larger farms has increased.

This article examines the trends in the adoption of genetically modified corn and soybean seed in Ontario and Quebec during the past three years.

Note to readers

Data for this article came from the June Seeded Area Survey and the November Crops Production Survey. Data were collected from telephone interviews in Quebec and Ontario of 8,300 farm operators in June and 8,800 farm operators in November. In June, 3,500 farmers reported acres seeded with soybeans and/or corn, while 2,800 reported harvesting these crops in November.

These surveys are designed to produce estimates representing all farms enumerated in the Census of Agriculture with the exception of institutional farms and farms on Indian reserves.

The science behind genetically modified organisms

Canada's Novel Food Guidelines defines "genetically modified" as "to change the inheritable trait of a plant, animal or microorganism by means of intentional manipulation."

Biotechnology techniques are used to transfer DNA or genes that confers a desirable attribute from a donor organism to a receiving organism. Other techniques alter the DNA through chemical or radiation exposure. These techniques accelerate a natural process (mutagenesis) that allows species to adapt to changes in their environment over time.

Bt crops contain a gene from a soil bacterium, *Bacillus thuringiensis*, which produces a protein that is toxic to certain insects, specially the European corn borer. It has been engineered into several crops and plants, including corn and potatoes.

Herbicide-tolerant crops were engineered to survive the application of specific herbicides, such as glyphosate, that would normally kill the non-modified crops. Bt corn and herbicide-tolerant soybean and corn were introduced in the United States and Canada in limited quantities in 1996.

Genetically modified seed used in nearly one-third of total corn acreage

Genetically modified (GM) soybeans and corn in Quebec and Ontario accounted for a large share of the total Canadian production. In 2001, 29% of Canadian corn production was grown from modified corn seeds. Modified soybeans represented 24% of Canadian soybean production.

Corn and soybean producers have increasingly used GM seeds since their introduction in the mid-1990s. In 2002, nearly one-third of the total corn acreage was planted with these seeds in Ontario and Quebec.

GM corn acreage has held steady around the 30% mark since 2000, the first time Statistics Canada included questions on genetically modified crops in its surveys (Table 1). The need to control infestation by the European corn borer may explain why Bt corn was so popular in 2000.

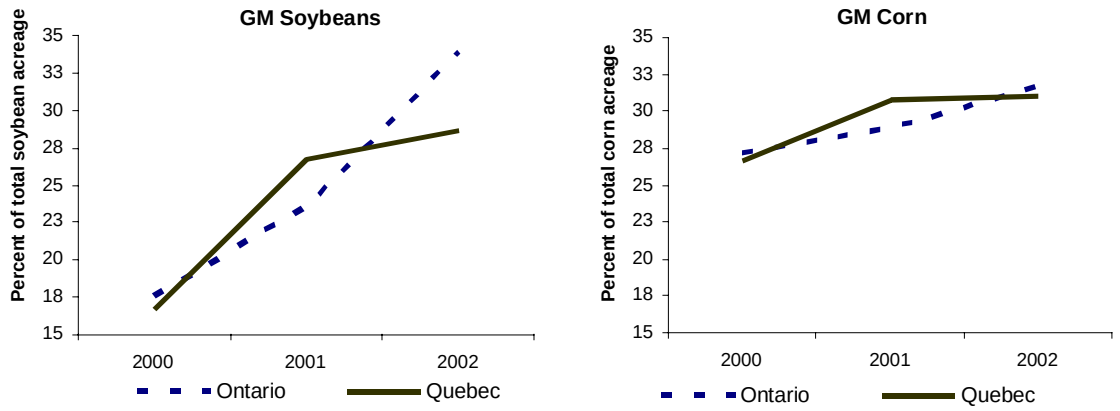
Table 1. Area seeded with genetically modified seeds continues to grow

	2000	2001	2002	2000	2001	2002
	% of total acreage			thousand acres		
GM Corn						
Quebec	27	31	31	274	334	346
Ontario	27	29	32	465	580	610
GM Soybeans						
Quebec	16	27	29	62	99	96
Ontario	18	23	34	405	520	700

Source: Statistics Canada, Agriculture Division

The conversion to GM soybeans has progressed at a much faster rate than conversion to GM corn over the same period. In 2002, GM soybean seed accounted for 34% of total soybean acreage in Ontario, almost double the proportion of 18% only two years earlier.

