

**Australian Nuffield Farming Scholarship
Trust.**

The Future for Genetically Modified
Crops in Australia: A study of overseas
acceptance and commercialisation of GM
technologies.

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1. **Executive Summary**

My Nuffield Scholarship was split into two halves. In February I set off with my fellow Nuffield Scholars on a two week tour of Singapore, Malaysia and Thailand where we looked at how culture and economic situations impact on the way agriculture operates and the affect this has on the way we export Australian produce.

The group then moved onto Europe where we had a further three weeks together looking at the driving forces behind the strong government involvement in agriculture. We spent time in the UK, Belgium and France. We also examined the farming systems to gain an appreciation of what drives farming.

After the organised part of the trip I spent a further six weeks in the UK and France. I spent some of my time looking into market acceptance of GM crops, what the scientific community are doing to promote the technology and what understanding farmers had about the potential for GM crops.

The feeling in Europe was one of concern; consumers were hearing a lot of negative publicity about “Frankenstein foods”. Farmers worried about the dominance of a few large multinational companies in the breeding programs and super markets were using the label of GM free as a selling point. The potential for this technology seemed very bleak indeed.

I then returned home for seeding before resuming my studies in the USA. I spent time in Washington DC and then the Midwest with both farmers and university and corporate scientists involved in commercialising the technology.

The attitude in the US was far more relaxed. This new science has been around for 15 years. The scientific community and the regulatory process is respected in the wider community. Farmers were experiencing real benefits from the improved farming systems. It was hard to understand what all the fuss was about. This was good science, well researched and well tested by the best scientists in the world.

I spent a lot of time examining the drivers in the push to commercialise GM crops and to understand the implications for the grains industry in Australia.

My conclusion is that to ignore the technology in our production systems will result in Australia being less competitive in relation to other countries using GM crops. Marketing ourselves as “GM free” may be a shortsighted vision. We need to be proactive as an industry to ensure that we make the most of this technology with out becoming beholden to the major multi-national companies who currently control this science. To achieve this I recommend the introduction of a working end point royalty system.

2. Acknowledgements

I must first thank the Australian Nuffield Farming Scholarship Foundation for giving me such a fantastic opportunity to travel overseas and gain an understanding of agriculture from a global perspective.

I must also thank my family who stayed at home and did all the work while I was away, without family support the whole thing would have been impossible.

Great thanks go to the investors of Nuffield who have a vision for the future of agriculture in Australia. In this case I thank QANTAS for support with airfares and particularly to the Grains Research and Development Corporation (GRDC) as my major sponsor. I hope that from the information contained in this report the GRDC can see value for money from their investment.

Whilst in Europe I relied heavily on the Nuffield network to organise contacts for me, additional thanks go to the staff at the BAB in Brussels, Bill Young, and James Young from England.

In the USA the Nuffield network is much less developed, I relied heavily on the Australian Embassy in Washington DC for all my contacts in the capital. In the Midwest I must thank Pete and Mary McVay in Minnesota for hosting me for a week. I then travelled down to St Louis for a week with Monsanto; particular thanks go to Elaine Brodsky and Sean Gardner. I then spent a further two weeks in and around Kansas with contacts organised by Ben Curtis and the South East Premium Wheat Growers Association of Esperance, West Australia, also thanks go to AWB Limited for contacts into the Chicago and Kansas Boards of trade.

3. Introduction.

Europe has very real concerns with Genetically Modified Organisms (GMO's). This concern can be traced to four areas:

1. Ethics
2. Food Safety
3. Environmental Safety
4. Corporate Issues, anti Multinational company fears.

The consumer in Europe has really had no opportunity to choose GM or non-GM foods as the supermarkets have largely removed openly labelled GM foods from the shelves.

Greenpeace has taken this issue and very publicly demonstrated against it. They have taken an unreasonable approach to the issue and are using it to push for memberships, somewhere along the line they appear to have forgotten to consider the environment.

On the other hand consumers in the US trust the US Food and Drug Administration (FDA). They don't place much credibility in organizations like Greenpeace. They accept GM foods to be substantially similar to conventional varieties.

