

THE WINSTON CHURCHILL MEMORIAL  
TRUST OF AUSTRALIA

**CHURCHILL FELLOWSHIP 2002**

The Samuel and Eileen Gluyas Churchill Fellowship to  
study overseas developments in genetically modified and  
organic grains in the stockfeed industry.

Nigel Hammond  
Quality Assurance Manager

Better Blend Stockfeeds Pty Ltd / A&B Packers Pty Ltd  
9 Queen Street, Oakey, Queensland 4401

Ph: 07 4691 4691

Fax: 07 4691 4692

E-mail [nhammond@betterblend.com.au](mailto:nhammond@betterblend.com.au)

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Signed

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# Index

	Page
1. Summary and Acknowledgement	3
2. Executive Summary	4
3. Programme	5
4. Introduction	6
5. Processing Specialty Crops	7
5.1 Agricultural Preparation	7
5.2 Measuring Genetically Modified Traits	9
5.3 Associated Issues & Marketing	11
6. Conclusion and Recommendations	13
7. Bibliography	14

# 1. Summary and Acknowledgement

This report details the findings from a 2002 Churchill Fellowship visit to United States of America, United Kingdom and Ireland investigating the methods used in segregation (identity preservation) of genetically modified grains and/or organic grains held in conjunction with conventional grains in a grain handling and stockfeed environment. Specific areas of study include:

- involvement with agricultural preparation in establishing the growing of specialty crops.
- use of field test kits to measure genetically modified trait levels in grain before, during and after seed and grain production.
- associated issues and marketing in controlling specialty crops through regulations, labelling and traceability.

My visit to the United States, Britain and Ireland and the invaluable experience I gained would not have been possible without:

- the financial support given to me by the Winston Churchill Memorial Trust and especially the generosity of my two sponsors, the joint trustees for the Samuel and Eileen Gluyas family who had provided me with the opportunity to visit these countries and helped open many doors that would have otherwise been closed;
- the support and commitment of my employer, which has encouraged my development towards professional expertise within the grain and stockfeed industry;
- the fraternity of scientists, researchers, crop specialists and processors in the US, UK and Ireland and their willingness to share experience and information; and
- my family Kate, Roxanne and Kobi for their love, support and encouragement through the whole experience, from the application through to the warm welcome received on my return.

## 2. Executive Summary

**Name:** Nigel Hammond  
**Position:** Quality Assurance Manager  
**Address:** Better Blend Stockfeeds Pty Ltd  
9 Queen Street, Oakey, Qld 4401  
**Contact:** ph – 07 4691 4691  
fax – 07 4691 4692  
e-mail – [nhammond@betterblend.com.au](mailto:nhammond@betterblend.com.au)

### **Fellowship objective:**

Investigating the processing of specialty crops (GM, non-GM & organic grains) in the US, UK and Ireland in the grain and stockfeed industries.

### **Fellowship Highlights:**

- summary of grain extension & economics investigating social & biological impacts with GM crops, Prof. Robert Wisner, Prof. Phillip Baumal, Prof. Neil Harl, Prof. Roger Ginder and faculty, Ames Campus, Iowa State University of Science & Technology.
- operational intake and storage controls of non-GMO grains in a larger elevator facility, Bill Beukema, Boone, Iowa West Central.
- laboratory methods in detecting genetic traits in plant and seed identification using Polymerase Chain Reaction, Dr John Fagan and Bill Thompson, Fairfield, Iowa Genetic ID.
- operational sequencing of organic raw materials as importers and suppliers to animal feed industry, Rachel Wainwright, Banbury, Adderbury UK Cherwell Valley Silo.
- review in biotechnology crop, animal, environment, industry and human health, Prof. Jim Burke, Carlow, Ireland TEAGASC Ag Food Development Authority Oak Research Centre.
- laboratory use of science behind biotechnology and innovation. Tour through laboratory with gene sequencing projects, Prof. Phil Dix, Dublin Ireland Maynooth College.

