Best practice canola production:

Exploring biotechnology, agronomic advances and new grower techniques

A report for

by **Andrew Broad (2005 Scholar)**

Completed: February-October 2006

Nuffield Australia Project No: NUF0008

Sponsored by:

GRDC
Grains Research & Development Corporation

Scholar Contact Details

(Name) Andrew Broad
Organisation 2005 Australian Nuffield Scholar

(Address) 1684 Yorkshire Road
Bridgewater on Loddon
Victoria, Australia 3516

Phone: 03 54373136
Mobile: 0428 373136
Fax: 03 54373136
Email: andyrach@impulse.net.au

In submitting this report, the Scholar has agreed to Nuffield Australia publishing this material in its edited form.

Nuffield Australia Contact Details

Nuffield Australia
Telephone: (02) 6964 6600
Facsimile: (02) 6964 1605
Email: enquiries@nuffield.com.au
PO Box 1385, Griffith NSW 2680

Foreword

The comments and opinions in this paper are based on my personal findings. No responsibility for the comments can be attributed to Nuffield Australia or any affiliated party.

Acknowledgments

I would like to thank Nuffield Australia for the opportunity to experience global agriculture. The name of Nuffield is held in high regard around the world, and I hope my association and contribution will continue in the future.

Thankyou to the other Scholars I travelled with during the global focus program, for the good time together and challenging conversation.

To the contacts and hosts who gave freely of their time and information, thanks for making the trip so rewarding. Also to all the industry representatives, research scientists and private people, a sincere thankyou.

Thankyou to my major sponsor, the Grain Research and Development Corporation, plus Rural Finance and Peter Rowe Agencies, for their contributions and commitment to Australian agriculture.

Thankyou to my farming neighbours and the community of Bridgewater on Loddon, for their continued encouragement.

To my parents Mervyn and Laurel Broad, for their assistance with my business and hard work in my absence.

Finally to my wife Rachel, for her patience and support throughout the whole Nuffield experience.

Contents

Executive Summary

- Australia's canola industry is in decline, with no improvement in five-year average yields, and total area seeded reduced by 44% in five years.

- Canada has grown genetically modified canola for ten years, yields have increased by 15.8% over ten years with total area seeded now five million hectares annually.

- GM and non-GM canola receive the same price on the world market.

- In the last ten years Canada has produced tonnage of genetically modified canola equivalent to fifty years of Australian canola production.

- Canola oil is ideal for biodiesel and should put long-term stability in product demand.

- GM canola has assisted the Canadian wheat industry through rotational weed management options.

- There are yield advantages through hybrid varieties, particularly under moisture stress.

- Better fertilizer utilization GM varieties are in the development stage.

- There is an over reliance of glyphosate within the Canadian farming system, and an integrated weed management strategy is essential to maximise the long term benefit of GM technology within Australia.

- Length of growing season and moisture are the two most important components to maximising canola yields.

- Maintaining leaves on the stalk as the canola runs up to flowering is essential to achieve high yield. Test plot yields in the United Kingdom are reaching 7-tonne/ hectare.

- Sound environmental management and genetically modified canola need to be promoted as complimentary to one another.

- Coexistence from paddock to port, of GM and non-GM can be achieved if admixture levels are increased.

- In the future there will be a greater differentiation of specialty oil types within canola, for specific oil applications.

- Both the Australian farmer and the public are being poorly informed by well organised, anti GM campaigners.

- The cost of the Roundup Ready technology for the farmer is significant, and needs to be reduced in order to be consistent with Australia's low input / low output farming system.

Introduction

Background information…

The Australian grain industry must be innovative to remain globally competitive. The large volumes produced by our industry relative to the small population base means that in commodity products, such as wheat and oilseeds, Australia is trading on an international market.

The seasonal variability of our climate creates an additional challenge that can only be overcome through better plant breeding, agronomic advances and financial risk management.

From the 1980's through to 2000, Australia achieved a steadily developing canola industry. The development of new varieties with shorter height, greater blackleg disease resistance and shorter seasonal growth, has assisted canola production in lower rainfall environments.

In June of 2002, a further development of varieties was about to be released for commercial production; this time bred through transgenic modification of the plant, making a canola variety that is resistant to the chemical glyphosate (commonly known as Roundup). Note: conventional breeding may look for a plant mutation and if conducive, adds that mutation into the plant, as with Clearfield canola variety.

Roundup has long been, and continues to be, a very important tool in modern farming systems. It is still our most important knock down herbicide. It has a lower toxicity to humans compared to many agricultural chemicals used by farmers today. It breaks down in the soil, leaving little long term residual. The reason for the quick removal of Roundup is due to a bacteria that essentially breaks down the chemical once in the soil.

The varieties that were to be released in 2002 were bred by placing a soil bacteria gene into a canola plant, making it resistant to small doses of glyphosate, (a maximum rate of two separate applications of 1.25 litres per hectare).

Although passing the legislative framework for commercial release, many of the state Governments placed moratoriums upon the commercial release of genetically modified (GM) canola. The purpose of the moratorium was to allow time to be reasonably sure that GM breeding would add value as a whole to the Australian agricultural industry and as such the people of Australia, without adverse environmental, marketing and health effects. The state based moratoriums were to run for five years, and will soon be due for review.

So what have we learnt in the five years?

Have we been left behind in our canola industry compared to other countries?

Canada is the world's biggest producer of GM canola. Would they turn back the clock if they could?

Are Canadian GM canola growers making money, or just the developers of the technology?

If Australian producers get access to this technology, how do we best apply it?

If Australia grows GM canola, can we sell it?

In the quest for answers to these and many more questions, I visited the following countries:

Australia

New Zealand

The Netherlands

France

United Kingdom

The Ukraine

Germany

Singapore

Canada – Alberta, Saskatewan, Manitoba.

United States of America – Washington D.C. Virginia, North Dakota, South Dakota, Minnesota, Illinios, New York, Nevada, California.

Since 2002…

Declining yields and profitability from Australian canola has become a significant issue. An Australian Oilseeds Federation industry review showed that producers are justified in their concern, with grain prices not keeping pace with rising input costs and average yields decreasing.

The declining popularity of canola as a profitable cash crop has resulted in Australia's canola acreage reducing by 44 per cent over the last five years. In addition, the five-year average yields have shown no improvement, with an overall average yield of 1.5 tonnes per hectare, (with a reduction) in the eastern states. Australian producers are now seventy percent reliant on triazine tolerant (TT) canola varieties that have a reduced yield and oil content. This adds additional environmental risk because of the damage sustained if triazine is leached into waterways. Currently, six hundred tonnes of triazines are going into Australian farming systems annually.

The Canadian experience is a very different story. The Canadian canola crop is a quick growing, short season crop with 45 days from seeding to flowering (Australia is 130 days), and 110 days from seeding to harvest. The crop is ideally seeded in the first week of May, and harvested in the middle of September. Canada's canola acreage is currently around five million hectares annually.

