



GE canola

Out of control in Canada



GREENPEACE

December, 2007

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1. Executive Summary

Canada is the only major canola producing country in the world to have adopted genetically engineered (GE) canola. In the 12 years since the commercial introduction of GE canola to Canada, there has been a pronounced increase in both herbicide use and weed resistance problems. The segregation of non-GE canola in Canada has failed, leading to the collapse of its non-GE and organic canola industries. Farm incomes have plummeted, and the country has entirely lost its canola seed exports to Europe. Australian State Governments should pay heed to what has happened in Canada, before throwing away our marketing advantage for a technology with no proven benefits.

The experience in Canada has shown that segregation is impossible, and contamination inevitable, wherever GE canola is grown. The growing of GE canola in Australia would remove choice for farmers who want to grow non-GE canola and for consumers who want to eat non-GE food.

Neither of the world's two largest canola producers, China and Europe, have chosen to go down the GE path.¹ In Europe one of the major reasons for not adopting GE canola, other than widespread consumer rejection, was evidence of serious biodiversity impacts if GE canola was grown there.² The experience in Canada has shown these concerns to be highly justified. In Canada, GE canola 'superweeds', resistant to up three different sorts of herbicide, are becoming a serious problem and farmers are resorting to highly toxic herbicides such as 2,4 D to control them.

There has been no thorough research looking at the likely impacts of GE canola on Australian biodiversity. There is a serious danger that GE canola may hybridise with noxious weeds, such as wild radish, posing severe economic and ecological challenges to farmers. These dangers need to be properly assessed before GE canola is introduced to Australia.

The State Governments of New South Wales and Victoria should reverse their decisions to allow their GE food crop bans to expire next year, until it can be demonstrated that GE canola can be properly segregated and that it poses no risk to the environment. All the evidence from Canada suggests that neither is the case. It is also important that the State Governments introduce liability legislation, so that biotech companies are held accountable for the environmental and economic damage caused by GE contamination.

2. Introduction

Canola is one of the most important oil seed crops in Canada and is cultivated on over 5 million hectares of farm land. In 1995, Canada became the first major canola producing country to grow GE canola commercially. This briefing reviews the recent experience in Canada and the lessons that should be learned in Australia, before the commercial growing of GE canola is allowed.

3. The adoption of GE canola in Canada

Following its commercial release in Canada, GE canola was adopted widely, as herbicide resistance was a 'new tool' that made it easier for farmers to farm vast acreages.³ However, the yield gains promised by the biotechnology industry have failed to materialise.⁴ One advantage to GE canola in Canada has been reduced tillage costs, due to adoption of minimum till. Although in other countries, such as Australia, where non-GE herbicide tolerant varieties are already available and minimum till is already widely used, these agronomic advantages obviously would not exist.⁵

In Canada the market is currently dominated by Bayer's Liberty Link and Monsanto's glyphosate tolerant Roundup Ready varieties. These are genetically engineered to be resistant to the herbicides glufosinate and glyphosate respectively.

4. The nature of canola

Canola plants are extremely prolific, with a single plant producing thousands of seeds. While this property endows canola with various agronomic benefits, it also makes it difficult to control. Seeds that fall to the ground during harvesting are prone to appear in subsequent years as volunteers, in other words weeds. Since canola is typically grown in rotation with other crops, these weeds have to be removed by the farmer to avoid yield penalties. Canola can often remain dormant in the soil for several years, making it a very persistent weed.⁶ Densities of volunteer canola can reach up to 1060 plants per square metre.⁷

As well as being prolific, canola is also highly promiscuous. A recent UK study found that GE canola cross-pollinated with non-GE canola more than 26 km away.⁸ Because of its prolific and promiscuous nature, canola has emerged as a major weed throughout western Canada.

