GMO REGULATIONS

AND USE

IN CANADA

- In Canada agricultural biotechnology is a highly regulated industry. Typically, new agricultural biotech products go through a series of safety assessments that conventional crops do not. Established regulatory agencies such as the Canadian Food Inspection Agency (CFIA), Health Canada, and the Pest Management Regulatory Agency (PMRA), review research data and the results of field trials before clearing new products for commercialization.

Many peer-reviewed scientific studies have been completed, both by universities and government agencies in the public sector, as well as by industry. These studies demonstrate the efficacy of the traits made available through biotechnology, their safety for human and animal consumption, and the benefits they deliver. Recent reports include the annual global report of the International Service for the Acquisition of Agri-Biotech Applications (ISAAA) and research completed by the Canola Council of Canada and PG Economics in the U.K. These reports have found that the benefits from biotech crops are scale-neutral; that is, farmers reap the benefits from the new biotech crop regardless of the amount of acreage cultivated. Further the reports document that the benefits to farmers include increased crop yields, the ability to reduce on-farm chemical use, the opportunity to transition to more environmentally-friendly farming practices, such as reduced tillage, and savings in both time and money.

2005 data showed that these new crops had been quickly adopted by millions of farmers worldwide and in only one decade the billionth cumulative acre had been planted.

This has led many to say that agricultural biotechnology has been adopted faster than any other farming improvement since mechanization started in the 1800's.

In Canada there has been a convergence of several technologies in the last decade that has quickly made conservation farming very popular.

25 years ago specialized equipment started appearing on the scene, with real advancements and refinements occurring in the last 10 years as sales justified product development. Then came advancements in chemicals that were better suited to conservation tillage and finally one of the most important advances has been a dramatic improvement in seed performance in large part through transgenic or GMO research.

In spite of a lot of negative press, farmers have quickly adopted this technology based on its proven results in their fields.

The first GMO canola was commercially released in 1996, and now only 12 years later over 90% of all canola fields are GMO. Because of the rapid use of GMO varieties and the resulting increased production through both expanded average and higher yields. Canola sales by dollar value have surpassed wheat as Canada's #1 agricultural export.

The acceptance for corn and soybeans is almost as rapid and dramatic with roughly 65% of these crops now being GMO.

Using the latest data I could access, Canada plants over 7 million hectares annually to GMO crops, placing it fourth after the United States, Argentina and Brazil, even though our agricultural land base is quite small compared to some of these other countries.

Some of the reasons for this very rapid acceptance are superior pest and disease resistance, better seedling vigor, higher yields, better cropping or rotation options and the ability to fight resistant weeds by using a whole new group of herbicides that are usually safer and environmentally friendlier.

Farmers through use of GMO crops have confirmed the studies that show these benefits allow them to adopt one or several conservation farming methods, reduce inputs such as pesticides, time and fuel plus coupled with higher yields, increase profitability

QUICK FACTS

** US Farm Journal article January 8, 2009*

- 90% chance Monsanto will release drought tolerant corn within 3 years and hopefully drought tolerant soybeans soon after.

- Very Expensive
- Monsanto and BASF have committed 1.5 billion dollars to this project

* from Council for Bio Technology website *2006 data (already obsolete)*

- 23 countries plant GMO crops
  - 12 developing
  - 11 industrial
- 40 more studying GMO's
- 12 million farms - 114 million hectares
- By area, India had the fifth largest amount of GMO crops with huge annual increases experienced in cotton.
- new crops in Canada include sugar beets and alfalfa
- beneficial traits being studied
  - adding tolerance to environmental stresses such as drought or frost to existing traits like insect or disease resistance and herbicide tolerance.

$C0_2$ SEQUESTRATION AND CARBON CREDIT MARKETS

A. CO_2 Emissions From Canadian Farms

In agriculture, there are three main sources of carbon dioxide emissions: changes that affect soil carbon reserves; CO_2 released through the use of fossil fuels on farms; and indirect emissions related to the use of fossil fuels to produce pesticides, fertilizers, etc. The following table shows estimated CO_2 emissions from various sources in the Canadian agricultural industry.