### **Findings**

There is considerable scope for Australian grain and stockfeed industries to look closely at what progress has been made overseas with potential benefits including:

- access to seed purity testing programmes and field test kits
- reduction of pollination drift of specialty crops.
- improved grain handling sequencing in facility acceptance with specialty crops.
- development of better traceability methods in the event of recall.

### **Suggested Publications & Presentations:**

#### **Seminars**

Presentations targeting identity preservation during storage and handling will be made at:

- the Queensland Stockfeed Association, Brisbane through Commerce Queensland, January 03.
- the Queensland Pig Consultants Group, (QPCG) southern Queensland.

#### **Publications**

It is expected that one refereed article detailing overseas experience with handling specialty crops (either GM or non-GM) defining segregation and hygiene controls will be published. Several articles for the grain and stockfeed journals and newspapers are also intended.

### 3. Programme

**United States / Oregon Portland** **25 June – 1 July**

- AWB USA Limited
- US Wheat Association
- Wheat Marketing & Research Centre.
- Pacific Northwest Grain & Feed Assoc

**United States / Missouri St Louis** **3 – 8 July**

- Fulton Westminster College (Winston Churchill site)
- American Soybean Association

**United States / Iowa Des Moines** **10 – 15 July**

- Du Pont Pioneer (International) Agriculture & Nutrition
- Iowa State University, Ames Campus
- Genetic-ID (Global Leader in GMO Identification), Fairfield
- West Central Soy, Ralston
- West Central (Certified Crops), Boone

**United States / Indiana Indianapolis** **17 – 25 July**

- United Feeds, Sheridan
- United Feeds, Illinois Pittsfield
- Signature Farms

**United Kingdom** **27 July – 19 August**

- Winston Churchill sites
- Chartwell House, Kent
- Jon Ratcliff, Food & Agriculture Consultant, Adderbury
- Cherwell Valley Silo (Organic Soy Importer), Adderbury
- INTA, Dr. Richard Summer (Certified Auditor), Worcester
- ABN (Pig Feed / Organic), Peterborough
- Cert ID Limited (Non GMO Certification), Birmingham
- Country Wide, Grain Department
- Bole Brothers, Burgess Hill
- Millennium Seed Bank, Wakehurst Place

**Ireland** **21 – 26 August**

- Alltech, Meath
- Irish Grain & Feed Association, Dublin
- Irish Agriculture Wholesale Society, Dublin
- TEAGASC-Ag Food Development Authority, Carlow
- Irish Farm Journal, Dublin
- Dublin Central University
- Maynooth Collage, Professor Phil Dix, Dublin

## 4. Introduction

### Background

Genetically modified (GM) crops and to a lesser extent organic grains are emerging as significant new feed ingredients in the national and international grain industries. The Australian grain and stockfeed industries have traditionally had little exposure to handling genetically modified crops and will be placed in a position to supply opposing markets within years. However the wide differences in consumer acceptance of GM grains in various overseas & domestic markets means that individual companies maybe forced to decide what markets (GM, organics, conventional) they want to be in. With unbiased and objective information, all parties within the supply chain can make educated decisions towards varieties of GM seed, handling methods, testing protocols, storage facilities are most appropriate for their system of operation.

It is important that Australia's grain and stockfeed industries consider developments in handling GM crops and to know what the associated issues are. The United States (US) already has approximately 13 varieties of GM corns on the market along with GM varieties of soy, canola, rice and wheat. In contrast, the United Kingdom (UK) and Ireland are mainly organic or non-GM feed. With strong markets to fill, many companies are delivering a product that is different to GM crops. Strategies for handling specialty crops are sometimes overlooked with a greater emphasis placed on policy direction and environmental considerations. Australia must understand *how* to handle these crops and *what* are the levels of concerns here and overseas.