5. The impact of GE canola on canola weediness

The problem of volunteer canola weeds in Canada has been greatly aggravated by the introduction of herbicide-tolerant genetically engineered varieties. Farmers have found volunteer herbicide-tolerant canola much more difficult to eradicate, since it is resistant to herbicides commonly used to control weeds. A study by English Nature revealed the widespread emergence of multiple herbicide resistant volunteer canola plants, following the growing of GE canola in the Canadian prairies.⁹

Weedy canola that is resistant to up to three herbicides is becoming common place in the Canadian prairies. An Agriculture Canada project found evidence of gene stacking at all 11 sites it sampled in 1999.¹³

Volunteer canola with resistance to all three of the most common herbicides, Roundup, Liberty and Clearfield, was identified in Canada as early as 1998, only 3 years after genetically engineered canola was first grown commercially.¹⁰

The occurrence of multiple genetically engineered traits in individual plants is referred to as 'gene stacking'. Gene stacking occurs as different varieties of transgenic canola in neighbouring fields interbreed, often assisted by the presence of volunteer and weed populations. The widespread emergence of plants resistant to multiple herbicides has led to "superweeds," with farmers resorting to highly toxic chemicals such as 2,4 D to control them.¹¹

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Scientists at the University of Manitoba, working with the Manitoba provincial government, found that the problem of herbicide-tolerant canola volunteers was most acute for farmers practicing low tillage and no tillage agriculture, since these farmers were most reliant on herbicides such as

Roundup and Liberty to control weed populations.¹⁴ Under conditions of global climate change, more farmers are turning to low disturbance methods of weed control. They are finding the problem of herbicide-tolerant canola volunteers increasingly difficult.¹⁵

Semi-wild, feral canola also grows when seed is spilled and scattered whilst being transported to processing plants. This is another way in which multiple herbicide tolerant weeds are likely to spread over time.

Since canola is grown on such a large scale (around 6 million hectares annually in Canada) some weed scientists predict that in Canada, GE canola volunteers will become the most difficult weed problem for many farmers in the Prairie region. In their study of GE crops and food, the Royal Society of Canada noted in this context '*... the inherent difficulties in the containment of genetic material in the context of normal farming practices in which literally millions of small seeds are produced and harvested over large areas of the landscape. Industry argues that as long as "good farming practices" are followed, these problems should not occur. This perspective may be unduly naive.*'¹⁶

Ironically, when the Canadian Food Inspection Agency first approved genetically engineered canola in 1995, they concluded that the Liberty Link canola possessed "no altered weed or invasiveness potential compared to currently commercialised canola varieties." At the time, they did note that "In the longer term ...careful management practices" would be needed to prevent the development of herbicide-tolerant crop volunteers.¹⁷ We can only conclude either that "careful management" practices were not followed, or that the potential dangers of genetically engineered canola were greater than initially predicted.

Unfortunately Canada's GE canola contamination is no longer confined to Canada. GE canola weeds, resulting from Canadian imports of canola seed for crushing, are now also widespread around ports and along transport routes in Japan.¹⁸ The weeds are a result of spillage from transport, which are inevitable - given the small size of canola seed. In fact, it is a common saying among farmers that if a truck can not hold water, it can not hold canola seed - as the seed is so small and leaks out of the smallest hole or gap in the back of trucks.¹⁹ The fact that Japan now has a GE canola contamination problem, despite not growing any GE canola, demonstrates just how unworkable the segregation of GE canola really is.

6. GE canola hybridisation with wild relatives

As well as being a weed in its own right, there is also growing evidence that GE canola is able to cross breed with wild weedy relatives, producing unpredictable and potentially uncontrollable weeds. Canola has a potential to interbreed with a number of brassica weed species including wild mustard, wild radish, oriental mustard and polish canola. Researchers have also found that transgenic hybrid weeds are able to persist in the environment over a number years.²⁰ If herbicide tolerance is passed on to natural weed populations, there is a concern that it may provide enhanced ecological fitness, leading to even greater weediness. Several of the most aggressive weeds worldwide are the result of crop hybridisation with wild relatives.²¹ Hybridisation with genetically engineered crops increases these dangers.