Table 1

Estimated CO_2 Emissions by the Canadian Agricultural Industry

	1981	1986	1991	1996
	(millions of tonnes of CO_2)			
Soils	7.7	7.3	5.1	1.8
Fuels used on farms	9.5	7.7	8.1	9.5
Indirect emissions	13.7	14.7	14.6	16.3
Total emissions attributable to agriculture	30.9	29.7	27.8	27.6

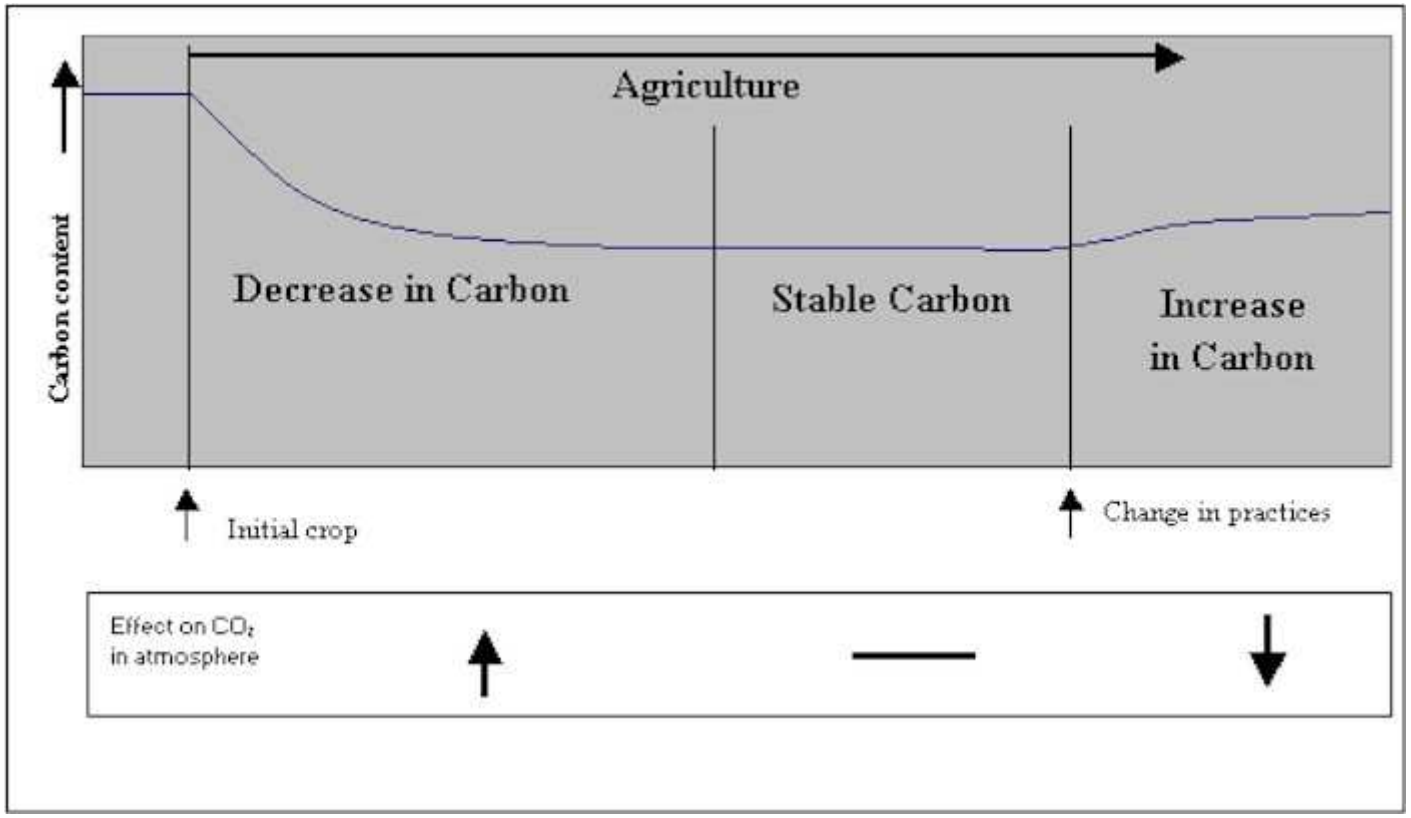
B. The Carbon Cycle in Agriculture

To understand CO_2 emissions from soil, it is important to have some idea of the carbon cycle in farm systems. Generally, CO_2 in the atmosphere is absorbed by plants, which transform it into carbohydrates, cellulose and other sugars. Each plant uses some of the carbon compounds to meet its energy needs and converts them back into CO_2. Some of the carbon remaining in the plant is then removed from the system when the plant is harvested; the rest ends up in the ground and is transformed into CO_2 again by microbes in the soil. This cycle is identical in all crop systems, but the quantities of CO_2 involved vary depending on climate, soil and type of plant.

On land that has undergone few changes over the years (a natural prairie, for example, or land that has been farmed the same way for many decades), there is a balance between the carbon captured by the plants and the carbon returned to the atmosphere; as a result, the quantities of carbon stored in the soil do not change. However, a change in land management disrupts the carbon cycle. For example, when forests and natural prairies are cleared for farming, a large quantity of the original organic matter is transformed into CO_2 and released into the atmosphere. When the land is then used for crops for several decades, the quantities stored in the soil become stable once again. However, when farming practices are changed to increase the organic carbon content of the soil, the reverse occurs: the soil captures more CO_2 than it emits, which means that CO_2 is removed from the atmosphere and stored in the soil. This process is called carbon sequestration: the term “soil sink” is used to mean agricultural soil that accumulates carbon.

Figure 1 illustrates the changes that occur at various times in carbon reserves in agricultural soil.

Figure 1
