



Gene technology and animal feed

Much discussion has taken place over the safety of genetically modified (GM) crops and foods. A focus point in this discussion is GM crops fed to animals, particularly those animals such as cattle, sheep and poultry that provide food for consumers.

Numerous scientific 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 animal products – such as meat, eggs and milk. Essentially, three main questions arise:

- Could genes from GM crops be transferred to animals feeding on the crops, and if so, could they cause adverse health effects in these animals?
- If an animal consumes GM feed, could genes be transferred from the feed to food products (such as milk, meat and eggs)?
- Finally, could genes from GM animal feed, lead to adverse health effects in humans consuming the meat or other food products?

Safety reviews conducted by three United States agencies - the Environmental Protection Agency, the Department of Agriculture, and the Food and Drug Administration - have identified no risk to mammals fed approved GM crops. More than 140 animal feeding studies designed to detect any unintended effects in livestock fed approved, commercial GM crops, have been conducted or are currently in progress. Many of these studies, conducted in Europe and the USA, compared the performances of livestock fed either GM crops or non-GM feeds, and have included dairy cows, beef cows, chickens, pigs, sheep and catfish. The GM crops studied included pest resistant corn, and herbicide tolerant soybeans, corn and sugar beet. The conclusions from these studies were consistent, showing no detrimental effects have been found in livestock fed GM crops.

How much?

In investigating the issue of GM animal feed, it is important to understand the amount of GM content in the feed, particularly when the feed is consumed and broken down.

According to a paper published in *Nutrition, Abstracts and Reviews* in 2000, most foodstuffs contain a complex mixture of proteins, lipids, carbohydrates, nucleic acids, minerals and vitamins. While the relative proportions may vary considerably, the quantity of genetic material or DNA in most food crops is 0.02 per cent. At such low levels, it is difficult to provide realistic estimates of the DNA intake for typical human diets. In addition, most of the DNA is degraded in the digestive tract, usually prior to the small intestine. Once DNA is broken down, its functionality is lost and often even its source cannot be identified.

The study reports that for a 600kg dairy cow, fed dry feed which included GM corn, the breakdown of GM DNA to non-GM DNA in the daily feed intake is 1:234,000 or 0.00042 per cent. To illustrate this, if you use a totally 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 tiny amount. The study concludes that, "exposure to DNA from GM crop material, will be negligible compared with normal exposure to non-GM crop DNA".

GM corn, cows and milk

In the United States, corn production accounts for more than 32 million hectares and the vast majority of this corn is used for livestock feed.

One study from the Iowa State University focused on dairy cows which had been fed GM (Bt) corn. The aim of the study was to investigate milk composition and the health of cows consuming Bt corn – a corn genetically modified to contain in-built protection against the European corn borer. The Bt corn produces a protein similar to that produced by certain strains of the common soil bacterium, *Bacillus thuringiensis*, which is harmless for most species but toxic to the European corn borer. The borer larvae that feed on the growing Bt corn plant eat small amounts of the protein and die.

The study examined 12 dairy cows from the University's dairy herd. For 14 days the cows were fed rations from one of three diets - that included chopped plants from one of three corn plants – a non-GM corn, and two varieties of GM corn. Each

day milk and feed samples and cow performance and health data were collected.

To ensure that the test was feasible, the scientists 'spiked' several milk samples to show that it was possible to detect the protein if it were present in the milk. The testing however, showed no Bt protein in the regular milk samples collected from the cows that were fed the diets, but it did detect it in the 55 'spiked' samples.

The results of the study showed milk production, feed intake, udder health and milk composition (fat, protein, lactose etc) were similar for all 12 cows. There were no differences in the amount or quality of the milk produced from the cows and no Bt protein was detected in the milk. Also, the three diet groups produced essentially the same amount of milk, per cow, per day.

Meat, milk, eggs, livestock and poultry

The Federation of Animal Science Societies (FASS), a federation comprising over 10 000 dairy, meat and poultry scientists have stated that meat, milk and eggs from livestock and poultry fed GM feed are safe to eat. The FASS scientists reviewed all the worldwide data available, and concluded that the studies confirmed that there is no effect from feeding approved, commercial GM crops to livestock and poultry on the nutritional value or safety of meat, milk and eggs.

One scientist, a dairy cattle nutritionist noted that in over 20 different animal studies, livestock growth, milk production, milk composition and health were equal, whether fed non-GM or GM feeds. Another scientist, an expert in farm 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.

Recent scientific overview

A recent scientific review of the literature available regarding the safety of milk, meat and eggs from animals fed GM crops conducted by the Council for Agricultural Science and Technology (CAST) concluded:

- Farm animals and humans have a long history of safety associated with the consumption of plant DNA; consequently, the consumption of DNA from all sources – including introduced DNA in GM crops – presents no health or safety concerns.
- No plant gene (or gene fragment) has ever been detected in the genome of animals or humans, despite a long history of daily consumption of plant DNA.

- There is no scientific evidence to suggest that meat, milk and eggs derived from animals fed GM crops is anything other than as safe as those from animals fed conventional crops.

Regulation

In Australia, animal feed derived from GM crops is regulated by the Office of the Gene Technology Regulator (OGTR). After a GM crop has undergone field trials, the organisation conducting the trials, may wish to use the unviable by-product as animal feed. Before allowing the GM product to be used in such a way, the Gene Technology Regulator will consider any biosafety risk associated with the proposed use. If necessary, the Regulator will apply special conditions or may prohibit the use of the GM crop as animal feed.

Animal feed containing GM content can also be imported into Australia from countries such as the USA during drought periods for example. This requires the normal approval process through the Australian Quarantine Inspection Service (AQIS), as well as approval for the GM component of the product by the OGTR. Licence conditions such as heat treatments and covering transport vehicles may be imposed by the OGTR.

Further information

Further information on this topic can be found at the following references:

- 'Study Finds No Bt in Milk', Faust M and Miller L, Iowa State University Integrated Crop Management Newsletter, IC-478, Fall 1997 Special Livestock Edition.
- 'Meat, Milk and Eggs are safe from Livestock and Poultry Fed Biotech Crops U.S. Scientists Say', Federation of Animal Science Societies, Media Release, November 2000.
- 'Safety issues associated with the DNA in animal feed derived from genetically modified crops. A review of scientific and regulatory procedures', Beever, D and Kemp, C. Nutrition Abstracts and Reviews, Series B: Livestock Feeds and Feeding 2000, Vol 70 No 3.
- 'Safety of meat, milk and eggs from animals fed crops derived from modern biotechnology', Issue Paper 34. Council for Agricultural Science and Technology, 2006. www.cast-science.org
- Regulatory information: www.ogtr.gov.au