

Transgenics: Superhighway or Road to Nowhere?

Grains Research and Development Corporation

John Lovett

PO Box E6
Kingston ACT 2604

Introduction

Transgenic crops are a reality. “Genetic engineering” emerged in the 1970s, at the same time as *in vitro* fertilisation techniques (Hindmarsh 1992). The first “genetically modified” crops were planted in China in 1993; large scale production commenced in 1996 (Huttner 1997) and, by 1998, almost 28 000 000 hectares of transgenic crops were planted, World-wide. Principally confined to the Americas, the United States and Canada accounted for some 84% of the total area in 1998. In Australia, the only commercial transgenic field crop remains “Ingard” cotton which, last season, was planted on 64,000ha, accounting for 20% of the crop.

While the reality of transgenic crops is indisputable, perceptions about them differ among the scientific community, primary producers and consumers. If nothing else, the high profile of transgenics has raised awareness that Australia’s rural industries are part of a much larger, global, agrifood industry. It follows that considerations of quality assurance and food safety assume paramount importance.

If positive perceptions gain the ascendancy then transgenic crops may well prove to be the superhighway which leads World agriculture to a profitable and sustainable future. If, however, negative perceptions hold sway then transgenics could prove to have been an expensively surfaced road to nowhere. For Australia’s Grains Research and Development Corporation (GRDC), the largest single investor in public sector grains research and development in Australia, the transgenic crop milieu offers both challenges and opportunities.

Science and Transgenic Crops

From a GRDC perspective, the science of transgenic crops is, in some ways, the least of the issues which need to be addressed. The science is not new. The double helix structure of DNA was discovered more than forty years ago (Watson and Crick, 1953) and recombinant DNA research has taken place since the late 1960s. To many, perhaps most, of those involved in crop improvement, transgenics are merely a further step in an evolution which, in the case of a crop such as wheat, extends from the dawn of agriculture. Gene technologies offer a new set of tools to be applied to the on-going task of enhancing crop productivity and profitability by improving the use of scarce resources, including water and nutrients; tolerance to abiotic stresses, including drought and frost; tolerance to biotic stresses, including pests and diseases; quality characteristics, including a diversified product range, and food safety, by reducing dependence on pesticides and herbicides.

Additional benefits are expected to accrue to the environment, since greater productivity per unit area of cropped land should reduce the pressure to clear what remains of potentially cultivable land, World-wide.

It is the case that, with a World population of some 6 billion people there is no current, net shortage of food: the tragedy of the World’s hungry is inequitable distribution rather than the amount of food available. But the difficulty of feeding a World population of 8 billion was exemplified by the then President of the International Federation of Agricultural Producers,

Graham Blight, in an address to the National Press Club, Canberra, in 1995. To do so will require that food production double by 2025. This means an extra three-quarters of a billion tonnes of grain from the three major cereal crops, wheat, rice and maize, alone.

Incremental gains from conventional plant breeding run at 1 to 1.5% per annum. Grain crops will not meet future demand without a step change in yield improvement, such as occurred during the “Green Revolution”. While “transitional high technology” plant breeding, perhaps including the delivery of improved traits via hybrids, may help to bridge the food gap, transgenics appear to offer the best prospect of meeting food needs in a sustainable way. For the GRDC, linking the molecular biology of transgenics with conventional plant breeding in a continuum of crop improvement is a priority.

At present, transgenic maize is the only one of the three major cereals in agricultural production. While progress is being made with barley, rice and wheat, attaining acceptable levels of transformation, especially with wheat, remains challenging.

Consumers and Transgenic Crops

As with *in vitro* fertilisation techniques, the manipulation of organisms at the cellular level inspires controversy. While, technically, genetically modified organisms are characterised merely by the insertion or deletion of fragments of DNA, many consumers of the end products of this technology view it as unacceptably “un-natural”.

This view is not universal. Gene technologies for most Americans are not an issue. These consumers will accept a product if they perceive a benefit to themselves or to society, and if the price is right. Their criteria for foods developed with gene technologies is the same as for other foods: quality, taste, nutrition, price, safety and convenience (Hoban 1998).

However, gene technologies remain an issue in some parts of Europe, principally, due to lack of confidence in regulation. The crisis engendered by the bovine spongiform encephalopathy (Mad Cow Disease) events of 1995/96 in Britain is still prominent in the public consciousness and has contributed to a pejorative media approach, exemplified by the “Frankenstein Food” headlines of 1999.

The European Union is calling for mandatory labeling and is preventing the importation of many products which cannot be certified as genetically modified (GM) free. Supermarkets in the United Kingdom have taken matters into their own hands, many declaring a moratorium on GM products in their stores.

To the extent that an overall trend can be discerned, overseas surveys indicate that consumers tend to be supportive of gene technologies to, for example, develop new types of insect-resistant plant. Reduction of pesticide use is, of course, a definable benefit to consumers. They are less likely to be accepting of “genetically-engineered” food, or of gene technologies where animals are involved, even in the context of potential benefit to human health (Hoban 1998).