Australia needs to examine:

- what support will be available to grain and stockfeed industries when GM crops are released?
- measures taken currently in the US, UK and Ireland for handling specialty crops (GM & organics)?
- how logistics, contract and quality assurance systems can deliver separation of GM and non-GM grains?
- risk management challenges confronting the feed and grain industries today?
- how these countries are approaching the issue of segregation and what are the levels of participation and what is actually being delivered?

While traveling throughout these countries I came across many wonderful people who were willing to share their knowledge and experiences and I hope this report helps pass on the same information to those inside and outside the industry.

## 5. Processing Specialty Crops

### 5.1 Agricultural Preparation

#### Seed & Materials

‘This is where it all starts, with the seed...get this wrong and the whole supply chain is affected’ At present GM crops are normally (1 gene-1 crop), multi gene crops have not yet been developed. In the US GM variety crops are used in stockfeed manufacturing with 90% of the feed sold back into their own domestic market.

Before spring grain elevators would talk with farmers & producers about the coming planting season and what are the concerns. Seed sold by the grain elevators must be guaranteed 99% purity. Within the mid west of America some elevators are offering to test farmers’ held-over seed before planting as a free service to help establish integrity in planting programmes. Grain elevators see this as not only providing a service to farmers but also to help establish better customer relations between both the farmer and themselves. Biotech seed companies are concerned about seeds being mixed with held-over seed from last season’s plantings. It has become an increasing problem with new varieties of seeds on the market being mixed with existing lots. Crops grown containing GM traits are corn, soy, canola and cottonseed. Developments are underway for a specific herbicide tolerant wheat crop with trial planting areas currently being reviewed. GM seeds if not correctly removed from equipment is often held-over in planters, bins and other storage or holding areas. There is a significant risk that conventional crops grown using the same equipment may be contaminated with GM seed unless tested or grown otherwise.

The main crops grown throughout UK & Ireland are wheat, barley, oats, canola and pulses. UK crop ratios are 70% wheat, 20% cereal and 10% oats. Ireland produces some corn mainly used for stock. All crops are produced under conventional farm management practices. No commercial GM crops are grown in the UK or Ireland however, the UK is presently trialling some controlled GM oilseed canola crops. Both countries source soy products from Brazil and US through suppliers specialising in handling Non-GM products. Ireland imports hard wheat through Canada and the US for flour milling purposes. A large percentage of the UK & Ireland poultry and pig feeds use non-GM specific soy material imported in the form of meal. Within Ireland some GM trials of Sugarbeets were undertaken however, due to the public release of the trial location and the growers’ names, activists descended upon the farms and destroyed the research. Under the European Union guidelines GM crops, approval has been given to a number of varieties. This includes herbicide resistant soy & canola and a number of types of pesticide resistant corn.

#### Harvest/ Storage / Hygiene

Prior to harvest grain elevators would normally mail out information to farmers reminding them to clean and to check equipment before starting. In some locations grain elevators invite farmers to attend pre-harvest meetings discussing hygiene matters and the coming harvest programme. The harvest window for soy and corn is relatively close with soy harvested between September and October while corn between November and December. 70% of contracts are received within the first 5 days of the soy harvest. Grain elevators are extremely busy and must be prepared to process deliveries efficiently to ensure contract integrity is maintained. Elevators who have contracted both non-GM & GM crops split their operations by running 2 entirely separate systems. This is the only way they can be assured of true isolation and identity preservation (IP). It is a massive job to clean down grain hoppers and other equipment if contamination were to happen so grain elevators limit their risk by separating the facility.

## **Contracts and Growing**

Segregating GM and conventional crops within the US is uncommon; grain elevators firstly need to workout whether they have the capacity to handle both non-GM and GM materials. As growing contracts are based on *area* and not *bushels*, elevators find it hard to calculate storage of incoming crops. Farmers hedge their bets by growing both non-GM and GM crops during the season. In the US there are limited follow-ups or checks on farms to see if contractual requirements are being maintained. Last year some elevators drove random field borders to identify buffer zones with a number of spot checks. Although only small, these field tests are probably more about customer relations and buyer concerns. Once an agreement is signed it is up to the farmer to dispose of their GM crop at an approved elevator, processor or feed company.