7. GE canola and chemical use

Scientists have warned for years that increased reliance on a single herbicide for weed management will lead to increase in herbicide resistant weeds, and hence increased herbicide use. This conclusion has been confirmed by data from the US Department of Agriculture that shows an overall increase in pesticide use of 56 million kilograms, about 4%, since 1996 as a result of the introduction of GE crops.²² Even the biotech companies have recognised emerging resistance by increasing recommended doses of herbicide for certain weeds. In the US, the recommended application rate for glyphosate use on certain weeds has increased by 50% to 200% since 1990.²³

While biotech companies, such as Monsanto and Bayer, claim that the use of GE crops will reduce toxic herbicide use, the emergence of superweeds in Canada is driving up the use of other, more toxic chemicals. Both 2,4D and paraquat (grammoxone) are being recommended by government agencies to control herbicide tolerant canola volunteers in Canada.²⁴ 2,4-D is an eye irritant and is considered “highly toxic”. Some forms are also highly toxic to fish.²⁵ English Nature considered that if herbicide tolerance genestacking arose in the UK, more paraquat and diquat may be used, which could harm an already threatened species, the hare.

Since the introduction of genetically engineered canola, the use of glyphosate-based herbicides such as Roundup, has also increased dramatically across the Canadian prairies. In the past two years farmers have experienced shortages of the herbicide, as demand has increased faster than production. Although both glyphosate and glufosinate are marketed as safer alternatives to 2,4 D and other herbicides, new research shows that they also pose threats to humans and the environment. French researchers have found that Roundup is capable of causing human endocrine and sexual hormone disruption at very low doses.²⁶ Moreover, most glyphosate herbicides also contain other compounds which can be toxic. An American study on four common pesticides in aquatic ecosystems found that application of Roundup “completely eliminated two species of tadpoles and nearly exterminated a third species, resulting in a 70% decline in the species richness of tadpoles.”²⁷

Ever willing to exploit an opportunity to increase chemical sales, agrochemical companies are now marketing herbicides to deal with herbicide tolerant weeds. One example is the promotion of Frontline (an imidazolone herbicide like Clearfield made by Dow AgroSciences) for the control of Roundup Ready and Liberty Link volunteers in wheat, barley and oats. Volunteer canola weeds are potentially a big problem so the environmental impacts from the chemicals used to control them could be immense.

8. GE canola and herbicide resistance

Aside from the toxic dangers of increased glyphosate use, a major agronomic concern is the evolution of increased tolerance to glyphosate among weeds. It is no coincidence that the vast majority of glyphosate resistant weeds have been found in the US, where the vast majority of glyphosate tolerant GE crops are grown.²⁸ According to US agro-economist, Dr Charles Benbrook “resistance to glyphosate has emerged as a serious concern across most of the intensively farmed regions of the US. The number of resistant weeds and their rate of spread is not surprising given the degree of selection pressure imposed on weed populations by farmers applying glyphosate herbicides multiple times per year, and sometimes year in and year out on the same field.”²⁹

9. The extent of GE contamination

“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.”

Canadian National Farmers Union³⁰

Following the large scale introduction of GE canola to Canada, contamination problems became apparent almost immediately. Farmers who had grown varieties specific to local conditions and environments were unable to stop the flow of genetically engineered canola seed and pollen on to their fields. Initial attempts to segregate non-GM canola in Canada failed and it is now nearly impossible to grow non-GM canola in most of Canada.

A little over a decade after the introduction of genetically engineered canola, Canadian farmers and communities are now experiencing the social, environmental and economic costs of an unregulated experiment across the agricultural ecosystems of Western Canada. Controlling the spread of genetically engineered canola is no longer possible in many regions and the effects of this experiment may never be reversed.

10. Seed supply contamination problems

“In western Canada, there is so much intraspecific transgene escape in canola that farmers in this region have come to expect the unintended appearance of transgenes in their canola.”

Dr Rene Van Acker, Department of Plant Agriculture, University of Guelph³¹

GE canola has been found to cross-pollinate with non-GE canola more than 26 km away.³² It is therefore not surprising the use of GE canola varieties has also led to the widespread genetic contamination of non-GE seed production. In 2003, Canadian researchers tested 33 samples of certified non-GE canola seed and found that 32 samples were contaminated with GE varieties. Three of the samples had contamination levels above 2%. Furthermore, a significant number of seedlings were found to be resistant to both Liberty

and Roundup herbicides. The authors concluded that cross contamination with various herbicide resistant traits was at a very high level and that purchasing pedigreed seed would not guarantee that the crop would be uncontaminated with genetically engineered traits.³³ Another study in the US found that similar problems have occurred in other GE crops, with virtually all samples of non-GE corn, soybeans, and canola seed being contaminated by GE varieties.³⁴

