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## Biotech Bulletin 11

# GM Animal Feed

Welcome to this edition of Agrifood Awareness Australia Limited's (AFAA) Biotech Bulletin. This edition of the Biotech Bulletin, entitled "GM Animal Feed" provides information on the regulation and labelling of animal feed, and the numerous animal feeding studies which have been conducted around the world.

### **INTRODUCTION**

Last week Melbourne hosted the International Dairy Federation (IDF) World Dairy Summit which brought together dairy representatives from around the world. Agrifood Awareness Australia Limited (AFAA) co-hosted Dr Richard Phipps from the University of Reading, a speaker at the Summit and international expert in the use of genetically modified (GM) feed ingredients in livestock production. Dr Phipps' visit presents a timely opportunity to examine the topic of GM animal feed and the research in this area which has been conducted around the world.

In Australia, the Office of the Gene Technology Regulator (OGTR) recently issued a licence for CSIRO field trials of genetically modified (GM) virus-resistant white clover - the first GM crop developed specifically targeting the dairy industry to undergo field trials. The clover has been developed with in-built resistance to Alfalfa Mosaic Virus (AMV), a virus that reduces the productivity and persistence of clover costing dairy farmers in excess of \$30 million per year according to CSIRO. These field trials present an interesting situation for the dairy industry which has been a strong supporter of state commercial GM crop bans.

Genetically modified products, particularly those fed to animals such as cattle, sheep and poultry have been targeted by anti-GM campaigners both in Australia and overseas. In Australia, the campaign has focused on the poultry industry. Similar campaigns have been undertaken in New Zealand, also targeting poultry, and in the United Kingdom focusing on the dairy industry. The campaigners claim that by eating animals fed GM crops consumers are part of a "giant genetic experiment" that presents "environmental concerns". They fail to acknowledge that over 140 animal feeding studies have been conducted around the world to assess the safety of GM animal feed, with the broad consensus being that approved GM animal feed presents no risk over conventional feeds and has no impact on the end product, be that eggs, meat or milk.

This Biotech Bulletin explores various aspects of GM animal feed including international regulation, labelling and research studies.

### **THE DNA DOSAGE – LIVESTOCK FEED IN PERSPECTIVE**

All whole foods and feedstuffs contain DNA, and animals and humans have consumed significant quantities of DNA from a wide variety of sources, including plants, animals, bacteria, parasites and viruses. Most foodstuffs contain a complex mixture of proteins, lipids, carbohydrates, nucleic acids, minerals and vitamins. It should be noted that many of the proteins that have been expressed in GM plants in order to confer these so called 'input' traits are already present in plant products or in other agricultural products.

Although it is difficult to provide realistic estimates of DNA intake for typical livestock diets, according to a paper published in *Feed Mix (Volume 10, Number 3)* in 2002, it has been estimated that the DNA content of most food crops is less than 0.02 per cent. To provide an example, the paper reports that in the case of a 600kg dairy cow, fed dry feed which included GM maize, the

fraction of the GM DNA in the diet represents 1:234,000 or 0.00042 per cent, of the total dietary DNA intake. To illustrate this, if you use a different analogy and compare the body weight of a mouse with a cow, the resulting ratio is only 1:24,000, reinforcing, that 1:234,000, is a very small amount. On this basis, the study concludes that, “there is a negligible exposure to introduced DNA of GM crop material compared to the normal exposure to non-GM DNA”.

Nutritional studies have demonstrated that most of the DNA is degraded in the digestive tract, usually prior to the small intestine. Once DNA is degraded, its functionality will be lost and often even its source cannot be identified.

For further information: [www.agbios.com/docroot/articles/02-232-001.pdf](http://www.agbios.com/docroot/articles/02-232-001.pdf)

### **ANIMAL FEED – SAFETY AND IMPACT**

Genetically modified animal feed has been fed to livestock since biotech crops were first commercialised in 1996. Livestock digest and absorb nutrients from biotech feeds in the same way as conventional feeds. The digestive process in all livestock breaks down the nutritional components in feeds and uses these nutrients for the growth and development of the animal.

According to a report entitled, “Safety issues associated with the DNA in animal feed derived from genetically modified crops: A review of scientific and regulatory procedures”, numerous studies have been conducted to evaluate the safety of GM animal feeds. These studies have examined the effect of feeding GM crops to animals on the animals themselves, and also the effects of these crops on the by-products – such as eggs, milk and meat. The studies have specifically addressed:

- Could the DNA of inserted or modified genes, or their products, if transferred to animals, cause adverse health effects in these animals?
- Could the DNA fragments or proteins be transferred to, and accumulate in, the products (milk, meat, eggs) of animals fed GM crops; and
- Will consumption of agricultural crop material or animal products derived from GM crops lead to adverse health effects in humans?