Effect of Farmland Management on Soil Carbon Content



Source: Adapted from R.L. Desjardins in *The Health of Our Air: toward sustainable agriculture in Canada*, Agriculture and Agri-Food Canada, Research Branch, 1998.

A country could therefore use the carbon sequestration capacity of its agricultural soil to reduce greenhouse gas emissions. That capacity is not unlimited, however, because the carbon reserves in the soil stabilize again after a number of years of unchanged land management.

C. Farming Practices that Allow Soil to Sequester Carbon

The long-term carbon retention capacity of soil depends on sound land management. Soil sinks cannot be created unless practices are adopted that increase the carbon content of the soil. Those practices, which can vary depending on the type of soil and climate, include:

a decrease in the amount of land left fallow;

- the use of direct planting, which does not disturb the soil as much and reduces the amount of CO_2 released into the atmosphere;
- the use of legumes and/or grasses in crop rotation;
- the conversion of marginal farmland to perennial grasses or trees;
- the use of rotation grazing and high-intensity short-term grazing;
- the planting of shrubs and trees as windbreaks; and
- the restoration of wetlands.

Many management methods aimed at storing carbon in soil sinks also contribute to environmental sustainability. Increasing the organic matter content of soil helps improve the soil's agronomic capabilities. It also produces better soil and better crops, improves water conservation, reduces erosion, and improves wildlife habitat and species protection, leading to greater biodiversity.

These methods can also make farms more profitable. For example, minimum tillage reduces the need for machinery, lowering inputs and therefore lowers production costs.

D. Soil Carbon Sequestration in Canada

Historical observations in Canada confirmed by mathematical models have shown that soil carbon reserves decreased quickly in the early 20th century as a result of the cultivation of a large amount of unused land. Those carbon losses gradually diminished as the soil achieved a new state of stability. The losses almost completely stopped in the mid-1990s.