The Roundup Ready (GM) variety was first released for commercial production into Canada in 1995. It initially resulted in reduced yields in the first year, but quickly received yield and weed management advances in subsequent years. The uptake by Canadian farmers has been rapid, the 2006 harvest comprising ninety five per cent non-conventional bred canola varieties.

50% Roundup Ready (GM) resistant to round up.

30% Liberty Link (GM) resistant to Liberty.

15% Clearfield (non GM) resistant to On Duty.

5% Conventional (non GM) resistant to Lontrel, Select, etc.

Canola Council of Canada

In the last ten years, Canada has produced tonnage of genetically modified canola equivalent to fifty years of Australian production. This makes Canada a credible case study. At present, canola yields average 1.83 tonne per hectare and has had a 15.8 percent average yield increase over the last decade. The Canadian canola industry has also been successful in placing this product into world markets. Major markets include the United States of America, Japan, United Arab Emirates, and China. United Arab Emirates and China are milling Canadian canola and selling the oil into Europe for use in biodiesel.

Biodiesel…the environmental fuel

The move toward biodiesel will continue to add strength to the Canadian canola industry. The Canadians are aiming to further increase their canola acreage by one million hectares, aiming for six million hectares per annum within five years.

Biodiesel can be made from soybean oil, used cooking oil, palm oil, and canola oil. Given that soybeans are such a pivotal crop in the USA mid west states, it seems that the Americans will favour this as their primary source. However, the advantage of canola is that it is still the only source for cold environment biodiesel; hence, the development of biodiesel production plants in the USA along the Canadian boarder. Canada's proximity to the United States should put a floor price in the Canadian market.

The United States soybean industry is having difficulty competing with cheaper produced soybeans from South America. This will probably see GM soybeans in the US bred for oil more suited to cold climate biodiesel. GM soybean plants tolerant to a cold environment are also only three to five years away from commercial production. This may also give the Canadians a pulse crop in their rotation that can also be used for biodeisel.

Since 1995, the area seeded to canola in North Dakota has increased from 80,000 hectares annually to 400,000 hectares, an increase of five hundred percent. Dr William Wilson of North Dakota State University attributes this increase completely to the uptake of GM Canola. He says that there was practically no canola grown in North Dakota pre GM technology. It is estimated that the North Dakota canola acreages will in the next two years increase to 650,000 hectares.

"GM technology has given the ability to grow crops, that otherwise wouldn't be possible."
Dr William W. Wilson, N.D.S.U. Fargo, U.S.A.

The European Union is aiming for a 15 per cent blend of biodiesel in its diesel by 2015. This progression will utilise sixty per cent of the 2006 total domestic production, and more going forward. Recent demand is resulting in edible oil processors vying for supply.

Ulrich Meyer, of Behrensen, Germany is one of many European farmers who have had their tractors converted to run on cold pressed canola oil. Although needing conventional diesel to start and warm up the tractor, he claims his Fendt 150 horsepower tractor "pulls better" and "runs sweeter" on straight canola oil. The conversion cost three thousand euros and was performed by his local machinery dealer. Ulrich estimates that his fuel costs have been reduced by fifty percent. The cold pressed canola oil being used is from China, originating

from seed exported from Canada. It is an amazing thing to see canola being grown in the Canadian prairies, and then to see the oil from that crop powering a tractor ploughing fields near a German village. Increasing demands for energy should put a sound base in global canola prices.

Canola oil from a cold press processing plant in Manitoba, Canada

United States is aiming to be self-sufficient in its energy needs

The word canola comes from Canadian oil…

Oilseed rape was first grown in Canada during world war two, producing oil for use as a marine lubricant to assist the allies war effort. It was agronomically successful but with high erucic acid and high glucosinolate, deemed unsuitable for human consumption.

During the following twenty years, two naturally occurring mutations were found and bred into the rapeseed, producing a double low (low erucic, low glucosinolate) rape. This oilseed was given the name "canola" and commercially released in 1974. The uptake of canola is a true success story and has reduced the reliance on wheat alone for the Canadian prairie farmers.

Fifty per cent (two and a half million hectares) of Canadian canola contains the Monsanto patented technology "Roundup Ready," glyphosate resistant. The uptake of this type of canola has been quick, and overwhelmingly popular with farmers. The technology can be bred into leading varieties of canola, and brought to commercialisation.

The Roundup Ready technology has essentially made canola a clean up crop. Many farmers are picking their weediest fields, seeding the canola, and then spraying with 1.25 litres to the hectare of Roundup 450, post emergence. Canola is a poor competitor to weeds early in its growth, so this improved weed control has in itself increased yields. If the paddock requires further control from late season weeds, another application of 1.25 litres to the hectare can be applied.

"In all the years I've been growing Roundup Ready canola, I have never had to it spray twice." Grain farmer, Saskatewan, Canada

Canadian canola seed is treated with both an insecticide (for flea beetle) and a fungicide. In Australian conditions, a post sowing, pre emergent application of insecticide would still be necessary to control red-legged earth mites.

It is of interest to note that amongst the strongest supporters of Roundup Ready canola, there are the strongest opponents of Roundup Ready wheat. This is not surprising, as the canola phase of their operation has allowed them to effectively 'clean up' fields for subsequent crops. In the season following, volunteer canola is cleaned up using MCPA, 2-4D, sulfonylurea or many of the other options available to take broadleaf plants out of cereals.

"I've never seen our wheat fields as clean as they are now, and that's because of the agronomic advantages of GM canola" Barry Senft, Canada

There continues to be little market acceptance of genetically modified wheat versus canola. There is no DNA in canola oil, only in the meal (that is used for high protein animal feed and fertilizer). Conversely, in wheat the genetic material is what humans consume. The technology may be acceptable for feed wheat varieties, as GM feed does not appear to have much resistance. This is evident by the utilisation of USA GM soybean meal as the main protein feed stock for the dairy industry in 'GM free' Europe. Adverse reaction to GM wheat may in time change … so research continues.

The continued uptake of GM technology by Canadian farmers is the overwhelming proof of its agronomic advantage.

"The developers of Roundup Ready canola (Monsanto) are a progressive company trying to make their own money. The spin off is they make a product that makes me money. If it didn't make me money I wouldn't buy it." Grain farmer, Saskatewan, Canada

Thirty per cent of Canada's canola (one and a half million hectares) contains the Bayer patented technology "Liberty Link". This is resistant to the chemical glufosinate-ammonium.

Used in much the same way as Roundup Ready, it is a sulfonylurea knock down herbicide that uses photogenesis to absorb the chemical. Many Canadian growers are using Liberty Link varieties, so they can rotate with Roundup Ready soybean crops. It is difficult to control roundup resistant canola in a Roundup resistant soybean crop.

The use of this chemical for this application in Australia would be unsuitable as the temperature for best result is thirty degrees Celsius. Its effect on weeds below twenty degrees is very poor. It also requires long daylight hours.

It is important to note that Australian canola is seeded in autumn, grows through the winter, and is harvested in early summer. Most weed control is done during winter when daylight hours are short and temperatures cool. Canada, however, grows their canola over the summer months when daylight hours are very long and temperatures high. Also, glufosinate-ammonium is not very effective on radish, Australian canola's number one problem weed.