Figure 1. GM soybean adoption has progressed at a much faster rate than GM corn



Source: Statistics Canada, Agriculture Division

In Quebec, GM soybean acreage represented 29% of the total in 2002, compared with only 17% two years earlier. The adoption of GM soybeans followed an expected growth. It became popular as farmers tried it on some of their fields that need stronger weed-control measures.

Ontario farmers planted an estimated 595,000 acres of GM corn in 2002, while their counterparts in Quebec planted 327,300 acres. Ontario farmers reported 697,500 acres of GM soybeans. In similar proportion to the adoption in Ontario, 82,900 acres of GM soybeans were planted in Quebec.

U.S. farmers reported similar trends in their use of GM crops. Herbicide-tolerant soybeans expanded from 17% of the entire U.S. soybean acreage in 1997 to 68% in 2001.

The adoption of Bt (*Bacillus thuringiensis*) corn was rapid at the end of the 1990s, peaking at 29% of U.S. corn acreage in 1999. Since then, use of GM corn has fluctuated, depending on weather conditions that affect the risk of insect infestations. In the 2000-01 crop year, 20% of the U.S. corn crop was seeded with Bt corn. The controversy around the possible contamination of corn used to make taco shells with StarLink corn (only approved as livestock feed) may also explain why Bt corn has fallen from its 1999 peak.

GM crops more popular on small farm operations

Among all operators who seeded GM crops, farmers with small agricultural operations, those of fewer than 490 acres, allocated a greater share of their soybean and corn acreage to GM crops.

In 2002, a typical small Ontario soybean grower used modified seeds for 76% of his total soybean acreage. In contrast, a soybean producer operating a large farm, that is, more than 980 acres, grew modified soybeans on just over one-half (56%) of his soybean acreage (Table 2).

Table 2. Among the farms using GM crops, adoption rate is more significant on small operations

Adoption rate (1) of GM soybeans (% of soybean acreage)	Quebec			Ontario		
	2000	2001	2002	2000	2001	2002
Farm size less than 490 acres	77	82	88	62	72	76
490 to 980 acres	59	69	72	47	56	63
over 980 acres	45	77	68	39	43	56
Adoption rate (1) of GM corn (% of corn acreage)						
Farm size less than 490 acres	49	59	58	64	64	65
490 to 980 acres	44	46	53	45	52	60
over 980 acres	41	52	50	49	50	59

Note: 1. Share of GM corn or soybeans to total corn or soybean acreage of each individual farm with GM crops.
Source: Statistics Canada, Agriculture Division

Although they are more expensive, GM seeds save farmers time and the trouble of handling more than one herbicide. In addition, operators of smaller farms might be less likely to hire herbicide spraying contractors, and they often use most of their corn to feed their livestock.

Individually, operators of larger farms were slower to jump on the GMO bandwagon. However, their collective share of both total GM acreage and production has steadily increased in Ontario. In Quebec, lower GM acreages were reported in 2002 (Table 3.)

In 2002, GM soybeans acreage planted on larger farms, accounted for 11% of soybean acreage in Ontario, almost triple the proportion of two years before. In Quebec, the proportion seeded by larger farmers doubled from 5% to 10% during the same period.

Table 3. The share of GM crops grown by larger farms has steadily increased in Ontario

	Quebec			Ontario		
Share (%) of GM Soybeans to Total Soybean Acreage	**2000**	**2001**	**2002**	**2000**	**2001**	**2002**
Farm size less than 490 acres	7	8	13	9	11	15
490 to 980 acres	5	5	6	4	5	7
over 980 acres	5	13	10	4	7	11
Share (%) of GM Corn to Total Corn Acreage						
Farm size less than 490 acres	13	12	14	13	12	13
490 to 980 acres	8	7	7	6	6	7
over 980 acres	6	12	10	8	10	12