Border contamination is an issue. During harvest of 'Non-GM' crops the first 60 feet (18m) is considered to be '*HOT*' meaning 'positive' and may contain GM seed. This is then dumped as positive and the remaining field is disposed as Non-GM. The biggest risk for contamination is equipment not cleaned for harvest of GM and non-GM crops. There are few industry standards for regulating GM contracts. It is up to the discretion of the buyer through the contract how they are going to accept the non-GM crops. The Iowa State University with the assistance of machinery manufacturers and others have produced a number of useful videos that identify why clean downs of equipment must be undertaken before and during each seasons. The University identified that an estimated 80% of problems related to planters and combine harvests failing to be flushed and 20% related to seed impurity.

## **Returns**

Growers receive a premium of US 20 cents / bushel above market price for non-GM crops if grown and delivered to the grain elevator at harvest. They receive US 25 cents / bushel above market price for non- GM if they are prepared to store grain on farm and be available on call (Buyers Call – deliver on requirement). The problem arises during winter when the farmers must be able to pull out corn during snow and deliver; quite often corn becomes frozen and hard to unblock from silos (not many farmers opt for this strategy due to problems). Grain elevators who have taken on these 'Buyers Call' contracts would work closely with the farmers and empty farm silos first before emptying their own as a courtesy to their farmers and maintaining good customer relations.

With limited access to markets and a number of restrictions on product, farmers in the UK and Ireland are reducing wheat and barley plantings. Wheat prices in the UK over the past 6 years experienced a dramatic drop in price from £120 per ton; last year growers received £50 per ton while for canola they received £20 per ton. International wheat is imported from Black Sea ports and is landed in the UK at £30 per ton. The grain trade industry is concerned that world wheat production is declining and trends showing yields are down. Ireland is based on small-scale intensive farming practices. At the growers level they are saying they receive (Euro) £50 per ton more for non-GM crops and are able to meet demand. Growers are also concerned if GM crops were introduced in Ireland, field husbandry would be their biggest risks, managing and maintaining environmental protocols.

## Transport

Within Britain & Ireland grain elevators (importers) bringing in non-GM soy would sample the material at delivery, as a single shipment could be as much as 10,000 to 40,000 tons. Sampling is undertaken to verify shipment and due diligence of the contract. The importer conducts annual audits on suppliers to confirm *'what being contracted is being delivered'*. There would only be a reason for concern if the testing of a shipment showed an error of greater than 1%. Specific accredited soy (organic, Non-GM or Low-GM) arriving at port is accompanied by a 'certificate of purity' and a contract. Copies of the certificate follow the load of specific accredited material through its life.

## 5.2 Measuring Genetically Modified Traits

### Testing & Sampling

In all countries seed and grain purity is the main focal point in producing a specific crop and it is important that testing determines the level of purity. An 'Enzyme Linked Immunosorbant Assay' (ELISA) strip test is used to identify genetic traits in seed, leaf or grain. Strip tests provide a simple 'Yes' or 'No' result within 5 minutes and if the result shows a negative a second test is conducted. The strip test works by identifying herbicide or pesticide traits within a sample and can deliver a pass or fail answer within minutes.

Examples of ELISA test kits with slightly different ratios.

Company / Product	Detection of GM	Confidence Level	Seed Sample
Strategic Diagnostic Inc (SDI)	1.0%	50%	125 seeds in duplicate
Strategic Diagnostic Inc (SDI)	0.1%	50%	700 seeds in duplicate
ADGEN	0.2%	95%	10000 seeds in duplicate

The ELISA strip test is used as a guide to validate materials for audit or contract process with a 'Polymerase Chain Reaction' (PCR) tests being the more acceptable standard. Companies exporting to countries requiring specific non-GM grains opted for the more rigorous PCR test. The ELISA strip test is considered to be an acceptable field test and works well to maintain grain system integrity from the beginning. The strip tests are used to ensure methods of segregation are correct and lots are not mixed. The buyer determines the extent of testing and method used.