Widespread GE contamination is driving seed production out of the prairies to other parts of North America. In some cases it is being driven out of Canada altogether, relocating to GE free producer nations such as New Zealand. Biotech companies have even been avoiding the unwanted cross-contamination of GE seed by bulking up GE varieties in ‘trials’ in Australia.³⁵

11. The costs of genetic contamination

The segregation of non-GE canola in Canada has failed, leading to the collapse of its non-GE and organic canola industries. Farm incomes in Canada have plummeted since the introduction of GE canola and Canada has entirely lost its canola seed exports to Europe.³⁶ For farmers who spend years developing identity preserved, traditional or organic varieties of canola, GE contamination affects their ability to preserve the purity of their crop and the added value that they derive from it.

GE contamination also raises the spectre of patent infringement. Canadian canola farmer Percy Schmeiser found his crop contaminated with Monsanto’s Roundup Ready canola in 1996. In 2004, the Supreme Court ruled that Schmeiser violated Monsanto’s patent, even though he had derived no benefit from doing so. Schmeiser

In the US, Monsanto has an annual budget of \$10 million dollars and a staff of 75 devoted solely to investigating and prosecuting farmers for patent infringement.³⁷ The estimated total of settlements paid to Monsanto by farmers so far is \$85.7 to \$160.6 million.³⁸

maintains that it was Monsanto that was at fault for the contamination, and that the corporation should be held liable for the losses he suffered from the incident. His countersuit is still in the courts, raising more uncertainties about the costs of genetically engineered canola.

In the US, Monsanto has an annual budget of \$10 million dollars and a staff of 75 devoted *solely* to investigating and prosecuting farmers for patent infringement.³⁹ The estimated total of settlements paid to Monsanto by farmers so far is \$85.7 to \$160.6 million.⁴⁰

As of October 26, 2007, Monsanto had filed 112 lawsuits against farmers for alleged violations of its Technology Agreement and/or its patents on genetically engineered seeds. Press reports and Monsanto's own statements suggest that the company investigates roughly 500 farmers each year.

For organic farmers, contamination affects their the ability to maintain organic certification. Several Canadian organic farmers have pending law suits against Monsanto, as it is impossible to grow uncontaminated organic canola across much of the Canadian prairies.⁴¹ Tony Marshall, one of the few processors in Canada for non-genetically engineered canola, maintains his supply by only purchasing from farmers who are more than four kilometres from farms growing genetically engineered crops. With this requirement, he is only able to obtain supplies from a handful of farms across the most isolated areas of his province.

The irreversibility and cost of the GE contamination of seed is also illustrated by the recent case of GE rice contamination in the US. In 2006, rice exporters in the United States discovered that American rice breeding stocks had been contaminated by an illegal GE rice variety five years earlier. The contamination is believed to have originated from an experimental field trial. This incident has not yet been fully resolved for the 2007 rice crop and already, damages from the incident are estimated at around US\$1.3 billion. It should be noted that rice is much less promiscuous and prolific than canola. The serious environmental and human health concerns surrounding GE crops, and the intractability and the high cost involved when seed stock contamination does occur, need to be taken extremely seriously by Governments considering allowing the planting of new GE crops.⁴²

12. Lessons for Australia

12.1 Contamination is inevitable

“There is no safe distance at which you can guarantee there will be no contamination. People have to realise that if they introduce these transgenes it is going to be everywhere. If you don't want it, or your neighbour doesn't want it, there is still going to be contamination. They need to go in there with there eyes wide open.”

Dr Lyle Friesen, Department of Plant Science,
University of Manitoba.

The experience in Canada has shown that GE contamination cannot be contained. Separation distances expected to prevent genetic pollution have proved hopelessly inadequate, since GE canola has been found to cross-pollinate with non-GE canola more than 26 km away.⁴³

In Australia, co-existence and choice has been promised by government and industry but there is no intention to deliver it. Peter Portman from CBH (the largest grain handler for export in Australia) has been reported as saying *“CBH believed we would segregate for only a couple of years and only then for political reasons.”*⁴⁴

12.2 The biotechnology industry is the sole beneficiary of GE crops

The sole beneficiaries of GE crops are the agrochemical companies. These companies are benefiting from herbicide tolerance twice over. First, through the sales of GE crops and the chemicals they are designed to tolerate. And second, in sales of chemicals to control the problems the GE crops create.