The main benefit 'Liberty Link' canola would add to the Australian industry is the high yielding hybrid varieties that Bayer have the breeding rights to. These varieties have the potential to push yield parameters once adapted to Australian conditions, even if grown using conventional weed control methods. During discussions with Canadian farmers, many desired the Liberty Link hybrids with the Roundup Resistant weed control options.

Fifteen percent of Canada's canola (seven hundred and fifty thousand hectares) contains the "Clearfield" technology. This is classed as non-genetically modified and is also grown in Australia. Clearfield was developed by mutagenesis; it has herbicide tolerance exactly the same as GM, and is tolerant to "On Duty" (Imidazolinone).

In Australia, the Clearfield Production System was released in 2000. Initially, the varieties were not very good, but improvements have resulted in twenty five per cent of Australian producers using Clearfield varieties. The success and adoption of the Clearfield system in Australia indicates that it is well placed to benefit from the use of Roundup Ready and Liberty Link.

New Developments…

The first trans-genic canola was developed in 1983, taking twelve years till it was refined and commercialised in Canada in 1995. Like all new technology, the first step is only ever the beginning. One generation ago, the idea of spraying a chemical onto a crop for weed control was unheard of, and looked upon with suspicion. And in the generation before that, the use of tractors instead of horses made big changes to global food production.

We can now observe ten years of GM canola production, so what is the future?

The Plant Biotechnology Institute in Saskatoon, Canada is working on some new developments. For example, greater usage of phosphate fertiliser by the plant, and better

utilisation of water, creating drought tolerant canola. All this using genomic mapping, and emphasising existing enzymes found within the canola plant instead of trans-gene.

The application of this technology is still a long way off, with estimates of commercial production nearer to 2020.

Monsanto is currently going through the testing and registration process of a canola technology that will produce the same yield with less nitrogen fertilizer. Nitrogen fertilizer is expensive and can cause environmental damage to waterways through run off and leaching in the soil. This technology if approved by the regulatory authorities, will soon be released for commercial production in countries that allow the production of GM canola.

Breeding advances continue in Canada, with a greater emphasis on hybrid varieties. Hybrid canola seed comes from controlled cross-pollination of male and female canola parent plants during the production process. This results in better plant vigour producing larger seed, higher yield and greater stress tolerance. The benefits in hybrid technology seem to show themselves more when compared to open pollinated canola in low moisture years. In Australia, a Southern Farming Systems trial during 2005 in Victoria's western district, demonstrated the potential of hybrids in adding as much as two hundred and fifty dollars a hectare to returns. This was over current triazine tolerant crops given good seasonal conditions.

The short growing season in Canada has meant that blackleg is a less destructive disease than it is to Australian canola. Although still a problem, the disease usually has little time to come from the stubble pores, onto the leaves, down to the stem and cause stem canker. This has seen some growers planting a canola / wheat / canola rotation. This would not be considered best practice, and is putting pressure on the resistance bred into varieties. However, with the emphasis on canola breeding (due to biotechnology acceptance) in Canada, the levels of blackleg have dropped away. It is now only a very small problem, and I saw no evidence of blackleg on the stems of the plants I inspected.

A contributing factor in yield decline in Australia is the restriction on nutrient flows because of blackleg stem canker. Australian canola growers also need to see the impact of the disease reduced through continued breeding.

Another future development will be gene stacking. Currently, Canada has canola that is insect resistant, herbicide tolerant, and has altered oil properties (for specialty applications). Reduced nitrogen may soon be added. It seems very likely that a variety will have more than

one key technology bred into it, allowing the crop to have multiple agronomic advantages. The added advantage of less toxic chemicals applied, combined with reduced nitrogen fertilizer should also have a beneficial impact upon the environment.

What can we learn?

When considering the application of GM canola into Australia's farming system, there are lessons to be learned from Canada. When 'Roundup Ready' canola was marketed to Canadian farmers, it was sold as 'the food that would feed the world… help struggling farmers stay viable, reduce chemical applications, and generally an answer to everything.' This was probably an overstatement by some farmers, but it was certainly well promoted. The world's population continues to increase, and even with declining agricultural land acreages and declining water supplies, farmers have been able to keep world food stocks to adequate levels.

"It is not lack of food, but unstable governments that are responsible for starvation." Dale Broad, Australia

A stable political environment allows the people in a country to go about conducting business, growing food, and raising the standard of living.

"Dealing with global starvation isn't just my problem, it's everybody's responsibility." Chris Pollock, Farmer Australia

Discussing trade implications with the Canadian International Grains Institute, Winnipeg, Canada

Current estimates place the world population at 6 billion people, double the number in 1960 (at 3 billion). It is projected that by 2050, the global population will be around 9 billion. Thus, greater pressure will be placed upon food producers, however this is currently not a strong argument for GM food crops. The world is already getting cheaper food than at any time in the past.

The Canola Council of Canada believes the uptake of GM canola has been a great success. And the continued move toward GM varieties even after ten years supports their claim. However, when the technology was commercially released, the industry came under criticism, both from some environmental groups and others who questioned the economic return to farmers and the Canadian economy. Although they felt sure there were benefits, the absence of concrete evidence resulted in scepticism. It was not until January 2001 that 'an agronomic and economic assessment of transgenic canola' was released. This independent and in depth case study gave the Canola Council justification to claims that had been made about GM canola. It had indeed increased financial return to the farmer and given agronomic advantage to their farming system. The need for independent agronomic and economic assessment soon after GM release in Australia would need to be documented to effectively counter criticism that may be unfounded.

The over reliance on glyphosate in the Canadian farming system may pose a problem in the future. Roundup Ready, Liberty link, Clearfield production systems, TT Canola - these are all tools that assist production; no one technology is the answer alone. In Australia, sheep still play a part in weed control, and we are learning to battle resistant ryegrass through integrated weed management systems, such as the double knock (Spray-seed, Roundup) chemical rotations and hay crops.

The Canadians have basically no livestock in their farming systems. It is rare to see a fence on the prairies! They rely on some tillage, some winterkill from snow, and chemicals. Roundup Ready canola may receive up to two applications in-crop. Canadian wheat may receive an application pre seeding, and another application to desiccate the crop pre harvest. This large reliance on glyphosate will be placing pressure on weed resistance. Fortunately, Canada doesn't have a ryegrass weed problem

Australian farmers battle high weed pressures. The use of chemical rotations, hay crops, weed seed collection at harvest, some tillage, livestock grazing, and the occasional burning will still be necessary. The GM technology should be an additional tool, and with proper management, will help in the economical control of problem weeds.

When meeting with Dr Martin H. Entz of the University of Winnipeg, he felt that there would have been value in the introduction of an integrated weed management strategy package to farmers, when releasing GM canola. It is important to increase crop and management diversity, and as such decrease the importance of herbicide for weed control.

"Farmers have become chemically addicted…you should never say how much yield you get, rather how much money an acre you make."