In the US farmers are benefiting from GM crops, this year they could potentially harvest a record corn and Soybean crop. The effect of this will be to reduce world prices for grains. It is hard to state the exact effect on yield and cost of production derived from using GM crops, but the fact is the benefit is real and under the US government assistance package good farmers are experiencing record income in times of record low grain prices.

This means the Australian farmer with no access to the technology is at a disadvantage. We are faced with lower prices without the ability to compete using the same technology as the US farmer.

If Australia wishes to gain access to the technology we will need to develop mechanisms, which enable the owners of the technology to extract value from their investment. An end point royalty system could be the most equitable and farmer friendly system to introduce in Australia.

4. The situation in Europe

The public debate around Europe regarding the possible commercialisation of genetically modified crops reached a point of public hysteria early in 2000. There are several reasons for this:

(The attitude of companies such as Monsanto has left a lot to be desired, they failed to address the very basic nature of public concerns regarding this new technology. They had a somewhat arrogant approach, claiming that the results from the US and Canada suggested that it would not be a problem for Europeans.

(The general public in Europe, and the UK in particular were reeling from recent food safety incidents, namely the BSE scare in beef and the Dioxins scare in chicken. This has led to the public losing faith in scientific “experts” and the farming community in general - they have more faith in the large supermarket chains.

(The competitive nature of the dominant supermarket chains within the food retail sector has meant that the non-GM food issue has taken on a marketing angle. The supermarkets home branded products are all now non-GM. Before the debate flared up GM foods were being sold and clearly labelled and the public had no problem with them.

(The timing of this debate was opportune for groups such as Green peace, who needed an issue to galvanise public support. The GM debate fell into their lap and has enabled them to generate masses of publicity.

The main issues to consider

There are four main issues in the debate in Europe that need to be considered:

(The debate over the *ethics* of the new science. This relates to the philosophical discussion on man’s right to interfere with nature. It is largely a personal issue with people but at the end of the day it needs to be treated on a case-by-case basis. Genetic modification involving the transfer of genes from animals to plants obviously draws more attention than cases involving plant-to-plant transfer.

(The debate over *food safety* of foods derived from the new science. Will these novel foods cause food safety problems in the future? Probably not but the public need to be convinced by scientific evidence, it is no use trying to brush this issue under the carpet - the consumer’s fears need to be put at rest.

(The *environmental* debate. This takes many forms and in Europe includes a loss of biodiversity relating to the increase in mono- culture. This could reduce food sources for the birds and insects in the environment. This is an issue that is hard for us in Australia to understand - the environment in Europe has evolved around agriculture and any changes to the way in which crops are managed has an impact on the wild life.

The other side of this debate is the fear of the wider impact the new genes could have on the environment. Will insect resistance genes cause harm to non- target insects? Will they result in the natural selection of chemical resistant insects? Will the inserted genes “escape” from the crop into weeds in the farm scape - creating a “super weed”? Will the crop itself become a major weed in following crops in the rotation?

The whole environmental issue is very complex and is the main focus of many of the scientific trials. All the issues that have arisen so far, and the many more that will arise can only be addressed by having an intensive trial program in place over many years. It will be important that the public is included in the trial process so that they may gain an understanding and appreciation of the issues at hand.

(The *commercial* debate. This looks at “multi-national” chemical companies who are the main owners of this new technology and how they will form business relationships with agribusiness already in operation. Undoubtedly the owners of this technology will aim to maximise profits. What effect will this have on the farm sector? What effect will it have on our markets? What regulatory controls need to be put in place to ensure the responsible application of this technology?

The Commercial debate is the main focus of my Nuffield Scholarship. From my travels in Europe I have gained a very strong appreciation of the importance of producing quality product for your consumer. In Europe this has been somewhat distorted by the producers focus on the subsidy system. Many farming decisions are based on how to achieve the maximum benefits from subsidy payments rather than on what the market signals indicate.

Market Acceptance.

