# Genetically modified organisms – the farmer's side of the field

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## Introduction

Developments in crop technology open many doors for farmers, and with those benefits however, come risks. At a time when many farmers are battling to survive, the arrival of this technology is both a windfall and a curse. The information with which farmers are being bombarded is not giving many of them a good idea about the actual benefits or costs of growing genetically modified organism (GMO) crops. One minute they are hearing of the production advantages and the next of unsaleable crops. They are very aware that farmers in the United States are in some cases saving hundreds of dollars on herbicides and pesticides, they are also aware of the problems some farmers are having selling their GMO produce. There is a need for more 'real' information, the promised advantages through extra weed management tools and higher productivity must be acknowledged, alongside the questionable economic benefits of the crops if the companies that own them enforce high technology fees and consumers continue in their refusal to buy food produced from them.

## Initial optimism

Farmers have benefited from and contributed towards the plant breeder's efforts. Plant breeding has us led towards more productive agriculture in conjunction with sustainable agriculture for example better yields, resistance to disease and improved quality targeting specific markets.

With the advent of GMOs farmers saw the potential to accelerate all of the above benefits and these potential benefits to farmers hit home with many. Farmers in Canada and America adopted the technology with alacrity. Many saw a potential to reduce use of chemicals combined with higher yielding crops. The weed and pest management opportunities were utilized with an enthusiasm not shown since the initial introduction of agrochemicals. Biotechnology had the potential to revolutionize the agricultural industry once again.

## Turning to dismay

The initial enthusiasm of farmers for GMO crops has suffered a blow with an uprising against the technology this year. Although over the years since its wide scale commercialization in countries such as America, Canada and Argentina there have been small pockets of consumer backlash. This, however, could not have prepared the farmers or the seed companies for the full scale media war which erupted initially in the EU and has now become part of the scene in Australia and even the USA and Canada.

GMOs became 'Frankenstein foods' and 'mutant foods'. Farmers producing GM crops found markets blocked off as the EU put barriers in the way to sales. It was once thought that the crops would be quietly introduced into Australia as they had been elsewhere, this was not to be the case. The anti-GMO lobby has taken a firm hold of the Australian consumer and if Europe is anything to go by this may not be a short lived opinion.

## Misleading arguments

Some of the loudest anti-GMO arguments to come forth were from environmentalists concerned about the perceived risk to the American monarch butterfly (*Danaus plexippus*) larvae. As you all are aware this was plastered over the headlines for weeks. As emotive arguments went it worked well, however the reports failed to mention that the levels of pollen being fed to larvae were in most cases a great deal higher that which would have occurred in the wild.

## Identification of legitimate concerns

Farmers do want to continue to have access to advanced plant breeding and the biotechnology but industry must be aware and considerate of our concerns.

## Commercial implications

Farmers are concerned about the potential effects of the technology being dominated by a diminishing number of increasingly powerful companies.

The ability to choose what and how we grow a particular crop is important to us. Remember it is our land and capital that is being invested. With the advent of the multinational seed companies we see the possibility of a future in which they could require complex contracts for the growth and sale of their crops. As David King, Secretary General of the International Federation of Agricultural Producers said, 'Farmers are not looking forward to a future as tractor drivers for big multinational companies.'

Through patents and plant breeders rights legislation, seed companies are developing 'technical' and 'legal' means with which to take away our rights to plant our own seed. Seed companies have a 'legal' means by introducing grower contracts to enforce the collection of technology fees. The now defunct 'terminator' technology would have been a prime example of the 'technical' means for the seed companies.

By forcing farmers to buy seed every year some feel that food security will be compromised. In developing countries many farmers rely on saved seed, this saved seed also provides food security in the poorer countries. Having to buy seed would be seen to increase the financial burden on farmers. However, those who now grow crops from hybrid seed have already adapted to this commercial reality. An end point royalty could be incorporated into a system that would allow farmers to save their own seed as well as acknowledged the plant breeder's rights to a commercial return.

- Will the farmer lose his freedom as an entrepreneur, and become a pawn in the game of the large agro-chemical 'life science companies' that control the technology?
- Will technology lead to the further disappearance of small farms? This is an important question in the developing countries. Whether GMO related or otherwise.

## Public breeding issues

The current trend is for governments to reduce their investment in agricultural research. Commercial companies see an opportunity to invest in this are and subsequently expect a commercial return on their investment.

It must be acknowledged that although the technology applied to plant species leads to a desired trait such as herbicide resistance or insect resistance the initial value of the now engineered variety of plant existed prior to genetic modification. The value of the additions is limited but due to patent laws companies can now own the seed.

In Australia we are lucky that modification is being done in many cases to publicly owned and adapted varieties. It does raise the issue of a need for properly controlled intellectual property rights to ensure that the plant breeders or institutions that developed the plant line are properly compensated for their part in the production of the new seed. The enhanced value of the seed should not belong exclusively to the holder of the technology patent.