Percy Schmeiser, anti GM farmer, Bruno, Canada

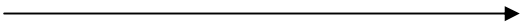
If Australia does adopt GM canola, responsible weed management strategies will need to be used to ensure the ongoing benefits offered by this technology. There may be merit in producing an integrated weed management package, applied to Australian farming systems to accompany its commercial release.

An integrated weed management approach leads to better control and reduced chemical usage.

As illustrated below…

'Get lucky'	'Make your luck'	'No herbicide required'
Assess herbicide need at time of spraying.	Create opportunity for reduced herbicide use.	Organic techniques and attitudes.

Increasing crop and management diversity



Decreasing importance of herbicide for weed control

Nazarko, Acker, Entz, 2004

Organic religion…

Among the many farmers visited were a Canadian organic grain grower, and a Hutterite colony. The Hutterites are a Christian colony attempting to live a simple community lifestyle, sharing all earnings and trying to live out early New Testament principals. The colony I visited generously gave of their time and information. They farmed four thousand hectares at Milden, Saskatewan using very up to date production techniques.

The Hutterite community seemed to have no religious problem with genetically modified canola. I questioned the use of biotechnology in seed breeding, and how they would view it from a religious viewpoint. Genetically modified canola was being grown, with the technology being seen for its agronomic advantages. It must be noted however, that the total seed for their first crop (forty hectares) was given to them. This has an estimated price of two thousand Canadian dollars. You may be given a cap by a seed breeding company, or a bag of seed if you're lucky, but that much seed may be seen as a marketing tool.

The organic grain industry has been able to survive and grow within Canada. The exception being organic canola, due to its standard of zero GM admixtures. Ensuring a zero level is unworkable. However gene transfer through cross-pollination can be reduced dramatically by seeding a non-GM strip ten meters wide around the parameter of a GM canola field.

Prior to the introduction of GM canola (1995), the organic canola sector was 0.02% of the total industry, and with canola being the second largest acreage crop in Canada, it was felt that the rights of non-organic farmers took precedence over a very small minority.

"I should have the right to grow the best varieties available in the world on my farm, so I can be globally competitive." Roundup Ready canola grower, Portage la Prairie, Canada

Without the use of herbicides, canola is a very difficult crop to reach profitable yields because it competes poorly with weeds in its early growth stages. Much of the organic farming I witnessed in Canada will have doubtful prospects of maintaining long-term profitability. Their system relies heavily on cultivation, and will suffer with the increase in world diesel prices and from very poor weed control.

I was not convinced that organic systems produced healthier products or were better for the environment. There is evidence of a niche market advantage, but if supply were to reach adequate levels, the price premium would reduce. The world would be hungry through this production system. The overwhelming response of farmers I talked in Canada favoured the benefits of biotechnology over a 0.02% organic canola industry.

Agronomic Advice…

Given good genetics the most important factor for maximising canola yield is length of growing season and adequate moisture. The Canadian crop has a very short season, with only forty-five days from seeding to flowering. In contrast, the European canola crop has an eleven-month growing season. Optimum seeding dates are 10th August to 20th September in the United Kingdom, and harvest occurs in late July of the following year. Canola is called oil seed rape in Europe. Average UK yields are 3.3 tonne to the hectare, with best farms producing 5 tonne to the hectare.

Canola is a good extractor of soil moisture as long as there is a well filled soil profile. One Canadian grower achieved a two and a half tonne to the hectare crop on only fifty millimetres of rainfall in 2006.

The Australian growing season is long enough to produce world-class yields given access to good genetics, technology and moisture. Seeding techniques differ from farmer to farmer, with little yield difference in row spacing from 7 inch to 12 inch. Most Canadians are seeding at 5kg/ha, although some are moving to toward 3.5 to 4 kg/ha. At 3 kg/ha, the margin for error is very small. Canola seed is a significant cost and the advance in seeding equipment is making use of the lowest seeding rates possible.

As canola is a poor competitor, early weed control is essential. Flea beetle poses an insect risk in Canadian seedlings in much the same way as earth mite does in Australia. I also observed many successful farming techniques from full deep tillage to complete no-till systems, each system working effectively for the farmer (given adequate nutrients).

Many times I had impressed on me the importance of sulphur in the nutrient mix. Canola needs a balance of macronutrients to produce maximum yield, the big four being Nitrogen (N), Phosphorus (P2O5), Potassium (K2O) and Sulphur (S).

Recommended ratio:

5 (N): 2.4 (P): 4 (K): 1 (S).

To produce a yield of 1.85 tonne to the hectare:

	Uptake	**Removal**
N	100-123 kg/ha	61-74 kg/ha
P	46-57 kg/ha	33-40 kg/ha
K	73-89 kg/ha	16-20 kg/ha
S	17-21 kg/ha	10-12 kg/ha

Canola council of Canada

It is important to apply adequate phosphorus and sulphur at seeding time because a large amount of phosphorus is used in the first six weeks of growth. Many farms in Canada are using liquid ammonium nitrate pre seeding as a cheap nitrogen source. However, given Australia's marginal rainfall environment, nitrogen can be delayed as part of a cost management strategy. It can be added if seasonal conditions are favourable.

As with any small seeded crop, seeding depth is critical. Canola germinates easily, so a depth of 1-2 cm into a moist firm soil is ideal. Dry seeding of canola is common practice in much of Australia, as moist soil is often rare at the optimum seeding date. It is very important to get

the crop sown early for maximum yield, but this puts great pressure on in-crop chemicals, allowing no time for a pre-sowing weed kill during late autumn breaks. The Roundup Ready technology would add much greater flexibility to an earlier seeding date.

The Canola Council of Canada has produced a very effective, simple CD ROM program that is available to Canadian producers, assisting them in both production techniques and problem identification. Simple tools such as this have helped producers gain in their knowledge and skills.

There is some very good research coming out of Europe. Test plots have shown yield potential in the United Kingdom of 7 tonne to the hectare with one variety producing 7.8 t/ha in a test plot environment. Canola has a less visual response to differing establishment techniques, but the outcome on yield actually shows that good soil conditions allowing deep root penetration is essential.

"Of all broad acre crops in the United Kingdom, canola is very very responsive to good soil conditions." Dr Chris Green, Crop Management Information, United Kingdom

In order to produce a yield of 7t/ha, you need 50 plants per square meter, 168 pods a plant, and 15.12 grams of seed per plant. So, if every plant produced a golf ball sized bag full of seeds, very high yields are achievable. In the UK, there is a tendency to sow a higher plant density and not be concerned about plants thinning. However, higher yields tend to be achieved by aiming for 40 plants per square meter, and keeping them alive. Small applications of Boron will give a yield response. It appears that there are benefits to having 40mg/kg Boron in the youngest open leaf. This is a third of the level required for wheat. Also in the past, it was assumed that as the canola plant ran up to flowering, the leaves would drop off the stalk. There is now evidence to suggest that maintaining the leaves as long as possible is very important to maximising yield.

