

## Genetically modified foods

A variety of foods can be genetically modified using biotechnology – these are known as GM foods. The genetic material may be altered with methods that do not occur naturally - this is known as 'genetic engineering'. Selected individual genes with specific traits are transferred from one organism to another. Traditional breeding can achieve similar effects, but over a much longer time span. However, traditional breeding cannot achieve the same effects using a transferred gene from a non-related species - this is possible with GM foods.

### Genetic engineering and plants

Genetic modification of food is not new. For centuries, food crops and animals have been altered through selective breeding. However, while genes can be transferred during selective plant breeding, the scope for exchanging genetic material is much wider using genetic engineering. In theory, genetic engineering allows genetic material to be transferred between any organism, including between plants and animals. For example, the gene from a fish that lives in very cold seas has been inserted into a strawberry, allowing the fruit to be frost-tolerant. This has not as yet been done for currently available commercial food crops. Concerns with climate change may also lead to consideration of GM food crops that are drought tolerant.

### Foods that have been modified

Some foods have been modified to make them resistant to insects and viruses and more able to tolerate herbicides. Crops that have been modified for these purposes in a number of countries, with approval from the relevant authorities, include:

- Maize (corn)
- Wheat
- Rice
- Oilseed rape (canola)
- Chicory
- Squash
- Potato
- Soybean
- Alfalfa
- Cotton.

### GM products in food

Modified genes may be present in whole foods, such as wheat, soybeans, maize and tomatoes. These GM whole foods are not presently available in Australia. Genetically modified food ingredients **are**, however, present in some Australian foods. For example, soy flour in bread may have come from imported GM soybeans.

Modified genes may have been used in an early stage of the food chain, but may or may not be present in the end product. Gene products - for example, phytochemicals (plant chemicals that contain compounds which may prevent disease) - may, however, remain in the food chain. From a health perspective, this could be an advantage or a disadvantage.

### Organic foods are not genetically modified

Foods certified as organic or biodynamic should not contain any GM ingredients, according to industry guidelines.

## Nutritional enhancement

Genetic engineering can also be used to increase the amount of particular nutrients (like vitamins) in food crops. Research into this technique, sometimes called 'nutritional enhancement', is now at an advanced stage. For example, GM golden rice is an example of a white rice crop that has had the vitamin A gene from a daffodil plant inserted. This changes the colour and the vitamin level for countries where vitamin A deficiency is prevalent. Researchers are especially looking at major health problems like iron deficiency. The removal of the proteins that cause allergies from nuts (such as peanuts and Brazil nuts) is also being researched.

## Benefits of GM foods

There is a need to produce inexpensive, safe and nutritious foods to help feed the world's growing population. Genetic modification may provide:

- Sturdy plants able to withstand weather extremes
- Better quality food crops
- Higher nutritional yields in crops
- Inexpensive and nutritious food, like carrots with more antioxidants
- Foods with a greater shelf life, like tomatoes that taste better and last longer
- Food with medicinal (nutraceutical) benefits, such as edible vaccines – for example, bananas with bacterial or rotavirus antigens
- Crops resistant to disease and insects and produce that requires less chemical application, such as pesticide and herbicide resistant plants: for example, GM canola.

GM advocates argue that genetically modified foods are potentially better for the environment. By using genetically engineered crops that are resistant to attack by pests or disease (insect resistant or IR), farmers and primary producers do not have to apply large amounts of pesticides and chemicals to the surrounding environment. Developing crops that are tolerant to particular herbicides (herbicide tolerant or HT) and pesticides may reduce the amount of pesticides used in food production and the residual pesticide levels in the environment.