With full supermarket shelves in Europe the consumer certainly doesn't need these first generation GM foods whose only benefits are to the producer. It seems that in the excitement over the potential of this new technology the basics of food marketing have been forgotten. It is a stated aim of Monsanto to first re-coup a return on their investment in first generation GM crops before commercialising the second-generation crops, which will have more of a consumer focus. They will be modified to include specific traits for direct end use (eg better feed for chickens, or even greater health benefits to humans). It is a reality that the public in Western societies will demand “choice” as to what they eat. If GM crops are going to have a place they need a market, if they are going to have a market then the consumer must be willing to accept them.

When GM tomato paste was first sold in supermarkets in the UK it was labelled as GM food and it was packaged in a larger container at the same price as non-GM paste. The consumer accepted this, perhaps out of ignorance as to what GM meant, but the fact was the consumer had choice and perceived value for money in this food. After the GM scare campaign started, due to the fact that food processors were importing GM grain from the US and not labelling it as such, all GM product was taken from the shelves. At the same time the home brand products advertised themselves as GM free as a marketing ploy. The consumer now perceives no value in this technology and until such time as they do these new foods have no market.

This is a serious threat to the long-term adoption of this technology. Monsanto in the UK recognise this and the fact that their original attitude in Europe was misguided. They now plan to consult more openly with the public in an effort to educate them and take the hysteria out of the debate. They aim to keep them fully informed and to give them choice. They also plan to demonstrate value to the consumer. This can be done with the backing of scientific evidence outlining the environmental benefits, the product quality benefits or (unfortunately for the farmer) price benefits. The thought of discounting the price of GM crops wouldn't appeal to most farmers. The success of such a program will require the help of the whole agribusiness sector.

Perhaps it would be easier if some of the consumer driven GM crops were commercialised as soon as possible so that, slowly, demand for these products could pull them through the supply chain, rather than trying to force them through to the consumer from the production side.

5. The situation in the USA.

The agricultural industry in the USA currently enjoys widespread community support, both financial and moral. Largely the US farmer is seen as a struggling small family farmer battling away against the low commodity prices and uncertain weather conditions. In reality the efficient commercial grain producers are doing very well, receiving up to 30% of their incomes from direct government financial support and enjoying comparatively little government regulation and control of what they do. Added to this the grain producers in the Corn Belt are enjoying the benefits of GM technology. The benefits of herbicide and insect resistant technology should not be underestimated, crops have never been healthier and this year we may see the proof, with talk of another record Corn and Soybean harvest.

Publicity in the US about the environmental effects of GM crops has largely been positive. The case of BT Corn (and its effects on the monarch butterfly is an exception, and even in this case more and more evidence suggests that the effects are minimal. Facts carrying far more weight are those such as the reduction in application of insecticides applied to cotton totalling over one million gallons. Roundup Ready Soybeans (result in a reduction in more hazardous herbicides, many of which are soil active and replaces them with the safer Glyphosate chemical.

The effect on the world market should also be noted. The US is a residual supplier of world grains; they have a huge influence over the world price of grains. The prices set on the large commodity futures exchange markets in the US are now being driven down by the large crops. This means grain producers in Australia who do not have access to GM technology are now less competitive; we are paying the price through lower grain prices.

Australia needs to determine if any premiums we receive from world markets for remaining "GM free" are going to compensate for the reduced world prices. If not we should move to access the technology as soon as possible. The facts are that in most markets the bulk of consumers are not prepared to pay more for GM free foods. In our free market economy, with no government financial support, the Australian farmer cannot afford to remain in this uncompetitive position, we must be given the opportunity to commercialise GM crops.

The US domestic market.

Almost 80% of the grain grown in the US is consumed domestically, of the key crops Corn and Soybeans have wide spread commercialisation of genetically enhanced varieties. Over 50% of the Soybeans are now Roundup Ready(. The US grain handling system is not going to be able to segregate between varieties of GM and non-GM. Even if the market is going to pay a premium for Identity Preserved (IP) GM free grain it will be hard to guarantee this at more than a tolerance of 95%.

The current GM crops grown commercially are considered to be “substantially similar” to the traditional varieties, therefore according to the US Food and Drug Authority (FDA) there is no need to treat them specially, to segregate or to label. The US public has faith in the FDA, they have not had the recent problems Europe has had with food scares. Greenpeace has not been given the same level of credibility in the US as in other parts of the world; the public has trusted the authorities to protect their health.