"The longer the leaves hang on, the higher the yield." Dr Chris Green

The most effective way of maintaining the leaf is through an application of nitrogen (10kg/ha foliar urea or 50 kg/ha granule urea) and the fungicide Amstar (0.3 l/ha, a third of the rate as required on wheat) at beginning of flowering. Certainly this is having a yield benefit within Europe, and should be a benefit in Australia, given adequate moisture.

The environmental messages we hear…

The topic of genetic modification has created heated discussion between those who strongly oppose it, and those who are great advocates. There are also many who are so confused by the constant to and fro, that they don't know what to think. For the sake of clarity, it is important to talk about the actual technology, and tackle the corporate ownership of agriculture later.

Paul Byrd, England, UK with 2006 canola seedlings - aiming for yields of 5 tonne/hectare

Harvesting rape, Meurig Raymond, Wales, UK

There is common ground for producers of GM foods and environmentalists. The major environmental problems that were encountered whilst I travelled were nitrogen fertilizer leaching into waterways causing algae blooms, and excess use of harmful chemical.

The commercial production of GM cotton in Australia greatly reduced the use of insecticides. GM canola in Canada has reduced tillage, a major cause of soil structure damage and erosion.

"The dusty prairies are no longer dusty thanks to GM canola."

Grain Farmer, Saskatchewan, Canada

Triazine tolerant canola would largely be replaced in Australia if Roundup Ready could be produced, replacing an environmentally damaging chemical with a more benign one. The soon to be released 'reduced nitrogen fertilizer' canola, should also have benefits for our waterways and streams. Added to this is the high-energy requirement in producing nitrogen fertilizer.

Sound environmental debate should be based on outcome. Are their fewer chemicals in our waterways? Are there measurable reductions in nitrogen fertilizer leaching? Removing emotion and adding science gives clarity to the debate. There are a lot of misconceptions about food production. An example of this was a sign advertising insect damage free apples in a Canadian supermarket: ***"Sprayed only when necessary"***

The cost of spraying is expensive, and with declining terms of trade for farmers, spraying is done only when necessary. Farmers don't enjoy spending money without a real purpose.

Since the state imposed moratoriums on the commercial release of GM canola, the Australian grain industry has received many visiting speakers of various viewpoints. I believe this has allowed some people an inexpensive tour of Australia. The information given has not always been holistic, and should be received with caution. I have heard stories of the amazing canola super weed that is taking over the Canadian prairies, but I saw no evidence of this during my travels.

A little bit of miss information goes a long way…

"The catalyst used to insert the GM gene is from the cauliflower mosaic virus, this virus is the same virus found in AIDS..." Percy Schmeiser, anti GM farmer, Bruno, Canada.

The grain industry is too important to Australia's economic well being to base our decisions on emotion; there is potential for positive environmental benefits with responsible use of GM technology. Breeding technology needn't conflict with the environmental lobby. Australian farmers are good environmental managers.

Corporations and Agriculture…

The Australian agricultural industry needs research and investment to remain globally competitive. Innovations in breeding have increased yields and disease resistance to date. The Canadians now have hard white wheat varieties that were developed to compete in Australia's traditional wheat markets. They have taken ten years to develop and have been in commercial production for the last three seasons. These white wheat varieties are less prone to pre harvest sprouting, achieved by crossing a white with a red and back crossing with white wheat. Their innovation will attempt to add additional pressure onto key Australian wheat markets.

The Australian grain industry has a unique research system through the Grain Research and Development Corporation (GRDC). Many countries I visited are envious of Australia's grower funded research body, which collects 1.1% of grain sales and then receives dollar for dollar funding by the Federal Government. The GRDC oversees the distribution of about one hundred and twenty million dollars to research, its aim to add value to Australian grain growers. Up to thirty million dollars of that money has been put into GM research. It is

essential to have Australian developed technology. However, the investment made by the Australian grain industry into GM research is completely dwarfed by some research companies. For example Monsanto, the US based agricultural company currently invest five hundred million US dollars a year into GM research. Monsanto spends the same amount on GM research in twenty-one days as the Australian grain industry can afford to spend in one year. Monsanto is not the only company conducting research; Bayer, Dow AgriSciences, BASF, Pioneer, the list goes on.

It is human nature to want something for nothing, but as long as grain farmers can benefit and make more money from the results of corporate investment, then a return from that investment must make its way back to the companies. Research isn't free!

"This is the real world, not the ideal world."

Peter Nixon, Nuffield Scholar, Moora, Australia.

It is the Trade Users Agreement (TUA) of fifteen dollars an acre for Roundup Ready canola that receives the most criticism and creates much discussion. In Canada, Roundup Ready technology is popular, the environmental concerns appear to have proven unfounded, and the market place is receiving GM canola without price penalty. But the TUA is not well liked. The Roundup Ready variety is the only variety that collects its royalty through a TUA. Liberty Link and Clearfield royalties are paid when purchasing the seed. Many farmers argue that the TUA should be reduced, as they suggest the amount collected from the Canadian industry has paid for the technology. The counter of this is that the TUA has remained at fifteen dollars per acre since the introduction of Roundup Ready canola in 1995, and not increased with inflation. (Have world commodities increased?)

It is very easy to overstate Australia's place in global production. We certainly 'punch above our weight' in commodities exported, but not in acreage grown. The royalties are collected on area seeded, not quantities exported. The crops of most interest to Monsanto are corn, followed by soybeans, cotton, and lastly canola. When canola was at its peak in Australia, one million hectares were seeded, a significant yet small acreage compared to North American corn and soybean. If the Australian canola industry chooses not to adopt GM technology, it will have more impact on Australia than Monsanto.

"The stopping of GM in Australia is a total disaster for the canola industry… Australia has greater weed burdens, less yield and more environmental damage caused by tillage."

Greg Buzza, (Australian) Monsanto canola breeder, Winnipeg, Canada

A corporate company owning the patent on a variety trait does not necessarily mean that conventional breeding improvements are restricted. For example, Pioneer may have an excellent canola variety; Monsanto will allow their Roundup Ready trait to be inserted into the Pioneer variety. Some royalties will go to the seed breeder (Pioneer), and some royalties will go to the trait developer (Monsanto).

In order to have continued investment by corporate companies, there are three essential elements that a country must have.

1. There must be a stable government. It is very hard to realise return on investment when there is not a safe political environment to conduct business.
2. The country must respect intellectual property rights. If there were no legal recourse to the theft of patented traits, the ability to retain ownership of the science would be difficult.
3. There must be a clear science based regulatory framework in the review of new technology. The pathway to commercialisation must be evident, so that a company knows what obligations a product must pass.

Australia had all three elements. It has a stable political system. It has intellectual property rights protected by law. And it also had science based regulatory processes in the review of both GM and non-GM food products. This third element however was compromised when state governments placed moratoriums upon GM canola, after regulatory bodies had approved it for commercial release. It must be added however, that this is the right of Government.

Australia's grain producing climate is different to much of the world, and development of such traits as drought tolerance, etc. will necessitate the continued input of grower invested breeding. Australian agriculture needs both industry and corporate investment, but return to the grower should always remain the primary focus.

Can't we all get along?