## The risks of genetically modified crops

Some concerns that have been raised by scientists, community groups and members of the public include:

- **New allergens could be inadvertently created** - known allergens could be transferred from traditional foods into GM foods. For instance, during laboratory testing, a gene from the Brazil nut was introduced into soybeans. It was found that people with allergies to Brazil nuts could also be allergic to soybeans that had been genetically modified in this way and so the project was ceased. No allergic effects have been found with currently approved GM foods.
- **Antibiotic resistance may develop** - bioengineers sometimes insert a selectable 'marker' gene to help them identify whether a new gene has been successfully introduced to the host DNA. One such marker gene is for resistance to particular antibiotics. If genes coded for such resistance enter the food chain and are taken up by human gut microflora, the effectiveness of antibiotics could be reduced and human infectious disease risk increased. Research has shown that the risk is very low; however, there is general agreement that use of these markers should be phased out.
- **Cross-breeding** - other risks include the potential for cross-breeding between GM crops and surrounding vegetation, including weeds. This could result in weeds that are resistant to herbicides and would thus require a greater use of herbicides, which could lead to soil and water contamination. The environmental safety aspects of GM crops vary considerably according to local conditions.
- **Herbicide tolerant (HR) crops** - the introduction of the glyphosate resistant soybean in 1996 was the start of crops that gave farmers an opportunity to reduce the cost of their herbicide use. However, the increasing acreage of HR crops (such as soybean and canola) has resulted in an increase in the types of weeds that are now glyphosate resistant (GR). These GR weeds may have a major environmental influence on crop production in years to come.
- **Pesticide resistant insects** - the genetic modification of some crops to permanently produce the natural biopesticide *Bacillus thuringiensis* (Bt) toxin could encourage the evolution of Bt-resistant insects, rendering the spray ineffective. Wherever pesticides are used, insect resistance can occur and good agricultural practice includes strategies to minimise this.

- **Biodiversity** - growing GM crops on a large scale may also have implications for biodiversity, the balance of wildlife and the environment. This is why environmental agencies closely monitor their use. Since bees are used to pollinate crops, there is also some suggestion that GM crops may affect organic farming.
- **Cross-contamination** - plants bioengineered to produce pharmaceuticals (such as medicines) may contaminate food crops. Provisions have been introduced in the USA requiring substantial buffer zones, use of separate equipment and a rule that land used for such crops lie fallow for the next year.
- **Pesticide use** - the use of pesticide resistant (Bt) crops would suggest a reduction in the application of pesticides; however, recent surveys in the USA suggest that Bt-corn that targets corn borer has not lowered pesticide use, since most pesticides are directed against other corn pests.
- **Health effects** - minimal research has been conducted into the potential acute or chronic health risks of using GM foods and of their performance in relation to a range of health effects. Research also needs to involve independent (not company-based) assessment of the long-term effects of GM crops in the field and on human health.

## Social and ethical concerns

Concerns about the social and ethical issues surrounding genetic modification include:

- The possible monopolisation of the world food market by large multinational companies that control the distribution of GM seeds.
- Using genes from animals in plant foods may pose ethical, philosophical or religious problems. For example, eating traces of genetic material from pork could be a problem for certain religious or cultural groups.
- Animal welfare could be adversely affected. For example, cows given more potent GM growth hormones could suffer from health problems related to growth or metabolism.
- New GM organisms could be patented so that 'life' itself could become commercial property through patenting.

## Regulation of GM foods

Current food regulations in Australia state that a GM food will only be approved for sale if it is safe and is as nutritious as its conventional counterparts. Food regulatory authorities require that GM foods receive individual pre-market safety assessments prior to use in foods for human consumption. The principle of 'substantial equivalence' is also used. This means that an existing food is compared with its genetically modified counterpart to find any differences between the existing food and the new product. The assessment investigates:

- Nutritional content
- Toxicity (using similar methods to those used for conventional foods)
- Tendency to provoke any allergic reaction
- Stability of the inserted gene
- Whether there is any nutritional deficit or change in the GM food
- Any other unintended effects of the gene insertion.

The safety of GM foods is still being debated, as it is impossible to predict all of the potential effects on human health and the environment. Some public health experts, however, advocate caution. They believe that we are at the 'scientific starting line' and that we don't know whether GM foods are safe or not.

