NSW Agriculture

NSW Agriculture Submission to the Legislative Council's Standing Committee on State Development

GENETICALLY MODIFIED FOOD

March 2000

EXECUTIVE SUMMARY

- Genetic modification (GM) technology has enabled the production of commercially valuable characteristics in plants, animals and micro-organisms which would be impossible to achieve through traditional breeding processes. The possibilities for the adoption of this technology are immense.

- The Commonwealth Government is currently developing a regulatory framework to ensure that the community's concerns over the safety of this new technology for human health and the environment are satisfied.

- The issue of whether the Australia and New Zealand Food Authority should mandate that food containing GM components or ingredients be labelled as such is still under discussion.

- The most significant direct costs associated with the wide scale adoption of GM technology in the food industry will revolve around labelling requirements. Mandatory labelling introduces the need to develop and maintain separate production, handling and processing streams for GM and non-GM food.

- Food producers and industries not adopting GM technology may suffer significant losses of competitiveness compared to their opponents, but on the other hand premium market opportunities are likely to arise where industries are able to guarantee their product is GM free.

- Benefits derived from GM foods may be realised by consumers, the wider community, food processors, farmers and the developers of the technology. These benefits need to be assessed on a case-by-case basis.

- Similarly, potential adverse impacts of such applications will also vary on a case by case basis and all these impacts including those on the natural resource base must be evaluated and managed.

- The impact on trade on the uptake of this technology is uncertain. Countries choosing not to adopt this technology are likely to use GM Food as a trade barrier.

- There is a need for NSW Agriculture, government as a whole and other independent scientific organisations to inform the public and industry of the advantages and disadvantages of adopting GM technology.

1. INTRODUCTION

Genetically modified organisms, the products of these organisms and their place in the food chain have recently been the centre of much attention. While Australia has not been at the forefront of large scale application of this technology in food and fibre production industries, recent moves towards general commercial release of a number of applications and discussion over development of an appropriate regulatory system have raised the level of public awareness and debate.

As a major provider of knowledge and services to the agricultural food and fibre industries of this State, NSW Agriculture has a strong interest in ensuring that public debate on any issues involving genetically modified foods is well informed.

NSW Agriculture welcomes the opportunity to contribute to this inquiry and has provided specific comments on each of the Terms of Reference provided.

2. GENETIC MODIFICATION

Genetically modified (GM) has become the term used to describe food produced by plants, animals or micro-organisms which have had genes inserted by means other than conventional breeding.

The growth in knowledge of how genes work has enabled scientists to identify specific genes in the DNA genome of one species and insert them into the genome of another species. These genes are known or proven to produce a desired response in the genetically transformed or modified individual.

It is also now possible to "silence" a specific gene in an individual by very similar technology, and hence prevent that gene producing an undesirable characteristic in that individual.

These gene insertions or silencing must be genetically stable and passed on to progeny in the normal way if they are to be commercially useful.

The technology has enabled scientists to produce commercially valuable characteristics in plants, animals and micro-organisms which would be impossible or very difficult to achieve through traditional breeding processes. These include:

- pest and disease resistances
- modified starch qualities in cereals for different processing and end uses
- modified oil characteristics in oilseeds for different end uses or for human health
- tolerance to herbicides
- better or faster malting quality in barley
- altered ripening qualities for fruit

- modified fibre properties for paper pulp trees
- the production of beneficial pharmaceutical chemicals, vitamins, and minerals
- plants which can extract currently unavailable nutrients from the soil
- plants which are better suited to the environment by tolerating salinity, hot, cold or dry conditions
- plants which can extract industrial pollutants from the air or soil, having the potential for bio-remediation of contaminated sites

The use of these breeding technologies in animals could possibly:

- change the characteristics and ratios of meat and fat
- alter the nature of milk from cattle either to remove allergenic milk proteins for use in the production of infant formulas or to produce large quantities of therapeutic proteins for use in human medicine
- introduce resistance to pests and diseases

The application of these technologies in micro-organisms has actual and potential benefits from:

- faster, better or different processed foods such as cheeses, beer and other fermented products
- cheaper production of enzymes for food processing or other uses
- development of better or cheaper vaccines
- development of biological reagents for tests
- development of pharmaceuticals
- use of micro-organisms to decompose toxic substances

The possibilities for the adoption of this technology are immense. We are only starting to see what might be possible at this early stage of development of the science.

There have been more commercial modifications of plants than of animals, with around 60 different forms of genetically modified crops released around the world. GM micro-organisms are also being used in commercial food production and for certain human and veterinary vaccines.