The Australian grain industry has an advantage over many other grain producing countries due to its variety declaration system. Upon delivering a cereal or oilseed into a receival site, the Australian grower must declare the variety, and this is recorded on the delivery docket. This system is perhaps the most important element when it comes to setting up a coexistence chain from paddock to ship if industry wants to market both GM and non-GM.

Currently in the U.S.A. there is some coexistence between GM and non-GM in both soybeans and corn. This appears to be successful, although it is questionable as to whether there are enough premiums to justify the cost. When considering a coexistence plan, the tolerances of GM admixture must be known, the potential premium considered, and allowance made for the additional cost. It must also be considered if coexistence will create access into new markets.

Just as Australia has differentiation within the wheat market, the Europeans have differentiation with rapeseed.

There are currently four types produced:

1. Double low oilseed rape (00) (low erucic, low glucosinolate) this is the same as Australian canola, used for food consumption and biodiesel.
2. High erucic rape (H.E.) this is not suitable for human consumption.
3. Specialty oil seed under contract for plastic production.
4. High oleic low lynolenic oilseed (H.O.L.L.) this doesn't require hydrogenation, and is preferred by MacDonald's restaurants.

The admixture levels are currently close to 2.5 per cent, a level that would be considered too high for organic producers (considering non-GM canola segregation from GM shipments). Therefore, for coexistence to be successful, admixture levels must be loosened or due diligence increased.

Agronomic considerations such as paddock selection and rotation, volunteer control, and grain hygiene are essential elements of a coexistence strategy. The supply chain from field to processor would also need to be monitored. This should be achievable, given the systems that are in place within industry now. Although coexistence is an option to Australia's oilseed industry, I feel currently there is no price premium from non-GM, and as such would be an additional cost on the industry that yields no financial benefit.

The global market place…

The concept that maintaining a non GM status within the Australian canola industry would eventually lead to price premiums and greater return to the grower through market access and product differentiation has not materialised. Increasingly, canola is being bought as a commodity product with import price being the main consideration. Oil from GM canola is being imported into Europe, and GM soybean meal is a very important protein component of

the European dairy industry. Although it isn't being openly stated, GM technology is assisting European agriculture. For example, a large proportion of the soybean crop in the Ukraine is Roundup Ready soybeans, even though the official policy states that there are no GMO food crops grown in the country.

An example of global canola prices…

2006 December delivery prices for canola.

Canadian price:

$274	on farm
$ 38	freight to port

$312	total Canadian dollars

$312 CAD x 1.2 (exchange rate) = $374.40 Australian dollars at Canadian port.

Australian prices:

$382	on farm
$ 18	freight to port

$400	total Australian dollars at Australian port.

United Kingdom prices:

£170	on farm
£ 7	freight to processor / port

£177	total UK pounds sterling

£177 UK x 2.53 (exchange rate) = $ 447.81 Australian dollars at UK port.

Don't forget sea freight rates…

Australia has a twenty-five dollar per tonne sea freight rate advantage over the Canadians to both Japan and the sub continent. It costs in excess of seventy Australian dollars per tonne to ship canola to Europe. Therefore, when you consider these figures, it can be concluded that

both Canadian canola (GM) and Australian canola (non GM) price is determined by the delivered price, minus sea freight and costs, adjusted through currency. There is currently no price premium for non-GM. Also, the UK processor price means that the UK grower is receiving a price above the Australian grower due to their proximity to markets. On these figures Australian canola needs to be priced at $370 AUS or less to be competitive with Europe.

The messages we send…

There is a great variation when it comes to buying food, some buy on animal rights principles, some buy on country of origin, others according to religious belief; the majority, however, just want to know the product is healthy and inexpensive. In North America and Australia, canola oil has shelf space in supermarkets, whereas olive oil dominates in Europe. A significant amount of canola oil is going into salad dressings, margarines, fast food restaurants etc. The Europeans call it oil seed rape, as the word 'canola' is associated with GM.

In western countries, cooking oil usage is estimated at fifty-one litres per person annually. This is consistent with the western 'would you like fries with that?' diet. Quantities per person do not seem to increase above this level. In contrast, Asia and the sub continent average twelve litres of vegetable oil per person consumption. Mainly used in stir-fries dishes. The growing demand for edible vegetable oil is coming from very small increases in the Asian diet. The increase in consumption is small, but the population numbers are so large that the total quantities are significant. Australia's proximity to these developing markets creates an opportunity to capitalise on this growth trend, and reinforces the need to stay active in trade and promotion.

It is essential from a marketing perspective when referring to GMO admixture, not to use the word 'contamination.' Contamination refers to something that may be deemed to be poisonous and toxic to human health. It is important that toxicity is determined by science and not market perception. What the market may perceive as bad now may in the future be seen as beneficial. It is therefore essential to send only clear signals to consumers.

A London restaurant has the following words on its menu:

- *"We have worked with our food suppliers to ensure that GM food stuffs are not used in our restaurants. All food served in our noodle bars is GMO free. We would be happy to outline our due diligence process if you need further assurance."*

Statements such as this give the consumer the impression that GMO is deadly. Upon requesting from the waiter further information about the due diligence process I was advised that…

- *"Organic is better than non organic / genetically modified, but in some dishes the food may contain genetically modified trace products."*

The Australian grain industry must be consistent in the message it presents to consumers about genetically modified canola. The organic industry sets its premium off mainstream industry, so it isn't beneficial for either group to criticise the other. There will always be an organic industry for the consumer who can afford it, but safety of food should always be based upon sound science.

Australia's low input low output farming system…

When compared to many first world countries, the strength of the Australian farming system is the low cost of producing a commodity. This combined with the quality that can be achieved through a dry climate, has maintained our competitive edge in an often-distorted global market place.

There are many advantages offered through GM technology to Australia's canola industry, although the cost, and restrictions placed upon farmers from retaining seed grown the previous year will need to be considered.

Many producers both in Australia and UK, regularly seed a field with first generation seed (F1), using some of the grain produced from that field to bulk up seed for the following season (called F2 seed). This reduces cost, although the yield and oil content is slightly compromised. This practice should not be considered when dealing with hybrid canola varieties.

The Canadians do not do this. For Liberty link, the royalty is collected at the point of sale of the seed. For Roundup ready, the royalty is collected through the trade use agreement (TUA), however the loop has been closed making the sowing of F2 seed very difficult.

The United Kingdom farmers are currently paying around 2.40 Pound ($6.07AU) a kilogram for open pollinated (OP) canola seed. Australian farmers are paying $6.60AU for OP varieties, and $17.16 for the latest hybrid seed. Canadian farmers, however, are paying up to $12.50 CA ($15AU) a kilogram for OP varieties, and as much as $29.00 CA ($34.80 AU) a kilogram for the latest hybrids.

Roundup Ready have seed costs of approximately $10.00 CA per kilogram, with a $15.00 CA per acre trade use agreement collected later. Liberty link seed costs $15.00 CA per kilogram, and royalties are included in this price.

Roundup Ready canola,
Saskatewan,
Canada.
The best way to determine yield is start at the fence and see how far you can run

Following is a simplistic costs spread on seeding and spraying 400 hectares (1000acres) of canola in Australia using a conventional variety, compared to using Roundup Ready canola.