These concerns have been addressed by considering the normal digestive fate of DNA and proteins present in all foods, the digestibility of new proteins expressed in GM plants, and investigating the occurrence of transgenic DNA and proteins in food products of animal origin.

In addition to demonstrating a history of safe use and/or a relation with “naturally occurring” food proteins, GM plant products are normally subjected to compositional comparison with non-GM counterparts, feeding trials, and acute toxicity studies with laboratory animals. Numerous studies have taken place comparing the nutritional composition and wholesomeness between animal feeds containing GM and non-GM components resulting in no significant differences.

According to safety reviews conducted by three agencies – the UN Food and Agriculture Organisation, the US Food and Drug Administration and the US Environmental Protection Agency - the consumption of DNA from all sources, including GM crops, is safe. Over a period of 1998 to 2003, many animal feeding studies designed to detect any unintended effects in livestock fed approved, commercial GM crops, have been conducted in Europe and the USA. These compared the performances of livestock fed either GM crops or non-GM feeds, and included beef and dairy cattle, chicken meat and egg laying chickens, pigs, sheep and catfish. The studies included GM insect resistant corn and cottonseed, herbicide tolerant soybeans, corn and sugarbeet. The studies consistently demonstrated no significant differences to the livestock in the nutritional composition or animal performance due to the consumption of GM or non-GM animal feed. The studies conclude, “protein and DNA contained in food and feeds, whether obtained from non-GM or GM crops, are typically degraded upon consumption by the normal digestive processes. For those commercially available GM crops that are components of livestock feeds, there is no evidence of significantly altered nutritional composition, deleterious effects, or the occurrence of transgenic DNA or proteins in subsequent foods of animal origin. This data, together with the history of safe usage of the transgenic proteins in agriculture and/or their similarity to already occurring constituents, provide a substantial assurance of safety.”

For further information: [www.animalbiotechnology.org/bkpaper.pdf](http://www.animalbiotechnology.org/bkpaper.pdf)  
[www.agbios.com/cstudies.php?book=COMM&ev=GMFEEDS](http://www.agbios.com/cstudies.php?book=COMM&ev=GMFEEDS)

## **ANIMAL FEED STUDIES**

Animal feeding studies have been conducted around the world to assess the safety of GM animal feed. The two items below provide examples of studies undertaken. The first is a review of available scientific data on animal feed conducted in 2000 while the second item details a specific animal feed study.

### **Meat, Milk, Eggs, Livestock and Poultry**

The Federation of Animal Science Societies (FASS) is a federation comprising over 10,000 animal, dairy and poultry scientists in academia, government and industry which works to improve all aspects of food animal production. The FASS announced in November 2000 that its scientists had reviewed all the data available worldwide from research studies on the effect of feeding biotech crops to livestock and poultry which had been published in refereed, peer-reviewed journals. These research results conclusively indicate that there is no effect on the nutritional value or safety of meat, milk and eggs from animals fed biotech crops.

One of FASS scientists, Dr Jimmy Clark, a dairy cattle nutritionist, stated that “nutrients in meat, milk and eggs from livestock fed biotech feeds are the same as those from livestock fed conventional feeds”. Dr Clark also stated that “in over 20 different animal studies, livestock growth, milk production, milk composition, and health are equal, whether fed conventional or biotech feeds”.

Another scientist, an expert on farm animal physiology, noted that as “most components of feeds are broken into smaller components during digestion by the animal, plant proteins have not been detected in milk, meat or eggs”.

Further information: [www.fass.org](http://www.fass.org)

### **Cows and Milk – GM Corn**

A study from the Iowa State University focused on dairy cows which had been fed corn, genetically modified to protect the plant against pests such as European corn borer and several other corn pests.

The aim of the study was to investigate milk production and the health of the cows consuming the GM corn. The study examined 12 dairy cows from the University’s dairy herd. The cows were fed test diets for a total of 14 days, during which time milk and feed samples and cow performance and health data were collected. Feed samples were evaluated to confirm the presence of transgenic protein in the GM corn feed and the lack of transgenic proteins in diets of the non-GM corn group.

To ensure that the testing was feasible, purified GM proteins were intentionally added to duplicate milk samples and analysed along with the original samples to show that it was possible to detect the protein if it were present in the milk. The testing showed no introduced proteins in the milk samples collected from the cows that were fed the three diets, but it did detect it in the ‘spiked’ samples.

The results of the study showed milk production, feed intake, udder health, and milk composition (fat, protein, lactose and other solids) were similar for all 12 cows fed all three diets. Most importantly, the results from these studies showed that there were no differences in the amount or quality of milk produced from each of the cows and no introduced protein was detected in the milk.