Other regulatory bodies are also involved in testing and registering genetically enhanced crops in the US. The Environmental Protection Agency (EPA) and the US Department of Agriculture (USDA) are also involved. More work goes into registering a GM crop than a new pesticide. With the benefit of experience the level and quality of testing now required to register a GM crop means the level of risk associated with its commercialisation is minimal. Not all GMO's are similar, they all need appraising on an individual basis.

Some US producers are concerned about producing a product that has no market but the facts for them are that consumers are not willing to pay more for GM free grain, and while the government is underpinning the industry with guaranteed minimum price (Loan Deficiency Payment) there is no commercial risk associated with this new technology.

6. World Trade politics and GMO's

GM crops have the potential to become a major issue in world trade negotiations as the EU tries to hold on to their anti GM stance. Currently the Sanitary and phytosanitary agreement (SPS) enables countries to use WTO rules to check the use of unjustified health related regulations that may restrict trade. SPS compatible measures must be based on scientific principles as laid down by Codex Alimentarius (scientific protocol). The EU is now pushing for the inclusion of the precautionary principal, which would restrict trade in cases where science is unable to give a clear answer. There must be reasonable grounds for concern about potentially dangerous effects on the environment, human, animal or plant health. Other WTO partners are concerned that this goes against the SPS agreement and unjustified use of the precautionary principle is a form of disguised trade protectionism.

In practice the EU may in the end be forced into accepting GM foods that have been endorsed by the US FDA. The world supply of GM free vegetable proteins will diminish as the technology spreads around the world. I am not sure that the EU consumer is willing to pay the full cost of sourcing non-GM crops.

There is a lot of rhetoric around the world about sourcing non-GM foods, however it is very unclear if any consumers will pay for this. To source non-GM foods in the US will cost consumers, as they have to pay for Identity Preservation from farm, through the supply chain, to the final processor. It is hard to place an exact cost on this as it will depend on the tolerance levels but estimates range from US 20-60c per bushel (US \$7-22 per tonne or A\$12-35 per tonne). So far it has not occurred on a large scale as no one is willing to pay more for essentially the same product.

7. Labelling and Consumer choice.

Labelling is an issue that needs to be handled with care. The US stance that currently approved GM foods are substantially similar, and therefore do not need labelling is one approach. The Australian stance of labelling with a tolerance of 99.9% is the other extreme.

There is no doubt that the consumer should be given choice, however if labels are too prescriptive it will be difficult for the consumer to find processed foods that do not contain GM foods. This is due to the fact that so many processed foods contain small amounts of a product like Soybean. If the label is guaranteeing 99.9% GM free then they will have to specially source GM free Soybeans, also to 99.9%. The cost of this will price the product out of the market.

In Europe now the consumer by default has no choice as almost all GM foods have been withdrawn from the market.

With labelling consumers need education to understand what the label means. Much injustice has been done to agriculture by the anti GM campaign. Consumer's knowledge of food production is poor thus a complete understanding of the whole GM argument is unlikely. It is important that the key points for GM foods are presented and understood. The public need to get the message that this technology is on balance good for the environment and that the food is safe to eat.

8. Quality enhanced GM crops.

The second-generation crops are still a few years away. The concept of these crops is that the end product will be altered to better suit the end use. Examples are wheat with higher protein for specialised flour blending, or feed grains with a better mix of nutrients for a specific animal feeding system.

Further down the line it is anticipated that crops will be altered to produce specialised chemicals for drugs or enhanced qualities for manufacturing.

It is apparent that registration of these foods will require even more rigorous testing than current GM crops require as they will no longer be substantially similar.

Another key consideration for quality-enhanced crops is the ability to preserve identity and capture value in the supply chain. This will result in added costs. For the technology to take off mechanisms need to be put in place that enable all players in the supply chain to profit from using these crops.