England and Ireland both receive imported materials from countries that are known for growing GM crops. PCR tests are the accepted standards for contracts with represented samples from each shipment submitted for testing. With a high demand for confidence and assurance shipments are tested for contaminants. The cost of PCR testing and the delays in receiving results are areas affecting importers today. PCR testing does not pick up conventional soybean types. A concern is that there are presently no uniform international standards for PCR testing. 'Soft' testing (conducting one PCR test every month with combined samples collected) for GM traits is mainly conducted on arrival of materials into Ireland, at this stage there is limited segregation of shipments. Under the United Kingdom Agriculture Supply Trade Association (UKASTA) scheme, manufacturers of stockfeed who claim "GM-Free" status must be able to substantiate less than 1% of GM deoxyribonucleic acid (DNA) within their manufacturing control programmes; therefore incoming soy must be less than 1% GM when selling the final product and this is confirmed by a PCR test.

### **Diagnostic Equipment Development**

With advancement into biotech grains comes the research and development into improved diagnostic testing equipment suitable for determining grain composition and purity. The 'Near Infrared Reflectance' (NIR) machine is now being developed to measure herbicide and pesticide traits along with moisture, protein, oils, starch and fibre etc. Grain harvesting machinery has been modified with an NIR machine to monitor crops coming off the field. Prototypes are still very much in their infancy development stage. These precise analytical instruments will not only be developed for laboratories but in the future will be included as part of harvesting equipment. A continuous sampling process could be used to analyze and segregate crops directly off the field before delivery to the elevators.

### **Training**

A number of universities within the corn and soy growing States in the US run educational crop quality programmes in conjunction with grain elevators, their associations and along with others within the industry. These programmes discuss fundamental concerns in the seed purity, growing techniques, harvesting methods and hygiene controls. Farm and field training awareness programmes have been a positive benefit with new techniques in helping to set standards within the industry. With the Europeans and Japanese markets insistence on Non-GM products it is important that the US maintain grain integrity by helping to provide assistance with its aim to help minimize the risk of contamination.

### **Biotechnology**

Gene flow occurs naturally by pollination drift but with science, interspecies transfer is by adding DNA and combining it with another to code for a particular function or trait. Today GM crop science development is looking at ways to multi gene crops and the ability to turn genes off and on when required. Scientists within Ireland are excited about biotechnology developments around the world and have embraced the tools to develop their own plant breeding programmes. Grass crops, potatoes, pulses and hemp are being researched. Ironically, recreational grass varieties developed grass crops using this technology have been released by commercial venture and are growing well in Australia and New Zealand today.

### **Scientific Benefits**

Tobacco is an easy plant to grow under laboratory conditions and is commonly used as the main plant to reproduce DNA strains in the biotech industry, as the full genetic sequence is known. Scientists are able to use GM technology as a guide to measure enzyme stresses in other plants. Another use of GM technology is the research into increasing shelf life of plants and vegetables by hormone control. Researchers are confident that GM technology will be used to develop crops with a salt tolerant gene for salty conditions or the ability to increase the range of growing in different soils and climate conditions. Future potential of GM technology within the UK, researchers through funding via commercial ventures and grants through the European Union are able to explore DNA sequencing. Research is now aimed towards medical vacation programmes, improved human organ transplant and the pharmaceutical industry. Although plant-breeding programmes for pharmaceutical development are small compared to crop production, separation via pollination contamination is still a consideration. Future research into gene technology will aid plant development, pollination research, plant material knowledge and scientific knowledge, with research progress an enormous benefit.