In 1998, Agriculture and Agri-Food Canada (AAFC) projected that agricultural soil would cease to be a source of CO_2 before 2001 and would store between 0.5 and 0.7 million tonnes of carbon a year beginning in 2010. This trend will continue only until the soil reaches a new balance and only if practices that foster increased carbon content are maintained.

There is still some uncertainty over how to quantify the CO_2 that is actually removed from the atmosphere and stored in soil. AAFC's estimates are based on the CENTURY model, which uses certain scientific theories about soil, climate, vegetation and other factors to calculate an estimate of changes in carbon resulting from farming practices. However, a great deal of research remains to be done, particularly on practices that sequester carbon in certain types of soil.

E. The Kyoto Protocol

Unlike reforestation, carbon sequestration in agricultural soil was not included in the original Kyoto Protocol; in other words, soils were not officially recognized as carbon sinks, and carbon stored in soil cannot be factored into a country's emissions budget.

To rectify the situation, Canada pushed to have carbon sinks included in the Protocol: this was done in agreement with many Canadian stakeholders, including the Agriculture and Agri-Food Table on Climate Change, which recommended in January 2000 that the federal government continue its efforts to have agricultural soils recognized as carbon sinks in the Protocol. The initiatives taken by the government and the industry to implement measures aimed at reducing the effect of greenhouse gases were designed with that objective in mind.

- **FOSTERING THE CREATION OF SINKS**

  Among the various measures aimed at reducing greenhouse gas emissions are those which use the market by putting a price on carbon (for example, a tax or a tradeable permit system) and those which use the power of regulations to limit certain practices (for example, energy efficiency standards for motor vehicles). These measures do not necessarily foster the creation of carbon sinks. This presentation therefore focuses on the establishment of a carbon market and the appeal that this approach holds for farmers. It goes on to briefly describe other solutions and their impact on the adoption of practices that promote carbon sequestration.

- **A. A Market for Carbon**

  "Carbon Credit Trading" has undergone a lot of study in Canada and seems to be best able to encourage farmers to adopt practices that promote carbon sequestration and thus the creation of carbon sinks.

  The Kyoto Protocol allows the development of emission trading mechanisms as a way of reducing the emission of greenhouse gases into the atmosphere. The first step in implementing an emission trading system is to set a limit on each country's greenhouse gas emissions; each country then distributes its allocation among the various sources of emissions. Finally, the trading system would allow one source to increase the amount of greenhouse gas it emits by trading with another source that was able to reduce its emissions to a level below its allocation.

  Carbon sequestration activities such as carbon sinks will be incorporated into emission trading systems: this creates a "carbon credit" for each additional equivalent unit of CO_2 in the soil. These credits can then be sold to sources of greenhouse gas in order to permit their emissions. Credit trading gives farmers a bonus for adopting methods that promote soil carbon retention.

It should be noted that forestation and reforestation are considered carbon sinks under the Kyoto Protocol. In addition to creating a soil sink by sequestering carbon in soil, the conversion of marginal farmland to forest would also be a forest sink that would make it possible to obtain additional carbon credits.

The quantity of carbon sequestered on an individual farm is too small to be tradeable. However, considering that Canada has large hectares of farmland, there is considerable potential for tradeable credits. Methods of pooling carbon credits in order to obtain a significant tradeable volume have been devised.

CONCLUSION

Soil carbon sequestration is one way of reducing agricultural greenhouse gas emissions, and the creation of a market for reducing carbon emissions enables farmers to benefit economically from the process.

The process, however, does not resolve the entire issue of agricultural greenhouse gas emissions. The gains achieved through carbon sequestration must not be accompanied by an increase in greenhouse gas or CO_2 emissions from sources other than soil. Carbon sinks are not a permanent solution because soil carbon reserves reach a new balance after a number of years and the practices needed to prevent the CO_2 from being re-released have to be maintained.