Monsanto and Cargill have formed a joint venture company called Renesen. The objectives of this company are to profitably commercialise second-generation genetically enhanced crops. It is envisaged that Renesen will go to the final processor of the grain and introduce traits to best suit their needs. They will then offer this crop at a set margin above the conventional crop. They then plan to work back through the supply chain to the farmer giving each player enough of the extra profit to make growing and elevating the crop worthwhile. The end result of this could be a dramatic change in the way farmers go about their decision making process; from what crop to plant and the marketing of that crop even before the seed is purchased.

9. Commercialisation of GM technology. Profitability - Farmer's v multi nationals

The overwhelming drive to commercialise GM technology has come from the large companies who have invested billions of dollars over the last two decades developing the intellectual property. For companies like Monsanto they are in a race against time to maximise their return to share holders before the patents on developed traits run out. For example, the Glyphosate tolerant gene was first patented in the late 1980's. Patents only last 20 years.

These companies are gaining more and more control of crop genetics around the world. Why? Obviously they see sales of seed as a way to recouping their investment. Over the last few years Monsanto purchased several seed companies, including the several billion dollar purchase of Dekalb seeds in the US (a hybrid corn seed company). This has set off a feeling of fear amongst farmers who are worried that they will become beholden to the few large multi national companies. This move by Monsanto failed. They tried their hand for a first mover advantage in the biotech industry. They misread the market place as it has taken a lot longer to commercialise the technology than first predicted. They have almost gone bust as a consequence. The feeling now is that they can gain far more by licensing the technology to anyone who is willing to pay for it.

Around the world there is a feeling that multi national companies are going to dominate agriculture and that farmers will become slaves to the large corporations. This is a fear that I believe is totally unjustified. The fact is that these companies are developing technology that is going to improve the profitability of agriculture, for them to gain market share they are going to have to make it attractive for farmers to use. A quick look in the US at the rate of genetic gain in the Corn crop shows considerable advantages over wheat. Much of this can be attributed to the scale of investment in plant breeding, which can be attributed to the potential for commercial organizations to capture value in the form of seed sales.

Over time competition between different multi national companies and public research organizations will result in the farmer receiving the best possible price. The period until the patents run out will be the most expensive for the farmer, but it will be better than not having the technology at all.

Where and how the owners of the technology commercialise their crops will depend on the ability to capture value. Firstly countries need to have working patent laws such as found in the EU, North America and Australia. Second, agriculture in that country needs to be able to pay for the technology. Monsanto recently mapped the rice genome, and then made it publicly available to the wider community. This was done as Monsanto didn't believe they could gain any commercial value from rice as most of the worlds'

production is in countries with inadequate patent laws and where farmers couldn't afford to pay for the cost of the technology anyway.

10. The Australian Situation

Consumer attitudes in Australia are very cautious towards the introduction of GM crops. This is largely a result of a lack of factual information regarding the GM science, the cynical nature of Australians and the level of negative publicity the issue has received.

Consumers in Australia are demanding choice, they require labelling and in response the federal government has drafted legislation to demand labelling to a tolerance of 99.9%. As a result it is going to be almost impossible to source GM free processed foods in supermarkets. Many foods contain some form of Soybean. Due to the difficulties in obtaining a sample of any crop that is 99.9% pure it will be almost impossible for food manufacturers to process foods with out labelling them as GM. Labelling to such a high level will be a disincentive for the food processing sector to try to satisfy the proportion of the community that demands GM free. They may have to satisfy themselves with the organic selections.

Grain marketing bodies such as the Grain Pool of Western Australia have come out recommending that Australia should remain GM free in the short term. They claim that they can extract a premium from the market place for remaining free from GM crops. As a consequence many grain producers are also very concerned about the introduction of GM crops.

The WA State government has imposed a two-year ban on the commercialisation of GM crops. In the meantime extensive trial programs are to be undertaken. In Tasmania the State government has imposed a complete ban on the growing of any GM crop – even trials

If GM crops are to have a future in Australia wide spread scientific testing must be undertaken. It is essential that facts are compiled to judge of the safety of this technology. At the same time an education process needs to be implemented informing people with the facts about what this technology can offer grain producers, consumers and the environment. It is hard for executives of Monsanto in the USA to fully understand just how hard it will be to truly gain consumer acceptance for this technology. It will require a concerted effort from all in the grains industries around the world to correct the current market perception that somehow GM foods are unsafe. It leaves Australian farmers in a difficult situation, we need this technology to remain competitive on the world scene, yet at the same time we can't afford to be producing products without focusing on what our customer demands.