### 5.3 Associated Issues & Marketing

#### Marketing

The Asian and European markets are very conscious about GM and chemical residues in their food and are now setting limits with their government agencies insisting on better regulations. The use of identity preservation (IP) within the US is regarded as a 'PUSH' system, meaning it's left mainly to farming associations, grain elevators and universities to educate the farming community on the need for improved hygiene, segregation and other requirements for GM and Non-GM crop. In a majority of cases farmers are paid a premium for participating in these programmes to change farming habits to meet the needs of their customers.

In the UK and Ireland the issue of GM traits in crops is very much on the back burner with any concerns now driven by retailers. The biggest issue in the UK is the price of food, '*what's in the trolley*'. Five major supermarket chains within Britain dominate and control 80% of groceries market. One of the major supermarket chains holds 20% of market share. It also purchases 40% of the beef in the UK and is the single biggest buyer for consumption of off-farm produce. Retail surveys have shown their customers want non-GM products on their shelves. As a result some products are being labelled as GM-Free, which may not be necessarily true. Supermarkets are pushing for safe food laws saying it's a consumer's requirement due to food scare overload. The 'HARD' and 'SOFT' IP system which was used to identify GM materials faded about 12 months ago when supermarkets got involved in setting their own standards. Today supermarket products are assured by way of the 'United Kingdom Agriculture Supply Trade Association' (UKASTA) scheme. Supermarkets are concerned about 'brand damage'. 76% of retailers want some form of testing and including traceability from the country of origin. Of all food products produced in the UK, 70% is directed to the domestic market while the remaining 30% is shipped to Italy, Spain, Portugal, Ireland and Africa. The future for feed and food will be covered under the same legislation.

#### Environment

Environmental liability is a sensitive and emotional issue that won't go away. Consumers are caught between environmentalists, lobbyists, scientists, industry and governments to select a position on GM technology. It seems pollen drift has become a 'nuisance factor' and field buffer zones are not coupling with climate circumstances. Some environmental groups are calling for up to a mile or more separation between Non-GM crops as part of segregation; however, distance is irrelevant as wind has no boundaries and dust can be blown for many miles when high in the atmosphere. As part of the international effort to conserve the planet's native wild plants, seeds are being collected on a massive scale. It's a race against time to collect seed populations of known and unknown species. Seeds are able to stay alive for up to 1000 years and can germinate when the conditions are right.

## **Regulations**

Three regulators share the responsibility for GM technology within the US; they are the US Department of Agriculture (USDA), the Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA). Under the European Union (EU) regulations (Directive and Regulations), the EU legislation is in favour of the GM technology but has left each member government to decide on its own laws. The European food scares caused consumers to demand a greater control over food production with supermarkets taking the lead to protect consumers, loyalty, brand names and to maintain market share. They produced a code of practice for the stockfeed manufacturers with products sold in Britain and Ireland regulated under the United Kingdom Agriculture Supply Trade Association (UKASTA) scheme. UKASTA developed two assurance schemes to reassure farmers and consumers that feed and food are safe. The UKASTA Feed Assurance Scheme (UFAS), which includes the Feed Materials Assurance Scheme (FEMAS) developed to satisfy supermarkets that commercially produced feeds used in the food chain are safe. This includes tracking feed materials and manufacture processes from the farm gate. With over 250 feed mills listed within the UK, UKASTA regulations covers 90% of all animal feed produced. While supermarkets push for safer food laws all stockfeed manufacturers will need to be registered with UFAS by July 2004 and have FEMAS audit programmes in place. With some 14,000 and 15,000 registered grain farmers in Britain, 90% are covered by one or more independently audited assurance schemes.

## **Organics**

The use of organics within the US was not visible, with farmers and producers more focused on non-GM crops. However in the UK & Ireland the demand for organics was high in the short term after the recent agriculture scares in Europe, but eased to more moderate growth as consumer confidence returned. Consumers at that time moved towards organic meat and egg products. Organic stockfeed manufacturers are not seeing the returns as expected from premiums paid in the beginning. With the assistance of the UK government 70% to 74% of organic materials are imported. The conventional farming industry in the UK views organics as a niche market and believes it will level out at 4% or 5% of overall production.