Conventional variety Australian farming system:

Input.	Cost/hectare.	Total 400 hectares/1000 acres.
Seed:	$33.00	$13200.00
Ruby 25kg/$165.00		
Pre-emergent weed control:	$ 9.44	$ 3776.00
Trifluralin 20 litres/$118.00		
Pre emergent insecticide:	$ 6.00	$ 2400.00
20 litres/$240.00		
In crop grass weed control:	$22.80	$ 9120.00
Select 5 litres/$380.00		
In crop broad leaf weed control:	$16.50	$ 6600.00
Lontrel 5 litres/$275.00		
In crop insecticide:	$ 2.50	$ 1000.00
Fastac 20 litres/$200.00		
Four spraying applications:	$25.00	$ 10000.00
$6.25 hectare x 4 applications	----------	----------
Total seed and chemicals.	$115.24	$46096.00

Roundup Ready variety Australian farming system:

Input.	Costs/hectare.	Total 400 hectares/1000 acres.
Seed:	$60.00	$24000.00
RR $12.00/kg		
Pre emergent insecticide:	$ 6.00	$ 2400.00
20 litres/$240.00		
1st application of Roundup:	$ 9.38	$ 3752.00
Powermax $150/20 litres		
In crop insecticide:	$ 2.50	$ 1000.00
Fastac 20 litres/$200.00		
2nd application of Roundup:	$ 9.38	$ 3752.00
(Only if required)		
Three spraying applications:	$18.75	$ 7500.00
$6.25 hectare x 3 applications		
Trade Use Agreement:	$37.05	$14820.00
$15 acre	---	---
Total seed, chemicals, TUA.	$143.06	$57224.00

The decision to grow Roundup Ready canola may result in an increase in costs, although the trade use agreement, ability to retain seed, and cost of seed are still to be considered within the Australian context. Certainly within Canada, most farmers would rather pay for the use of the technology when purchasing the seed than pay the trade use agreement.

The administration of the trade use agreement is more costly than collecting at the point of sale, and not imposing a TUA within Australia would make the Roundup Ready canola competitive with conventional types. Because of the variable seasons that are characteristic of Australian farming, there may also be scope to have some royalties collected at the harvest of the crop; this would share some of the risk between grower and company. The only GM variety that has a TUA is Roundup Ready.

The comparative example between Roundup Ready and conventional canola, showed an increase in cost from Roundup Ready of $27.82 per hectare. However, it is important to note that an additional $27.82 dollars per hectare is easily compensated for if there is an increase in yield of four per cent.

1.8 tonne / hectare x $ 400.00 a tonne = $720.00 hectare gross return

$720.00 x 4% = $28.80

The final word…

The long-term viability of Australia's grain and oilseed industry is not assured. Despite being a significant player in the global commodity market, we are exposed to the competitive advantages that are being achieved in other parts of the world. The adoption and successful production and marketing of GM canola have been a huge benefit to the Canadian farmer and Canadian economy. Australian farmers are being forced to compete on a global market using inferior genetics without receiving any extra market access or price advantage by maintaining non-GM.

The Australian farmers and public have been poorly informed by well organised, anti GM campaigners whose farming system, if adopted within Australia would leave the rural economy bankrupt.

The future of canola breeding will be in genomic manipulation and not in gene transfer, with genetic modification being achieved by genomic mapping and emphasising existing enzymes found within the canola plant. This will lead to further advances in breeding. There are clear signals that in the future, breeding will assist with salt tolerance and drought tolerance. Australia needs to encourage continued research specific to our needs. When there is no path to commercialisation, this development is being stifled.

The world demand for energy will increase, and biodiesel uses up large quantities of vegetable oil. This makes the long-term market view of canola look solid.

The technology offered though GM should be seen as a tool to assist in grain and oilseed production, not as an answer to unsustainable farming systems. Through correct management, this technology will add ongoing value. However, over reliance will cause resistance problems. Australian farmers should be capable of implementing an integrated chemical management scheme due to their experience with Roundup resistant ryegrass.

Companies that invest in developing a product that makes money for the farmer deserve to make a return on that investment. The introduction of a trade use agreement would be unpopular with the Australian farming sector. Paying for the technology at seed purchase or at the point of delivery would be more accepted. Most important is the net financial return to the grower.

The adoption of GM technology within Australia will yield clear environmental benefits. Less toxic chemicals and reduced usage, less nitrogen fertilizer, and less tillage and soil erosion,

should be seen as good, and promoted. There is a need for the agricultural industry to work closer with environmental groups. It is important to be outcome focused, and not hold onto preconceived ideas that all GM technology is bad. Most farmers have affiliations with their land that go back generations; they are sound environmental managers.

Although currently not financially justified, coexistence of non-GM and GM canola can be maintained from production to port. This can only be achieved if the level of acceptable admixture is increased to two and a half per cent. Coexistence and differentiation of oilseed rape is being achieved within the United Kingdom, and will be more common in Australia as the move toward specialty oils and seed grown under specific contracts continues.

Every generation faces a revolution in agriculture.

In the last one hundred years, there was the transition from ploughing fields with a team of horses, to the use of tractors and general mechanisation of farming. Then came the use of better fertilizers and chemicals in production systems that have boosted yields and assisted in weed control. The latest revolution is the improvements that are offered through GM breeding techniques.

All of these changes have not only affected farmers, but have also allowed populations to have cheaper food, more consistent quality, and more secure supply. Because of the adoption of technology, starvation is no longer a consideration for most people living in countries with developed agriculture.

Overview of global agriculture…

Note: *This is a brief summary of my observations during the Nuffield global focus program in Feb-March 2006. These issues are particularly relevant to Australian agriculture.*

The most basic human need is food and water, and all over the world many producers in different countries are addressing ways to meet global food demands. Australia, a large exporter of agricultural products has an important role to play. There are many challenges ahead.

The single greatest asset in agriculture is people, and globally the farmer is getting older. This is consistent with our ageing population, as the baby boomers reach the retirement years. It is however, most important that the acquired knowledge and skill involved in food production is

passed onto the next generation of farmers. There is a growing awareness of this, with some good examples being the New Zealand dairy industry through Dairy InSight and the Manitoba Agriculture, Food and Rural Initiatives Canada. Developing pathways into farming in Australia will need to be addressed if we are to remain globally competitive.

Where is the wool? Fashion week in Paris, and there are many fine sights, but very little wool. In the world of organics, healthy living, and environmental conscientiousness, there should be a place for wool. Yet walking Avenue des Champs Elysees, it is evident that somehow the merits of Australian merino have failed to be promoted. Even in Canada at minus 23 degrees Celsius, when a light warm natural fibre should be the premium choice of every shivering consumer, there appeared to be little use or knowledge of the benefits of wool. Australia is the world's largest producer of merino wool; this is a product that is still ideal for much of our clothing needs.