Source: Statistics Canada, Agriculture Division

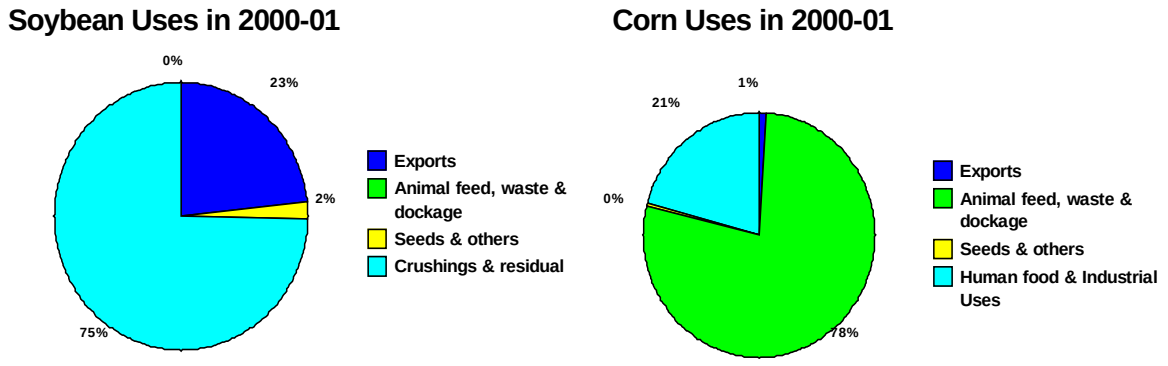
In Ontario, the share of GM corn grown on large farms increased from 8% of total acreage in 2000 to 12% in 2002. In Quebec, GM corn grown on large farms accounted for 10% of the province's corn crop in 2002, compared with 6% in 2000.

Little known about uses of GM crops

As our surveys contained no questions on the uses of genetically modified corn and soybeans, little can be said about the final uses of GM crops. The quantities sold off farm or used to feed animals on farm are unknown.

Figure 2 shows the uses of soybeans and corn, both GM and non-GM crops. In 2001, over 75% of these crops were used to feed livestock, either directly for corn or after being crushed as soybean meal. In 2000-01, 22% of soybeans available was exported, mainly to the United States. In that same year, 19% of the corn available was used for human food and industrial processing. It is unknown how much of this amount was produced from genetically modified corn. Corn could be used to produce several by-products such as ethanol, starches, corn syrup, gluten and sweeteners.

Figure 2. Soybeans and corn are mainly used to feed livestock



Source: Statistics Canada, Grain Trade of Canada, Cat. no. 22-201

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GM crops: benefits and costs

The jury is still out on the benefits of GM crops, and it probably will be for some time. Complex research to assess benefits and costs is underway in many countries.

GM crops have been promoted as a way to increase yield and production, and to reduce crop damage by insects. In Ontario and Quebec, farmers who grew genetically modified corn and soybeans reported higher yields in 2000, 2001 and 2002 than did non-GM growers. Statistics Canada surveys used to collect information on GM crops do not have questions related to other potential benefits.

According to published reports, GM crops benefit both the environment and farmers. They reduce the amount of herbicide and insecticide sprays used. Herbicide-tolerant corn and soybeans resist glyphosate herbicide, which is less toxic and persists in the environment for a shorter period of time than other herbicides. Glyphosate soybean is also linked to the increased use of conservation tillage, or a reduction of tillage passes, which saves fuel and labour, and cuts down on soil erosion.

From the field to the consumers' plate, there are billions of dollars at stake. Changes in labelling and traceability of genetically modified crops or derived ingredients imply major changes in the way food commodities are grown, harvested, stored, handled, graded, distributed and processed. Contract arrangements and agricultural and handling practices may have to be redefined to ensure GM crops or ingredients are not inadvertently mixed with non-modified products. To avoid this possibility, the production system from the field to food processing plants must be segregated when necessary.

A key issue for farmers is the "contamination" of non-modified field and wild relatives through pollen drift from fields where genetically modified crops are grown. There is also risk related to the potential reduction of biodiversity, the harm to useful insects and the development of resistance by targeted insects.