## GM labelling and the law

Since December 2002, the law in Australia requires that food labels must show if food has been genetically modified or contains genetically modified ingredients, or whether GM additives or processing aids remain in the final food product. In Australia, GM foods are regulated by the Australia New Zealand Food Standards (FSANZ) Code under Standard 1.5.2 - Food produced using Gene Technology.

Special labels are not required for:

- 'Highly refined' foods where the altered DNA or protein is no longer in the food (for example, oil from modified corn)

- GM food additives or processing aids - unless the new DNA remains in the food to which it is added
- GM flavours where less than 0.1 per cent is present in the food
- Food, food ingredients or processing aids where GM ingredients are 'unintentionally' present in less than 1.0 per cent
- Food that is prepared at the point of sale (takeaway and restaurant food does not have to be labelled).

Labels may be required where:

- Genetic modification has altered the food so that its composition or nutritional value is 'outside the normal range' of similar non-GM goods; for example, if GM technology is used to add vitamins or omega-3 fatty acids
- Naturally occurring toxins are 'significantly different' to similar non-GM foods
- The food produced using GM technology contains a 'new factor', which can cause allergic reactions in some people
- Genetic modification raises 'significant ethical, cultural and religious concerns' regarding the origin of the genetic material used.

## GM food on the shelves

Many foods on supermarket shelves contain imported GM ingredients. A variety of GM foods have also been approved for production in Australia. These foods include corn, soybeans, potatoes and canola. Others are still undergoing field trials approved by the Office of the Gene Technology Regulator (OGTR), although the moratorium by State Governments (lifted in Victoria and NSW in early 2008) stopped some GM field trials. Imported food products are subject to the same regulations as domestically manufactured foods.

There are around 20 GM foods, additives, flavourings, growth hormone (bovine somatotropin) and enzymes (like rennet, used to make cheese) currently approved in Europe. In the USA, there are more than 40 approved GM foods. The main sources of GM foods in Australia include:

- **Imported soya from the United States** - this is one of the main sources of GM ingredients in food sold in Australia since 1996. The soya has been genetically modified to be resistant to a herbicide. It can be found in a wide range of foods, such as chocolates, potato chips, margarine, mayonnaise, biscuits and bread.
- **Cottonseed oil made from GM cotton** - this oil, made from cotton that is resistant to a pesticide, is used in Australia for frying (by the food industry) and in mayonnaise and salad dressings.
- **Imported GM corn** - this is mainly used as cattle feed at present and has not been approved for farming in Australia. However, GM corn may have entered the Australian market through imported foods like breakfast cereal, bread, corn chips and gravy mixes. If so, it is now required to be labelled.
- **Other GM foods available overseas** - these may be ingredients in foods imported to Australia including potatoes, canola oil, sugar beet, yeast, cauliflower and coffee.

## If you want GM-free food

Due to consumer demand, some food manufacturers in Australia have taken steps to provide GM-free food. These products may be labelled accordingly; for example, 'contains no genetically modified ingredients'. Although Food Standards Australia New Zealand (FSANZ) does not provide a consumer hotline on GM matters, people can make enquiries to the Office of the Gene Technology Regulator.

## Where to get help

- Food Standards Australia New Zealand Tel. (02) 6271 2222
- TechNyou Tel. 1800 631 276 (formerly the Gene and NanoTechnology Information Service)
- Office of the Gene Technology Regulator Tel. 1800 181 030

## Things to remember

- There are potential benefits, risks and ethical concerns regarding GM foods that are still being researched and debated.
- The health risks associated with consuming GM foods or ingredients have not been unequivocally established.
- There is no current evidence that suggests that GM foods are likely to be harmful to health.
- GM foods sold in Australia, or foods containing GM ingredients, are required by law to be labelled.

**This page has been produced in consultation with, and approved by:**

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