## **Labelling**

British consumers are looking for choice in food selection and believe labelling needs to be more transparent. Labelling of GM materials has raised more questions than answers. As part of the refinements under EU legislation it is faced with opposition from industry by not providing sufficient answers, with examples like, 'what determines generically modified material?' or 'what's to be included?' or 'is it a single ingredient or as a lot?' The farming industry sees labelling as the right direction but believes it is an industry concern and needs to be a 'one-in, all-in' approach.

## **Traceability**

Grain elevators in the US are finding it increasingly difficult to maintain two separate systems to hold both Non-GM and GM grains at the same time, most likely it will be on a limited basis and whether they have capacity to store these crops over time. Traceability extends back to hygiene practices on farm, seed purity, and growing contracts with conditions of acceptance, testing levels, storage methods on farm and transport consideration. In Europe they are moving traceability more towards labelling as feed and food and will fall under the one legislation. Documentation for producing crops must be kept for 5 years. Due to environmental and human health concerns, this period maybe extended to 10 years.

## 6. Conclusion and Recommendations

A common practice accepted by the US, UK & Ireland is the level of testing undertaken by all countries. As an observation the amount of testing with specialty crops was high throughout the supply chain. Confidence levels could not be determined without testing. This also extends to machinery and equipment used to transport & hold, as the risk of contamination may lie within the next piece of equipment. Regulation within the US regarding growing GM crops is relaxed with the emphasis placed on non-GM crops and the associated hygiene requirements. Farmers participating in these programmes are paid more per bushel than GM crops. The public food debate on the social issues with GM crops has moved forward within Ireland and researchers are in favour of the science behind the GM technology and wanting to learn more. Although no GM crops are grown it is widely suspected that long term acceptance of these crops will probably be adopted, but slowly. While in Britain public perception saw GM as an issue 12 to 18 months ago. After the agriculture scares supermarkets did not think existing regulations went far enough and needed to reassure consumers that their products were safe by introducing their own regulations & codes. A concern today is that everyone wants to know where products are coming from, including country of origin and whether they are traceable through the supply chain. Traceability is linked to food safety by having suppliers approved.

There is considerable scope for Australian grain and stockfeed industries to look closely at what progress has been made overseas with safeguards including:

- access to seed purity testing programmes and field test kits. These are available through a number of sources within the US and EU (check web). Strip test kits (ELISA) range in price, 'example shown' £ UK 500 pounds for 100 tests in a box, and can be successfully used to demonstrate plant and grain GM traits. An appropriate, acceptable standard test with audits and contracts is the PCR test.
- reduction of pollination drift of specialty crops to ensure neighbouring farms, e.g. plant and crop species, are not contaminated via gene transfer. Maintenance of strict controls set by regulations and regular field monitoring. The current debate in the UK is to increase separation distance up to 5 km. Australia must consider environmental research as well as commercial growing techniques when setting crop separation distances.
- improved grain handling sequencing in facility acceptance with specialty crops, to ensure contamination does not occur in facilities. It is clear that throughout the US grain elevators would only take on GM and non-GM crops on the same site if separate systems can be used. Multi grain systems were not seen during this trip and the advice given indicated that contractual requirements would be difficult to control if using the same plant and equipment to process both GM and non-GM crops; and
- development of better traceability methods in the event of recall of GM crops as it must extend back to the seed. This starts by knowing the level of purity and if it holds any GM traits. A growing contract must be in place with conditions of acceptance noted and testing levels. Records of crops must be held as well as noting separation distances from other crops, including neighbouring fields. Mixing seed is not recommended, as well as ensuring plant and equipment are thoroughly cleaned down before use.

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