There are similar issues for consumers. In Canada, corn, soybeans and canola are most likely to be grown from seed developed with biotechnology engineering. Table potatoes, tomatoes and sweet corn could also be grown from seed engineered with the bacterium *Bacillus thuringiensis* gene to resist pests.

Little is known about the food derived from engineered seed that may find its way onto Canadians' plates and into their drinks. There is a good chance that some of the sweet corn, french fries, salad and cooking oil, starches, corn syrup and soft drinks we eat, drink and use contain products and by-products of crops grown with engineered seed.

Consumer groups have already demanded to know more about what they are eating. In Canada, under current regulations, GM foods must be labelled when they may contain potential allergens, or when their nutritional composition is different from non-modified foods.

Are current labelling standards for GM food sufficient? The debate is likely to continue as consumers become more concerned with what they are eating and where it comes from.

In the European Union, more stringent regulations have been introduced for the labelling and traceability of all food and animal feed produced from GM crops. These regulations are an effort to restore public confidence in food safety, which has been eroded by crises such as the mad cow disease and tainted food products.

Scheduled Releases of Agricultural Information

September 1, 2002 through February 28, 2003

Field Crops

September 10 - Stocks of Canadian grain at July 31, 2002 (Catalogue no. 22-002-XPB/XIB)

October 4 - September estimates of production of principal field crops by province for 2002 (Catalogue no. 22-002-XPB/XIB)

December 5 - November estimates of production of principal field crops by province for 2002 (Catalogue no. 22-002-XPB/XIB)

January 31 - Stocks of Canadian grain at December 31, 2002 (Catalogue no. 22-002-XPB/XIB)

Grain Markets

September 26 - Cereals and Oilseeds Review, monthly (Catalogue no. 22-007-XPB/XIB)
October 28
November 27
December 20
January 27
February 28

Horticulture Crops

November 22 - Area, yield and production of potatoes by province for 2002
January 17 (Catalogue no. 23-008-UIB)

February 14 -Area, production and value of fruit and vegetable crops by province for 2002 (Catalogue no. 22-003-XIB)

November 15 - Production and value of honey and maple products by province for 2001 (Catalogue no. 23-221-XIB)

Food Consumption

October 17 - Supply, disposition and per capita disappearance of oils, fats, fruits, vegetables, potatoes and fish for 2001 (Catalogue no. 32-230-XIB)

Livestock and Animal Products

November 13 - Farm sales of milk for fluid and manufacturing purposes, production and stocks of
February 12 creamery butter, cheddar cheese and other dairy products by province, quarterly (Catalogue no. 23-001-XIB)

October 23 - Inventories of pigs by province on October 1 (Catalogue no. 23-603-XIE)

February 19 - Inventories of pigs, cattle and sheep by province on January 1 (Catalogue no. 23-603-XIE)

October 23 - Wool sales and value for 2002 (Catalogue no. 23-603-XIE)

Scheduled Releases of Agricultural Information

September 1, 2002 through February 28, 2003

Livestock and Animal Products

September 26 - Stocks of frozen meat products in Canada by type of meat product and by province, monthly (Catalogue no. 23-009-XIE)
October 31
November 28
December 23
January 30
February 27

Poultry

September 19 - Stocks of frozen poultry meat by province, monthly (Catalogue no. 23-603-XIE)
October 21
November 21
December 18
January 22

September 6 - Egg production and number of laying hens by province, monthly (Catalogue no. 23-003-XIB)
October 8
November 8
December 6
January 8
February 7

Farm Income and Prices

November 26 - Farm cash receipts by province, quarterly (Catalogue no. 21-001-XIB)
February 25

November 26 - Estimates of ten agricultural economic indicators for 2001: farm income, farm cash receipts, farm operating expenses and depreciation charges, the index of farm production, current values of farm capital, farm debt outstanding, the farm product price index, direct program payments, the agriculture production account and balance sheets (Catalogue no. 21-603-UPE)

September 24 - Farm Product Price index, monthly (Catalogue no. 21-007-XIB)
October 22
November 22
January 6
January 30
February 26

Users may obtain these releases on the date of release through the contacts listed on the next page. Much of the data is available in machine-readable form in CANSIM at the same time. The publications will be available at a later date.

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