Over the past decade the price of Canadian canola has plummeted, as markets around the world have either closed to Canada's contaminated canola or offered preference to non-genetically engineered suppliers, such as Australia.

Canadian farmers have observed the situation in Australia in disbelief:

“I can’t imagine throwing that marketing advantage out the window by ending the moratorium [in Australia] for some mistaken idea that you might get some yield benefit from growing GMO.”

Doug Bone, Saskatchewan grain farmer.

No independent trials have been conducted in Australia to assess any potential yield gains associated with GE canola and Bayer and Monsanto have failed to enter their GE canola varieties into national seed listing trials in order that they can be independently assessed. In 2005 Ian MacDonald, the New South Wales Agriculture Minister, argued that before the NSW moratorium could be lifted “it is important that independent, small-scale agronomy trials of GM canola occur prior to larger-scale segregation trials being conducted to address marketing issues.”⁴⁵ This work has still not been completed.

12.3 GE canola has serious biodiversity impacts

Canada is the only major canola producing country in the world to have adopted GE canola. Neither of the world’s two largest canola producers, China and Europe, have chosen to go down the GE path.⁴⁶ In Europe one of the major reasons, other than widespread consumer rejection, for not adopting GE canola was evidence of serious biodiversity impacts if GE canola was grown there.⁴⁷ The experience in Canada has shown these concerns to be highly justified.

The last trial in a four-year UK study, published in the Royal Society’s journal *Proceedings B* in March 2005, compared herbicide resistant GE canola, to its conventional non-GE equivalent. It found there were fewer seeds, bees and butterflies in GE fields. There were also fewer broad-leaved weeds, which are important because they feed insects and birds. The effects were attributed to the herbicide regime associated with the crops.⁴⁸

While the Australian Office of the Gene Technology Regulator (OGTR) dismissed the study as ‘irrelevant’ to Australia because of differences in cropping areas, CSIRO pointed out that the need to conduct similar studies in Australia.⁴⁹ Such studies have yet to be conducted.

The biotechnology industry promised that GE crops would lead to a reduction in herbicide use

and that the herbicides used would be less harmful to the environment. After 12 years, the Canadian experience is showing how untrue this is.

12.4 GE crops will exacerbate herbicide resistance problems

Glyphosate is the most popular weed knockdown chemical used by farmers in Australia. Farmers tend to integrate a range of resistance management options to avoid its overuse, and to control resistant weeds with alternative chemicals. Despite this, incidences of glyphosate resistant rigid ryegrass (*Lolium rigidum*) have already been reported in New South Wales, South Australia and Victoria.⁵⁰ The increased use of glyphosate that would accompany the introduction of GE crops in Australia would only make these glyphosate resistance problems worse – as has already occurred in the US.⁵¹

As well as being a weed in its own right, there is also a danger that if GE canola is introduced to Australia it may hybridise with weedy relatives such as wild radish (*Raphanus raphanistrum*) and wild mustard (*Sinapis arvensis*). Wild radish, in particular, is already categorised as a noxious weed and is a major problem in all Australian grain crops.⁵² The transfer of herbicide resistance to these weeds would present significant economic and ecological challenges to farmers.

13. Summary

The experience in Canada has shown that once GE canola is released into the environment it poses serious environmental problems and cannot be contained. Because GE contamination is unavoidable, the growing of GE canola removes choice for farmers who want to grow non-GE canola and for consumers who want to eat non-GE food.

The State Governments of New South Wales and Victoria should reverse their decisions to allow their GE food crop bans to expire next year, until it can be demonstrated that GE canola can be properly segregated and that it poses no risk to the environment. All the evidence from Canada suggests that neither is the case. It is also important that the State Governments introduce liability legislation, so that biotech companies are held accountable for the environmental and economic damage caused by GE contamination.

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