For further information: [www.tomorrowbounty.org/library/iowastate.htm](http://www.tomorrowbounty.org/library/iowastate.htm)  
[www.extension.iastate.edu/Pages/grain/news/newsarchive/02biotechnews/021209bionews.html](http://www.extension.iastate.edu/Pages/grain/news/newsarchive/02biotechnews/021209bionews.html)

## **REGULATION**

No country in the world currently requires the labelling of eggs, meat and milk from animals fed GM feed. The following highlights different international animal feed regulations.

## **Australia**

Animal feed derived from GM products is regulated by the OGTR. The OGTR considers any biosafety risks associated with the proposed details of the GM product. If necessary, the Regulator will apply special conditions, or may prohibit the use of the GM product as animal feed. For example, after a GM product has undergone field trials (such as GM cotton), the organisation conducting the trials, may wish to use the unviable by-product (such as the cotton seed) as animal feed. Before the product is used in anyway, the Gene Technology Regulator will consider any risks and if necessary, will apply conditions or disallow the GM product to be used.

Genetically modified grain imported into Australia for animal feed, such as soybean and corn, must be approved by the Australian Quarantine and Inspection Service (AQIS) and the OGTR. The AQIS provides quarantine inspection and certification for the arrival of imports of GM products to ensure the product is free of pest and disease. In addition, specific licence conditions are enforced to ensure the product meets certain requirements, including preventing germination. The OGTR also assesses the product, issues a licence to the organisation importing the product, and may apply further conditions above those stipulated by AQIS.

Genetically modified animal feed is not required to be labelled in Australia.

For further information:

The Office of the Gene Technology Regulator: [www.ogtr.gov.au/moncomp/imports.htm](http://www.ogtr.gov.au/moncomp/imports.htm)

Food Standards Australia New Zealand: [www.foodstandards.gov.au](http://www.foodstandards.gov.au)

## **Canada**

Canada imports, mainly from the United States, large quantities of maize for its intensive livestock industries as animal feed. The Canadian Food Inspection Agency under the *Feeds Act and Regulations*, administers a national livestock feed program to verify that livestock feeds manufactured and sold in Canada or imported into Canada, are safe, effective and are labelled appropriately.

The safety assessment of animal feed looks at the composition, toxicological and nutritional characteristics of the novel feed compared with its conventional counterpart. Any ingredient added to livestock rations must first be approved and listed in the *Feeds Regulations*. Safety considerations include the animal eating the feed, consumption of the animal product by consumers and environmental aspects from use of the feed.

Genetically modified animal feed is not required to be labelled in Canada.

For further information: [www.inspection.gc.ca/english/anima/feebet/feebete.shtml](http://www.inspection.gc.ca/english/anima/feebet/feebete.shtml)

## **European Union**

A total of 12.8 million tonnes of GM soybean and soybean meal was imported into the European Union (EU) in 2003. Legislation on GMOs has been in place in Europe since the early 1990s, and over the years, this regulation framework has been extended and refined. The main legislation in place relating to GMOs in Europe is Directive 2001/18/EC. The legislation puts in place a step-by-step approval process for a case-by-case assessment of the risks to human health and the environment before any GMO, or product containing GMOs, can be released into the environment or the marketplace.

The European Commission formally adopted in July 2003 a new legislative package on GMOs. The package consisted of two proposals, one for the traceability and labelling of GMOs and products produced from GMOs and the other on regulating GM food and feed. This legislation came into place in April this year.

The new GM food and feed labelling legislation package “allows consumers to exercise their freedom of choice”. The extra provisions require the labelling of:

1. All foods produced from GMOs irrespective of whether there is DNA or protein of GM origin in the final product (eg highly refined oils produced from GM crops);
2. All GM animal feed.

According to the new laws, products which will not require labels in the future (and have not required labels in the past) are:

- Food from animals fed on GM feed – eggs, milk, meat
- Food produced with the help of a GM enzyme – bakery products produced with amylase, cheese produced with the help of chymosin.

The laws stipulate for the unintended presence of unauthorised GM material in food or feed, where the GMO in question has received a favourable EU scientific assessment, a threshold of 0.5 per cent will apply, limited to three years.

Under Directive 2001/18/EC, all GM products imported into the EU are subject to a rigorous pre-market risk assessment and are subject to the new strict labelling and traceability rules ([Regulation \[EC\] 1829/2003](#) on GM food and feed). The regulation ensures that GMOs likely to be used as food and feed can only be authorised for both uses, or not at all. Under the new Directive, businesses in the production and distribution chains that handle GM animal feed will have to provide information tracing such products through each step of the chain.