Global wheat trade is not a fair trading environment. There is a difficulty in gaining a competitive advantage in a commodity-based product. But wheat isn't wheat the world over, and Australia has a reputation for producing a quality product, clean and low moisture. The Australian grower has certainly been advantaged by the efforts of AWB Ltd. 'AWB' has become a label, a brand name of quality and certainty. This long standing reputation of providing a quality product at the specifications that the miller requires has added a great deal of value to the Australian economy and wheat industry, and should not be discarded.

"Be good and tell and sell it." Australian farmers are good environmental managers, and we need to continue to be proactive in enhancing our environmental management skills. But we must also promote ourselves to Australia's urban population. The legislation currently being imposed upon the European Union and Californian agriculture is not only enormous, but also built upon voter perception instead of science. Regulation, just to be seen to be 'doing something' doesn't necessarily help the planet. This is now having stifling effects upon the viability of industry. If we want sound environmental management, this is best achieved by a responsible viable agricultural industry.

"The most profitable day on my farm is the day I sit down and fill in my subsidy forms" (UK Farmer). Although it be may sound attractive to be subsidized, the subsidy programs tend to develop inefficiencies and stifle innovation. Of the farmers in Europe receiving subsidies, only the top 25 to 50% of producers will remain viable - the remainder will eventually exit the industry. There is continued movement toward a reduction in farm subsidy programs, although it should be stated that global food and trade production would never be completely

liberalized. The expansion of the European Union from fifteen to twenty-six countries will put huge pressure upon the Common Agriculture Policy, and the Europeans are beginning to look at the implications of this. The United States Farm Bill however, tends to restrict long-term continuity of agricultural policy by its complete rewriting every five years. Agricultural industries need a clear long-term policy framework to set direction, and a gradual removal of US subsidies would both assist US and Australian agriculture. But don't hold your breath!

If you think land prices are expensive here, go farm in the Netherlands. In extreme cases one square meter of agricultural land can costs up to $170 Australian. And the race to acquire more farming land across the world is on. The urban sprawl is influencing land prices, yet it is mainly the ability of farmers to manage larger holdings, long term stable interest rates, and the benefits of scale that are making land prices skyrocket. Global farm debt is increasing, with perhaps a correction in the market still to come.

The Australian and New Zealand lamb industries are more complimentary than competitive. The production of prime lamb coming out of New Zealand appears to target the European market very successfully, aiming for a 17-kilogram carcass, with excellent product branding. The heavier export lambs produced in Australia are suited to the American consumer. But general lamb consumption in the US is small, and is priced at a higher level than US beef. There needs to be continued promotion of both the quality characteristics of lamb and the many ways to prepare this food within the United States.

There are large benefits to be gained through biotechnology. Genetically modified crops aren't the 'silver bullet' for agriculture. Some of the dollar savings in chemicals offered through GM crops will be swallowed up in plant breeder royalties. However, the benefits are very good and if Australia is to remain competitive, the grains industry must have access to this technology. The reduction in both chemicals and nitrogen fertilizer will have positive outcomes for the environment, as well as the rotational options that this technology affords. The huge move toward bio-diesel, with Europe aiming for 15% by 2015 will increase the need for energy crops; genomic and transgenic will play an important role in this.

As I travelled, I met farmers quietly going about their business; growing crops, raising livestock, feeding the world. Next time you eat give a thought to those whose task it is to meet your basic human need… food.

References

Keith H. Adamson, Nuffield Scholar, 2003 Nuffield report

Tim Allen, Senior agronomist, Peter Rowe Agencies, Bendigo, Victoria, Australia

Luanne Anderson, ICMS inc.

Jim Bessel, Senior Agronomist and Project Leader, Canola Council of Canada

Dale Broad, Bendigo Australia, former accountant, World Vision

JoAnne Buth, Vice President, Crop Production & Biotechnology, Canola Council of Canada

Gregory C. Buzza, Canola Research Manager-Monsanto, Winnipeg, Canada

Paul Byrd, Oilseed rape grower, Newport, England, U.K.

Canadian Wheat Board, Winnipeg, Canada

Helen Chambers, Farmer, Marong, Australia

B.J. Christopher, Odessa, Ukraine, & U.S.A.

Martin Davies, Nuffield Scholar, Farm consultant, England, U.K.

Wally Doerksen, Nuffield Scholar, Steinbach, Manitoba, Canada

Dr Martin H. Entz, University of Manitoba, Canada

Mark Fallon, Engineer, Hildesheim, Germany

David Faurschou, Member of the Legislative Assembly, Manitoba Province, Canada

Dr George Friesen, Winnipeg, Canada

Dr Fawzy Georges, Plant Biotechnology Institute, National Research Council Canada

Dr Chris Green, Crop Management Information, Boothby Pagnell, England, U.K.

Sinclair Harrison, Nuffield Scholar, President of Farmer Rail Coalition, Moosomin, Canada

David Heide, Agronomist, Moosomin, Canada

Hutterite Colony, Milden, Saskatchewan, Canada

Dr Wilfred A. Keller, Plant Biotechnology Institute, National Research Council Canada

Dr. Linda J. Malcolmson, Director of Special Crops, Oilseeds, and Pulses, Canadian International Grains Institute

Ian McPhadden, Nuffield Scholar, Milden, Saskatchewan, Canada

John Mayko, Agronomic Research and Extension Manager, Canola Council of Canada

Ulrich Meyer, Farmer, Behrensen, Coppenbrugge, Germany

Kevin Morthorpe, Pioneer Hi-Bred Australia, Australian Grain Magazine, July-August 2006

Orla M. Nazarko, Rene C. Van Acker, Martin H. Entz, 'Strategies and tactics for herbicide use reduction in field crops in Canada: a review' November 2004

Network of Concerned Farmers, Australia

Peter Nixon, Nuffield Scholar, Moora, Australia

Dr Rob Norton, University of Melbourne, University of Manitoba, Canada

Chris Pollock, Farmer, Bridgewater, Australia

Meurig Raymond, Deputy President, National Farmers Union, U.K.

Nicola Raymond, Nuffield Scholar, Wales, U.K.

Jim Rees, Farm manager, Farmcare, England, U.K.

Percy Schmeiser, anti GM campaigner, Bruno, Saskatchewan, Canada

Len Seguin, Program Manager, Canadian International Grains Institute

Barry W. Senft, Executive Director, Canadian International Grains Institute

Gordie Siebring, Odessa, Ukraine

Don Sissons, Nuffield Scholar, Portage la Prairie, Manitoba, Canada

John and Barb Stefanyshyn-Cote, Nuffield Scholar, Leask, Saskatchewan, Canada

Mike Tebbit, Oilseed rape grower, England, U.K.

Robert Willick, organic grain farmer, Blane Lake, Saskatchewan, Canada

Dr William W. Wilson, Professor, North Dakota State University, Fargo, U.S.A.

Diane Wreford, Assistant Vice President, Public Affairs, Canola Council of Canada

Brent Wright, Nuffield Scholar, ICMS inc. Portage la Prairie, Manitoba, Canada

Dr Jitao Zou, Plant Biotechnology Institute, National Research Council Canada