Thus, for the GRDC, the delivery of outcomes from multi-million dollar investments in high technology crop improvement could be put at risk more by a lack of national and international consumer confidence than by any shortcomings in science.

Public awareness

The First Australian Consensus Conference was held during March, in Canberra (Australian Museum 1999). Titled “*Gene Technology in the Food Chain*”, the Lay Panel of fourteen Australians provided insights as to consumer attitudes. Key messages were that consumers:

- want reassurance that there are adequate, independent regulatory safeguards to protect public health;
- seek the early establishment of a Gene Technology Office as a statutory authority, and
- need to be kept informed about genetically modified products and have the freedom to choose amongst alternative products via adequate labeling.

While recommending that “*No new commercial releases or unlabelled importation of GMO foods, both whole or processed, be allowed in Australia*” until certain criteria, including establishment of a GTO with a supporting regulatory framework, were met, the Panel did not support a moratorium on research and development or on current transgenic crops or crop products.

The rural Research and Development Corporations, including the GRDC, supported the Consensus Conference and accept that both the process and the outcomes justified their investment. A specific need is to identify benefits to consumers, in terms of health and nutrition, from a position which is scientifically based and ethically sound.

As part of its efforts to promote public awareness the GRDC is a founder member of the recently established Agrifood Alliance Australia (AAA). This coalition of interests along the agrifood chain includes the Australian Biotechnology Association, Avcare, the Cooperative Research Centres Association, the Seed Industry Association of Australia and the National Farmers’ Federation. The goal of AAA, by enhancing consumer access to balanced, quality information on gene technologies, is: “*to help achieve public acceptance of gene technology as a fundamental tool for sustainable agriculture and world trade competitiveness*”.

The preliminary findings from research commissioned by the AAA, involving focus groups within three target markets, indicates that achieving this goal will require enhancing public awareness about some fundamental issues. In essence, consumers are afraid of the unknown and are concerned as to the long term effect of gene technologies on their children. Significantly, they have only a basic understanding of how food, generically, is produced. This presents an opportunity for the agrifood industry to explain food production techniques; food safety protocols and the application of quality assurance approaches; the relationship of food production with the environment, and Australia’s excellent reputation as an exporter of quality food products. A redefinition of the relationship of consumers with other links in the agrifood chain might include promotion of the concept that, in logic, all food should be subject to the rigours currently proposed for genetically modified products.

In addition to addressing consumer concerns, AAA is also preparing to undertake a survey across all primary industries, to obtain a greater understanding of primary producers’ understanding of gene technologies, current perception of their role in the food chain and any concerns regarding uptake of the technology.

Challenges for the GRDC

The position of the GRDC on transgenic crops is that they will, increasingly, become important and beneficial components of the food chain. It is, therefore, vital to the GRDC that its stakeholders, Australia’s grain growers and the Federal Government, accept the need

to develop a transgenic crop option. Improvements in productivity, profitability and sustainability are important to growers, while environmental, as well as economic, benefits will appeal to Government.

The GRDC invests in research and development for 25 grain crops. Of these, transgenic soybean, maize and canola are already grown overseas. In Australia only three crops, wheat, barley and canola, are likely to be of sufficient economic importance to justify interest by multinationals, which have a controlling interest in gene technologies. Some spin-off from technologies applied to large crops may benefit others. Equally, the remaining 22 crops in the GRDC's portfolio may represent opportunities for Australian biotechnology companies.

While the GRDC investment in transgenic crops and related areas, about \$9.5M in the current financial year, is significant, to gain best effect it must be applied to position Australian research providers to exert maximum leverage in accessing intellectual property, germplasm and resources. In this context, Lindner (1999) draws a parallel between the "explosion" in molecular biology and the "revolution" in the legal framework pertaining to intellectual property rights in all aspects of plant genetic resources. This revolution presents an additional opportunity for the GRDC which is being addressed, in part, by support for the concept of an Australian IP centre with initial foci on education, training and policy development.

Transgenic crops are part of a world of strategic alliances essential to delivering on costly, high risk initiatives. To assist Australia to take a global position, the GRDC is a member of one such strategic alliance. "Graingene" has brought together three joint venturers who contribute complementary skills

- AWB Ltd – commercial skills and market direction
- CSIRO – World class biotechnology
- GRDC – research management and crop improvement portfolio.

Already encompassing much of the agrifood value chain, "Graingene" is seeking associates to optimise delivery of its outputs and outcomes in Australia and overseas. Other alliances are expected to emerge.

Conclusion

Superhighway or road to nowhere? Before what promises to be a lengthy journey is complete we may come to sympathise with Henri Matisse, who wrote: "*What I dream of is an art of balance, of purity and serenity devoid of troubling or depressing subject matter... a soothing, calming influence on the mind, rather like a good armchair which provides relaxation from physical fatigue*".

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