## Genetic biodiversity

Whilst farmers are aware that the seed companies require a reasonable return on the large capital investments they have made in research into biotechnology, the farmers rights to plant their own seed must also be understood and respected. Farmers' rights are protected by

the United Nations convention on Biodiversity, Food and Agriculture Organization International Undertaking on Plant Genetic Resources and by the International Union for the Protection of New Varieties of Plants Convention.

- Will biodiversity be preserved?
- How can we ensure that public varieties survive so farmers have a choice?

Many of those against the development of GM crops are concerned that by introducing these genetically altered species to the environment we will dramatically alter our ecosystem. Another potential problem is genetic uniformity. Since the advent of genetic maize varieties in countries like Mexico the overall number of maize varieties grown has fallen dramatically. This is due in the most part to the popularity of GM varieties not the lack of availability of the traditional varieties. Biodiversity is an important argument in the fight to maintain our public breeding programs. We must ensure that varieties remain available through schemes such as the seed maintenance program that maintains seed banks of varieties for use by plant breeders.

There are environmental arguments both for and against GM crops. Naturalists agree that the biggest threat to wildlife in the 21st century is the loss of habitat. Farming already takes up about 36% of the earth's land area. Modern agriculture has saved millions of square kilometres of wildlands from being ploughed under to produce low-yield crops. Without further increases in yields the world could lose the forests that still cover one third of the earth.

Although the public is told that the products have been fully tested and found safe these claims become less credible when issues such as the threat to Monarch butterflies (*Danaus plexippus*) becomes known. Monsanto now intend to conduct studies on how much pollen is spread in the wild, how long it stays on milkweed leaves (the caterpillars main food source) and if it is produced when the caterpillars are feeding. Situations like this give critics ample fuel to suggest that not enough tests were done before the plants were released on a wide scale.

## Weed management

There is concern that genes that code for resistance to herbicides could be transferred from GM plants to weedy relatives, or even become weeds themselves. In Canada GM oats have been banned due to the problems of herbicide tolerance within wild oat.

Many groups have suggested that in conjunction with the commercial release of GM crops farmers should be given a management plan to follow. The management plan would be aimed at increasing knowledge and maximizing the time before further herbicide resistant weeds become a problem. It is acknowledged by many that the resistance to chemicals will come from the repeated use of those chemicals rather than the crossbreeding of the GM crop plants with wild relatives. It will be important that GM crops are incorporated into Integrated Weed Management and Integrated Pest Management plans in order to encourage responsible use of the technology. We have already seen this process in operation with the release of other herbicide and pesticide management packages.

Already in areas of Australia farmers have to deal with herbicide resistant weed species such as ryegrass (*Lolium* spp). We must recognize that despite problems now such as chemical resistant weeds and pests the current productivity gains achieved would not have been possible without the use of agrochemicals.

## Segregation

A major factor that seems to have been ignored is no matter how attractive the technology farmers can only afford to grow what they can sell. For example large numbers of farmers in America have experienced difficulty selling their GMO corn crops. It now appears that if Australian farmers adopt GM crops, segregation will be necessary to ensure no restrictions of markets.

Co-mingling was the norm in America, but with the advent of consumer hostility many of Americas largest food handling and processing groups are now demanding segregation in order to satisfy their overseas markets. Australian farmers are already familiar with segregation issues and segregation is an achievable and relatively inexpensive way of allowing consumers choice, it will also go a long way towards allaying some of their concerns. However, segregation can only be an option if all parties can agree on a credible definition of what is GMO free.

## Market access and consumer reaction

As consumers become interested in how their food is produced farmers come under scrutiny. Consumers want a quantity of good quality, healthy food but they are also sensitive to price. Farmers are in a vice and see productivity increases as an economic solution to depressed prices. Biotechnology may offer farmers a chance to increase productivity from the same land area.

Are products from GM crops safe for both health and the environment? Until the public is properly informed and long term research proves the safety of these crops there will be consumer resistance and therefore market problems.

We must understand and respect the concerns of consumers over the safety of GM crop based foods. Many consumers are mistrustful of claims made by companies or scientists seen to have a vested interest in a product. Pushing the products on them without labels shows a disrespect for their concerns, people must be allowed choice especially as they purchase the end product. Without consumer acceptance the technology is doomed no one will grow what they can't sell, or at least they won't grow it for long.

## The VFF Grains Group perspective

In absence of formal policy direction from the full membership of the Victorian Farmer's Federation (VFF) Grains Group the Grains Council put forward a number of resolutions in order to address the concerns of members.

Prior to the formulation of policy on GMOs ratified by the full Grains Group membership the Grains Council has developed some preliminary motions in order to address members concerns. The resolutions discussed were:

i. The VFF Grains Group believes that subject to an acceptable segregation and separation protocol there is greater benefit to grain growers to release GM canola and peas as they become available
ii. That the VFF Grains Council seeks details of all GMO canola and other GMO crops being grown under trial conditions in Victoria. The details to include contract information between seed companies and research organizations including protocols and restrictions under which these trials take place. This information is to be made public.
iii. We believe that further testing of GMO grain products be undertaken to confirm their safety for consumption and so allay consumer concerns.
iv. The VFF Grains Groups should support the National Farmer's Federation and the Grains Research and Development Corporation in their efforts to release scientific data in order to present a well-balanced view of the argument.