Regulatory Framework

The Commonwealth has been developing a regulatory regime to ensure that the community's concerns over the safety of this new technology for human health and the environment are satisfied. The use of Genetically Modified Organisms (GMOs) and their products is currently regulated under a range of existing legislation and authorities such as the Australia New Zealand Food Authority (ANZFA), the Australian Quarantine and Inspection Service (AQIS), the Therapeutic Goods Administration (TGA), the National Registration Authority (NRA), the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) and the Genetic Manipulation Advisory Committee (GMAC).

However, the emergence of "gap" applications such as herbicide tolerant crops, the move toward general release of modified organisms and community and industry expectations of regulatory systems has been behind the establishment of new legislation and a regulatory authority to fill in any gaps and to work alongside the existing regulatory authorities.

The Office of the Gene Technology Regulator (OGTR) is to be established in the Therapeutic Goods Administration of the Federal Department of Health and Aged Care, under a Gene Technology Act. The Gene Technology Regulator will report directly to the Federal Parliament.

A draft Gene Technology Bill has been available for public scrutiny and comment after lengthy consultation with the States and Territories, and industry. It is expected that the Bill will be amended as a result of this public consultation, and it will be introduced in Parliament later this year. It is hoped it will be passed by Parliament in time for the OGTR to be fully operational by 3 January 2001.

The key elements of the Bill are that all "dealings", with GMOs must be licensed by the OGTR, and that any proposal to release GMOs into the environment must be subject to a rigorous risk assessment to quantify potential risks to human health and the environment. Any identified risk must be reduced to minimal or acceptable levels by appropriate risk management procedures, which will be enforced by the OGTR.

In addition to this risk assessment, the OGTR must also take into account the national interest, established by a Ministerial Council, which will also oversight the operations and policies of the OGTR.

The OGTR will be supported by a scientific advisory committee, a community consultative committee, and an ethics committee. It will be able to commission independent research. All applications, and the decisions of the OGTR, will be transparent and open to public scrutiny.

The proposed membership of the community consultative committee and draft regulations are due to be released for public consultation in March 2000.

The overall process is to assure the public that its concerns over the safety of this technology are being satisfactorily addressed, and not allow the regulatory regime to be captured by either the extreme advocates, or opponents, of the technology.

Labelling of Food

The labelling of GM food is the responsibility of ANZFA. The issue of whether to require all food containing any GM component or ingredient to be labelled as such, or to allow exemptions for small proportions of GM ingredients, is still

under discussion. The outcome of that debate will have a significant bearing on the costs of introducing GM food to markets.

3. LIKELY PUBLIC AND PRIVATE COSTS OF GM FOOD TO NEW SOUTH WALES

The most significant costs, both public and private revolve around labelling requirements. Any labelling requirement introduces the need to develop and maintain separate production, handling and processing streams for GM and non-GM food. Each stream will require its own Quality Assurance (QA) scheme to ensure the integrity of the GM/non-GM status of the end product. In fact it is likely that there will be a multitude of QA schemes, with large processors and retailers having to be satisfied about the integrity of the product they produce or sell.

If labelling and segregation are required, costs will be incurred both by GM producers and by producers of non GM food, who will have to prove that their products are not mixed with GM products. These spill-over costs have the potential to be widely distributed.

While most of these costs will be private and ultimately borne by the community, there will also be some direct public cost for monitoring and verification of compliance with the labelling requirements. In a study of compliance costs KPMG (1999) estimated that the proposed Australian mandatory labelling scheme would push up food prices by 5 - 12 percent.

There will also be increased costs of production at the farm level, with proponents of GM technologies needing to recover the costs of developing the GM technology, the costs of complying with the requirements of the OGTR, and making a profit on their investment, from the farmer.

Farmers of course will not be prepared to meet these increased costs unless they see a financial benefit to themselves. This is discussed in the next section.

Quantifying the costs would be a difficult process. It should be possible to estimate the costs of separate handling and processing systems on an industry by industry basis, but these would only be approximate, as efficiencies may be possible once such systems are in place.

4. LIKELY PUBLIC AND PRIVATE BENEFITS FROM GM FOOD TO NEW SOUTH WALES

There are a number of potential private benefits. The development of GM plant varieties, animals, micro-organisms or technology is a very expensive and risky process requiring a long lead in time before commercialisation and

realisation of returns. Significant investment will only occur if potential profits are offered.

The producer of GM food products will generally be a farmer. To invest in these new technologies farmers will need to realise a benefit from either reduced production costs, increased productivity, or higher prices for the product. The level of profit will depend on the balance between their extra costs for accessing the technology, and the income they can derive from using it.

Some GM foods will also offer benefits to food processors in the form of lower input prices, better quality product, by sourcing product with different quality attributes, lower processing costs, or from marketing a higher priced product.

Retailer benefits may be derived from lower priced inputs, products for which the public is prepared to pay a higher price, by offering a wider range of products, or by offering new products.