The first GM animal feed product to be approved for import into the EU under the new Directive was GM Maize in July 2004. The authorisation covers the import and the use of GM maize as animal feed, but not cultivation or food uses. Prior to approval, the GM maize was independently scientifically assessed by the European Food Safety Authority (EFSA) to be as safe as any conventional maize.

For further information: [www.efsa.eu.int](http://www.efsa.eu.int)

GM food/feed approved:

[http://europa.eu.int/comm/food/food/biotechnology/authorisation/index\\_en.htm](http://europa.eu.int/comm/food/food/biotechnology/authorisation/index_en.htm)

EU Regulation Questions and Answers:

<http://europa.eu.int/rapid/pressReleasesAction.do?reference=MEMO/04/102&format=HTML&aged=1&language=EN&guiLanguage=fr>

## **Japan**

Japan is one of the world's biggest grain importers, importing roughly 16 million tonnes of corn per year for animal feed. Japan first started importing GM crops in 1996. In 2003, 15 GM products had been approved for animal feed use since the first introduction of GM products in 1996.

The Ministry of Agriculture, Forestry and Fisheries is responsible for assessing the safety of GM feed. This assessment became mandatory from April 2003.

Genetically modified animal feed is not required to be labelled in Japan.

Further information: [www.maff.go.jp/eindex.html](http://www.maff.go.jp/eindex.html)

## **United States of America**

In the United States (US), three Government Agencies regulate GM crops: the Food and Drug Administration (FDA), the United States Department of Agriculture (USDA) and the Environmental Protection Authority (EPA).

The Food and Drug Administration (FDA) has the responsibility to ensure that any human food or livestock feed derived from new plant varieties, including GM crops, is safe to eat. The assessment is based on the concept of 'substantial equivalence'.

The United States Department of Agriculture (USDA) is the US government's lead agency regulating the safe field-testing of new biotech plant varieties. The impact on the environment, on endangered or threatened species and on "non-target" species are all considered.

The Environmental Protection Authority (EPA) has authority over all new pesticides, including GM plants. In deciding whether to register a new biotech product, the EPA considers human safety,

impact on the environment, effectiveness on the targeted pest and any effects on other endangered and threatened species.

In 2000, GM StarLink corn, which was only approved for use as a domestic animal feed and for non-food, industrial use in the US (and not for human consumption) was found in food products in the US. Despite no evidence of harm to human health, what followed was a multi-million dollar food recall, loss of export markets, and a corn buy back scheme across the nation. As a result, the US now has a policy of not approving biotech crops intended for animal feeding without simultaneously approving the crops for human food. Labelling of GM animal feed is not required in the US.

For further information see:

United States Department of Agriculture: [www.aphis.usda.gov/brs/index.html](http://www.aphis.usda.gov/brs/index.html)

Animal Plant Health Inspection Service (APHIS): [www.aphis.usda.gov](http://www.aphis.usda.gov)

StarLink™ Corn in the USA Fact Sheet: [www.afa.com.au](http://www.afa.com.au)

## CONCLUSION

While many of the commercially available GM crops have been modified to improve agronomic characteristics, there is considerable research taking place around the world to develop crops to improve animal production such as:

- crops with improved nutritional characteristics;
  - amino acid composition;
  - mineral availability;
  - energy; and
- crops for improved animal health.

With 67.7 million hectares of GM crops grown globally in 2003, it is inevitable that GM crops will continue to be used as livestock feed. In the future it is possible that animal industries will utilise GM crops specifically designed for their industry to enhance production levels.

To conclude with a statement from Dr Phipps, "There is considerable GM work going on in improving the quality of feeds – both in terms of forages and the supplements that you feed to both dairy and beef cattle... If farmers shy away from at least having the option of using GM technology they will become less competitive and in a global economy this will be a disaster for livestock production systems."

## FURTHER INFORMATION

References for over 140 livestock feeding studies can be found at [www.animalbiotechnology.org/references.asp](http://www.animalbiotechnology.org/references.asp)

Animal Biotechnology: [www.animalbiotechnology.org/abstc.pdf](http://www.animalbiotechnology.org/abstc.pdf)

Federation of Animal Science Societies: [www.fass.org](http://www.fass.org)

Ingham's GM policy - [www.ingham.com.au/ingham1/mission\\_vision\\_test.asp](http://www.ingham.com.au/ingham1/mission_vision_test.asp)

International Dairy Federation World Dairy Summit - [www.idfmelbourne2004.com](http://www.idfmelbourne2004.com)

Virus-Resistant Genetically Modified White Clover - [www.oqtr.gov.au/ir/dir047.htm](http://www.oqtr.gov.au/ir/dir047.htm)

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We look forward to your feedback on this newsletter.

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