11. Commercialisation issues for Australia.

Clearly Australia is an attractive market for the commercialisation of GM technologies, we have good patent laws and farmers that can afford to pay for new technology. Talk that Australia is a small market that may be overlooked is simply not true. How the companies involved capture value in Australia is yet to be determined. In cotton, the only commercialised GM crop in Australia, Monsanto use an area based technology fee. This is a similar mechanism to that used throughout the US. This system works even more efficiently in crops that require new seed to be used each season as the technology fee can then be hidden in the price of new seed.

In Australia, the main cereal growing areas have a long tradition of farmer saved seed; any attempt to change this practice may not be well received. Any moves to introduce an area based technology payment may also run into problems with low compliance as farmers try to minimise costs. In addition there are many problems associated in setting the price level of an area-based fee in a country with such diverse and variable production. Potential consumers could be priced out of the market in low production zones.

The concept of an end point royalty (collected as a % of farm gate receipts) would seem to have far greater equity in Australia. This way risk is shared between the farmer and multinational company both for price and yield. Australia is fortunate in that we have a precedent for this type of system in the GRDC levy, we have a reasonably centralised collection system and most farmers are supportive of such mechanisms to pay for improvements in genetic gain.

If Australia is serious about improving the genetic gain from breeding programs in our key crops, such as wheat, mechanisms must be put in place that attract multinational investment. A working end point collection system will be very attractive to the life science companies. It can only be to the benefit of the Australian farmer to have these companies invest time and money in our crops rather than those of our competitors.

One of the cornerstones of successful insect or herbicide tolerant crops will be a stewardship program. It is important for the farmers and for the companies to prolong the life of the product, the risk of chemical tolerance developing in the target pest is a real threat. To facilitate this, a stewardship program that encourages best practice based on the best available science needs to be implemented and followed. This requires education and discipline from all in the industry. If, as an industry we are unable to self-administer the application of these new technologies in an environmentally sustainable manner, governments may impose regulation, or worse remove technology from the market place.

Conclusion.

After looking at the situation in Europe and the US I firmly believe that the Grains industry in Australia will be best served by adopting GM technology. The benefits of the first generation traits will enhance our ability to compete on the world market by improving our productivity and reducing the cost of production.

I clearly recognise the fact that a lot of work needs to be put into the education of consumers about GM crops. I realise that the marketing of GM crops will be difficult until consumers are more accepting of what this technology really means. However I think at the end of the day the facts will prevail and that a lot of the negative publicity will die down.

In the future GM crops have unlimited potential to allow us to break out of the commodity mentality and start to produce specific crop types for specific end markets. It will enable growers to better serve our customers, which should lead to an improvement in profitability.

As an industry we need to realise that the owners of these technologies are large companies who are driven by a need to return a dividend to their shareholders. If the grains industry is to maximise the potential of this technology we need to be proactive. The owners need to be attracted to Australia but we need to retain some control of our current breeding programs. This is all possible if we first implement a working end point royalty system that offers a mechanism for value capture. As farmers we are going to have to pay for the technology but providing we retain strong conventional breeding programs we will always have choice. This will mean that the technology will always have to be priced in a way that makes the farmer more money. At the end of the day we are going to be far better off having these companies investing time and money in Australia rather than in our competitors countries.

GM crops are based on good science; they are well researched and vigorously tested for food safety and environmental impact. While there is a possibility that some GM crops could have a negative impact on the environment the overall benefits of being able to reduce the application of more dangerous chemicals such as soil active herbicides and insecticides means that the effect on the environment will be positive.

I think looking to markets that are seeking GM free crops is a shortsighted approach. In the long term we need this science to remain competitive on the world market and like all technology the aim is to gain improvements in efficiency at a faster rate than the rest of the world. Delaying the introduction of this technology will result in us falling behind. As an industry without direct government assistance we cannot afford this delay. GM technologies are the way of the future and the Australian grains industry needs to start working to implement this science now.