Consumers of GM foods may benefit from cheaper food, by being able to source a wider range of processed food products, from foods with enhanced nutritional or medicinal value or from better quality food.

Other benefits to the wider community would accrue from food production systems which have less harmful environmental impacts (pest or disease resistance plants which require less or no pesticide), or which may have a positive environmental impact, such as salt tolerant plants.

Assessing the benefits from adopting this technology needs to be done on a case by case basis.

5. THE IMPACTS OF GM FOOD TECHNOLOGY ON THE AGRICULTURAL AND FOOD PROCESSING SECTOR

It is possible to look at existing cases where GM technology is already available. In Australia this is restricted to cotton. Bt[1] cotton has been grown commercially for three seasons in NSW.

Where it has been used Bt cotton crops have been associated with a significant reduction in the amount of insecticide applied with associated environmental and social benefits. Adoption of this technology used in conjunction with integrated pest management strategies has reduced insecticide applications by an average of 44% over the past three seasons. It has been particularly effective in controlling damage from pests early in the growth of the crop, reducing early insecticide applications by 61%. This has had another major benefit in reducing the pressure on development of resistance in the insect populations.

[1] Bt cotton incorporates genes from a micro-organism, *Bacillus thuringiensis*, which allows the cotton plant to produce an insecticidal protein.

However, this reduction in insecticide use probably has not been reflected in lower farmers' production costs, as the owner of the technology has charged farmers close to the expected level of the saving, resulting from the reduced application of insecticide, for access to the technology.

This was not the case in the USA, where cotton farmers were charged significantly less for access to the technology than Australian farmers.

The next range of GM plant varieties for which commercial release will be sought in Australia include a range of herbicide resistances in a range of species. The use of these varieties should allow farmers to lower the cost of weed management, and to grow crops in paddocks where the weed burden would otherwise be too high to allow that crop to be sown.

There could be both positive and negative environmental impacts from this technology, with perhaps a lower overall level of herbicide application, but a higher risk of developing herbicide resistance in target weeds. It will be important that these herbicide resistant varieties be released and grown only with comprehensive crop management plans to reduce the risk of herbicide resistant weeds developing.

Plant varieties with modified quality characteristics are being developed. These will expand the products that can be developed from that crop, reduce processing costs, or provide health benefits to consumers such as modified fatty acid composition of plant oils. These will have much more immediate benefit to consumers. Wheat varieties with modified starch characteristics, and barley varieties with better malting characteristics are being developed.

GM micro-organisms have been developed and will continue to be developed which either process food faster or to different products, produce different, or cheaper enzymes for use in food processing, produce more effective or cheaper vaccines for domestic animals, or produce more effective or complete fermentation in the rumen of domestic ruminant animals.

Development with farm animals have been slower due to the higher costs and technical difficulties. Transgenic sheep and pigs have been developed, but not released commercially. A transgenic pig line was developed and tested during the late 1980s and early 1990s in Australia. While this strain of pig had the capacity to grow significantly faster and leaner than other strains it was never successfully marketed as Australian regulators, at the time, had no mechanisms to approve its use.

Recent developments in animal cloning technologies will reduce the cost of developing GM animal lines and are likely to stimulate further research into applications of GM technology in food animals.

The impacts of such applications will vary on a case by case basis and while there are potential benefits for producers, processors, and consumers, potential adverse impacts including those to the natural resource base must be managed.

The uptake of GM technology has enormous potential. Claims have been made that the "biotechnology revolution", of which GM is but a component, will be the next major driver of global economic development, after the "information revolution" created by the personal computer.

There are opportunities for substantial benefits to both the subsistence farmers and consumers in developing countries. The development of rice strains with higher iron, or iodine content is considered achievable. Rice and wheat varieties able to consistently produce higher yields under a range of environmental stresses may also be developed. Of particular value, both in developing countries and in Australia would be crop varieties able to access more of the currently unavailable phosphorus in the soil.

It is feasible to develop crop plants which fix their own nitrogen, by transferring the genes responsible for this characteristic from legumes to the major food crop plants. While this is some distance away, it would have an enormous positive impact on food production and the environment in both developed and undeveloped countries.

There are opportunities for the development of new crops for the production of pharmaceuticals or "neutraceuticals" through the insertion of genes which lead plants to create valuable medicinal chemicals for human medication. Plants already create a myriad of chemicals, and genetic modification to produce enhanced levels, modified chemicals or novel compounds are all practical applications of existing GM technology.