There is a need for long term food safety testing. No one is suggesting that the GM derived foods be tested at the level that drugs are, but there is a need recognition that these products may be different from plants bred by traditional methods. Further testing may be unnecessary in the eyes of the scientists and the GM plant owners but it is not in the eyes of the consumer. If all further testing does is prove the safety of GM derived foods and allay consumer concerns then that would be money well spent.

There is a great deal of talk from both sides of the argument, unfortunately there is little transparency or accountability in the arguments from either side of the debate. The public would have been more receptive had the progress so far been at a

rate slow enough to reassure the public that we were moving carefully. Consumer confusion caused by a lack of independent investigation has become a lack of confidence in the regulatory system for food safety. The only way to address this is to encourage independent food safety testing of the products before they are put on the market. No one would accept the results of a quality assurance audit if it was undertaken by those with a vested interest in the results and so will it be with the food safety testing of GM derived products.

The harder you push for acceptance the more resistance you will meet, the concerns of farmers and consumers must be acknowledged and respected. Now is not the time for million dollar advertisement or 'education' campaigns about the benefits of biotechnology it is the time for honest, transparent and accountable debate.

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# The myths of gene transfer – a canola case study

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## Summary
**Canola (*Brassica napus*) is not a significant weed in managed ecosystems, nor is it invasive of natural ecosystems. Canola incorporating herbicide tolerance (HT) genes has no altered weed or invasiveness potential. The novel trait confers no competitive advantage unless plants are challenged with the specific herbicide. Multiple HT canola volunteers are no more difficult to control in following crops than conventional or single HT canola. They are susceptible to a range of conventional herbicides representing a number of different herbicide groups. There are significant barriers to the introgression of HT genes into the genome of weedy species. However, should introgression occur, any HT weeds, as with HT volunteers, would be controlled using other available herbicides. Enhanced management practices will be required to minimize HT gene flow, either through pollen transfer or seed movement, to non-HT canola, to other HT canola types and to weedy species.**

## Introduction
Genetically modified (GM) canola (*Brassica napus*) offers considerable benefits to the Australian industry, including potentially higher yields, a healthier and broader product range and renewable oil sources. The first GM canola products to be available in Australia commercially will be herbicide tolerant (HT) cultivars, which bring major benefits in terms of enhanced weed control and higher yields. However, there are also a number of potential concerns with the development of HT canola cultivars, including the potential that addition of the herbicide tolerance gene will make canola a weed of agriculture and invasive of natural habitats. Further, there are concerns of potential gene flow from HT canola to other canola crops and to wild relatives, whose offspring may become more weedy or invasive. This report evaluates these concerns and presents some management suggestions for HT canola.

## Potential weediness of HT canola
Canola (*B. napus*) is not a significant weed in managed ecosystems, nor is it recorded as being invasive of natural ecosystems (AAFC 1994). Results from Canada and the UK have shown that the incorporation of a HT gene into *B. napus* has not altered its weediness or invasive potential (AAFC 1995a,b,c,d, 1996a,b, Rasche and Gadsby 1997, PBO 1998, Norris *et al.* 1999). Like non-HT canola, HT canola is not a significant weed in managed ecosystems, nor is it invasive of natural ecosystems.

Studies of reproductive and survival characteristics of HT canola, incorporating vegetative vigour, overwintering capacity, flowering period, time to maturity, seed production and dormancy, showed that the HT canola values fell within the normal range of expression of characters in unmodified *B. napus*. This has been shown for all novel HT types, including different transformants with glyphosphate tolerance (AAFC 1995b, 1996a), glufosinate-ammonium tolerance, including where the HT gene has been combined with the hybrid system (AAFC 1995a,d, 1996b), bromoxynil tolerance (PBO 1998) and the non-GM imidazolinone tolerance (AAFC 1995c).

The number of HT volunteers in the year following GMO trials varies widely, and is influenced by trial size, harvesting conditions and environmental conditions (Norris *et al.* 1999). The numbers of HT volunteers in the year following trials are comparable to, or less than, unmodified *B. napus* in both Canadian and UK trials (Crawley *et al.* 1993, Booth *et al.* 1996, Hails *et al.* 1997, Rasche and Gadsby 1997, Sweet *et al.* 1997, Norris *et al.* 1999). HT volunteers do not show increased numbers or fitness relative to conventional volunteers (Messean 1997, Norris *et al.* 1999, Sweet and Shepperson 1998, Sweet *et al.* 1999a,b). GM HT canola did not lead to increased problems of volunteer management in subsequent crops (Norris *et al.* 1999).

Monitoring results from unmanaged areas adjacent to fields and along transportation corridors in Canada indicated that the frequency of HT volunteers is equal to traditional volunteers. Both are equally likely to appear by the roadside if seed falls from trucks or farming equipment (Rasche and Gadsby 1997, MacDonald personal communication). Evidence from Canada (MacDonald personal communication) indicates that roadside populations of canola only survive if they