6. POTENTIAL ADVERSE CONSEQUENCES TO TRADE, FOOD SAFETY AND THE ENVIRONMENT FROM THE INTRODUCTION OF GM FOOD TECHNOLOGY

Some of the potential adverse effects on the environment have been described above, for example, the development of herbicide resistant weeds from the commercial release of plants genetically modified for resistance to specific herbicides. It has been claimed that the pollen produced from some plants modified to increase resistance to pests, can adversely affect other insects.

Determination of the impact of GMOs on the environment should be subject to a rigorous, scientific, risk assessment in the same manner as the claimed benefits.

The impact on trade of the uptake of this technology is uncertain. Adoption of GM crops has been rapid in some countries and non-existent in others. Whilst the adoption of GM crops has been high in the US, Canada and Argentina, consumer concerns and a reluctance to either produce or supply GM foods have arisen on a significant scale in Western Europe, Brazil and to a lesser extent more recently in Japan and South Korea.

A recent review of the market implications for GM crops by Foster (2000) suggested that *"the current generation of crop innovations without market access restrictions is estimated to have lowered coarse grain and oilseed prices by around 4 percent and benefited grain consumers by around US$6 billion annually (in 2000 dollars)".*

Foster's review also analysed, via econometric models, the impact of market access restrictions and the cost of grain segregations into conventional and GM lines so that trade flow was not affected. The review concluded that market access restrictions leading to increased grain segregation requirements would probably mean that the price benefits from using the GM technology would be largely eliminated.

There may be some industries where it may not be in the national interest, from a trade perspective, to produce GM food. However, for other industries there may be very positive economic benefits from producing both GM and non-GM food, and from meeting the cost of developing and maintaining separate production handling and processing streams. These issues should be resolved by the industries following informed discussion and debate with all groups who may be affected.

It must also be recognised that the presence of GM crops in Australia may be used by some countries as a trade barrier, even if Australia does go to the expense of establishing and maintaining appropriate and adequate QA systems to ensure the integrity of the non-GM food stream. While it is theoretically possible to use World Trade Organisation procedures to address these issues if they arise, if large markets such as the EU or Japan exclude products because of potential GM contamination, it will be difficult to overturn the decision.

Other issues have been raised, for example, the "contamination" of organic, or non-GM plants which may well impact on trade. Technically, this can only occur with cross-pollinating plants. The crop which has been singled out to date is canola. There have been claims that pollen has been shown to drift some kilometres and pollinate emasculated plants (plants in which the stamen or pollen producing organ was removed), however, the conditions under which this has been shown were highly artificial. In practice cross pollination will occur from plant to plant within the same paddock. In self pollinating crops such as wheat and barley, cross pollination with GM crops is not likely. However the consumer perception that this may happen could prejudice organic and other non-GM farmers.

Genetic integrity is important in seed crops, and seed certification authorities have developed standard rules for isolation distances from crops to be certified to uncertified crops of the same species. These rules recognise that in a crop situation, huge numbers of pollen grains are released at the time the female floral parts are receptive, and they overwhelm the relatively few pollen grains which may reach the seed crop from another crop even only a few hundred metres away. The proportion of florets pollinated from outside the crop is minuscule.

With some foodstuffs, for example processed edible oils and sugar (products containing none of the plant's DNA or protein), it is not possible by chemical analysis to determine whether these products have come from a GM plant or non-GM plant. Other GM products containing protein or DNA may be traceable through the food chain by specific testing, so costly testing requirements may be imposed on all products for certain markets, with consequent spill-over costs to industry.

ANZFA has the responsibility to ensure that any GM food is at least as safe for human consumption as its non-GM counterpart. Risk assessments show that pathogenic micro-organism contamination of food poses a much higher risk to human health than GM technology.

One issue that needs to be addressed is that of the possible development of allergies in some people to the new proteins produced in GM foods. While it should be possible for ANZFA to require new GM foods to be tested prior to release, this risk needs to be kept in perspective. Many people are allergic to a wide range of naturally occurring proteins and microscopic particles such as pollen and mites. Quite a number of people are allergic to gluten, the protein in wheat which gives it the unique ability to hold gas bubbles and hence produce leavened bread and cakes. It is likely that the risk of people developing allergies to new proteins in GM food is the same as for existing proteins, and probably much smaller than the proportion of the population allergic to some pollens.

CONCLUSION

The debate on whether GM foods will provide an overall benefit or cost to the community needs to be considered on a case-by-case basis. As has been outlined above, there are considerable potential benefits for the environment, to people in developing nations and to consumers and farmers in western cultures. However, there are some costs to individual communities associated with the adoption of GM technology, as well as a philosophical opposition by some people and markets to their use.

The use and further development of GM products will continue to be an issue and it is essential that widespread community debate and participation in the decision making process occur. This will ensure that the benefits of GM technology to the community of NSW will be maximised and the detrimental aspects minimised.

7. BIBLIOGRAPHY

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