GMOs in the UK

An overview

Pat Thomas
Beyond GM

in collaboration with
Greencuisine Trust

For 20 years a very visible public and media campaign has helped keep genetically engineered crops from being planted in the EU. Because of this most people could be forgiven for believing that European countries are 'safe' from these crops.

European legislation on genetically engineered farming and food is historically some of the toughest in the world with admirably high levels of consumer and environmental protection. But the issue has never gone away.

In reality the debate has, for some time, been at a stand-off, with consumers and NGOs largely against genetically engineering in food and farming, and large corporations, politicians and regulators trying to push it more widely into the marketplace.

This stand-off has allowed the issue of genetically modified organisms (GMOs) to slip beneath the public radar, leaving many unaware of the fact that, far from being iron clad, regulation that once protected consumers has begun to erode.

Where are we now?

The extent of this erosion became clear in 2015 when the EU coalition that, for many years, had blocked planting of GMO crops in Europe was broken up. In January 2015 the European Parliament voted to allow Member States to make independent decisions about growing GM crops.

Up to that point only two crops have ever been grown commercially in the EU. A pest-resistant Bt maize (known as MON810) grown mainly in Spain and Portugal for use in animal feed and, between 2010-12, the Amflora potato, genetically modified to produce starch for use in paper-making and grown in small quantities in Sweden & Germany.

Biotech companies have replaced the term 'genetic engineering' with the softer sounding 'gene editing'.

This is still the case, though the frequency of open air field trials, particularly in the UK, is increasing – as are approvals for genetically modified crops for food and feed. Since 2015, 10 new GM crops have been authorised in the EU, bringing the number of GMOs which can be grown or imported into the UK for food and feed to 68.

Within the last few years, new types of genetically engineered crops – sometimes called 'new breeding techniques' or simply 'GMO 2.0' – have begun to appear. Biotech companies have replaced the term 'genetic engineering' with softer sounding names like 'gene editing' and 'bioengineering'. Policymakers no longer talk about GMOs but instead talk about 'sustainable intensification' and 'precision agriculture'.

Stories have also begun to appear about synthetic biology, or 'synbio' and its ability to engineer new microorganisms almost from scratch. These organisms are being be made to produce everything from oils and probiotics to 'nature identical' flavouring ingredients none of which are currently regulated as GMOs.

These new methods have appeared with a huge new publicity push which claims that biotech companies have listened to public concerns about genetic engineering and addressed them.

Plants engineered using gene-editing techniques such as CRISPR are promoted as more precise and, crucially – because they (mostly) do not use genes from unrelated species – a more 'natural' approach to genetic engineering; so natural in fact that manufacturers claim they are not GMOs at all.

Abandoning the Precautionary Principle

This claim was tested in the European Court of Justice (ECJ) throughout 2018 when a group of French NGOs sought a judgement on whether one method involved in the production of these new GMOs – directed mutagenesis – should be regulated under existing regulations.

The ECJ ruling was that organisms produced using this technique were GMOs and did fall under current regulations. By extension, since all new GMOs use this step at some point, these would also fall under the existing regulations.

The response of biotech companies was to call for existing regulations to be re-written. They now argue that the Precautionary Principle, which allows EU regulators to take action to protect consumers even in the face of scientific uncertainty, was too restrictive to development and trade.

The Precautionary Principle, they said, should be balanced by an 'Innovation Principle' to ensure that, when it comes to bringing new GMOs to the market, economic and market-based priorities can trump environmental or health concerns. At the end of 2018 the EU made the first attempts to bring the 'Innovation Principle' into law.

Post Brexit Concerns

The erosion of EU regulations has been seen as good news by the UK government. Indeed, one of the consequences of Brexit is that the UK will be free to grow GMO crops without being held back by the majority view of its European partners.

In 2016 when the UK voted to leave the European Union, DEFRA officials began making more frequent public statements about a more liberal approach to planting and consuming GMO crops and foods. There are already field trials in the UK for GM flax, potatoes and wheat and more are planned.

Official policy is that, post-Brexit, GMOs in agriculture will be an early candidate for deregulation in order to facilitate international trade deals. If the UK deregulates GMOs several things could happen fairly quickly:

- **The market for GMO ingredients will expand.** This would include processes and ingredients used in supplements and health foods as well as additives in regular food.

- **Imports of GMO foods will increase.** We will see more in our supermarkets – mostly from the US – as a way of normalising them and increasing public acceptance.

- **We'll be eating GMO foods without knowing** as labelling would no longer be required.

In the longer term, the deregulation of new GMO technologies could see the introduction of other, more controversial, uses of genetic engineering in food:

- **Genetically engineered livestock is coming.** The development of GMO animals using gene-editing techniques is now achievable, and North America has advanced this agenda with the approval of unlabelled genetically engineered salmon for human consumption.

- **Gene drives could be released.** Gene drives spread or 'drive' GMO traits through populations of insects and plants in the field. Once released they cannot be removed and the scientist who invented the gene-drive is now advising extreme caution over their use.

- **Genetically modified insects** could be used to 'gene-edit' plants in the field or to transfer new genetic information to plants. Some GM insects have already been released to try and combat problems like malaria. These field trials have not been successful and there is concern that these insects could cross-breed with naturally-occurring insects in the wild.

- **Gene silencing sprays can be used** in the field to alter plant function. Known as RNA interference (RNAi) sprays, these are absorbed into the plant and alter it by attaching to specific strands of RNA and switching them off. Effects on biodiversity have not been assessed and it's feared they could affect non-target organisms – such as worms or fungi in soil.

New names, but the same concerns

Almost as soon as the PR around methods like CRISPR began to appear, so too did scientific papers urging greater caution.

CRISPR may be a boon to scientists because it is cheap and quick to use, but studies show that 'editing' the genome with CRISPR can cause greater damage than previously understood, including changes in genes other than those that were originally 'targeted'.

Essentially, while the methods for genetic engineering may have changed, the complexity of the genome of plants and animals has not. A single gene can have multiple functions, thus a single change in the way a gene functions can have multiple impacts throughout the organism.

In early genetic engineering experiments with petunias, genes for the colour red not only changed the colour of the petals but also decreased fertility and altered the growth of the roots and leaves. Salmon genetically engineered with a growth hormone not only grew too big and too fast but also turned green. In more recent experiments, splicing a gene for human growth hormone into mice produced very large mice, while splicing the same gene into pigs produced skinny, cross-eyed, arthritic animals.

These kids of problems persist with so-called new GMOs and it can be difficult (though not impossible) to test for unexpected or 'off-target' effects.

Disturbing changes

Although a genetically engineered organism may look the same as its natural counterpart, 'off-target' effects mean it may also be producing toxic by-products, or have less of certain nutrients.

For instance, there is evidence that individuals who are allergic to Brazil nuts suffer the same allergic reaction when consuming GMO soybeans that contain Brazil nut genes. Most recently, a genetically engineered maize authorised in the EU was found to contain significantly higher levels of the polyamines cadaverine and putrescine, which can heighten allergic reactions and are involved in the formation of carcinogenic substances in the body.

Many people manage food allergies by avoiding the foods they are allergic to. If GMO foods are not labelled with the source of the foreign genes, identifying potential allergens will be impossible.

Genetic engineering can also alter the nutritional quality of certain foods. Genetically engineered soybeans, for example, were found to be 12-14% lower in phytoestrogens, a significant nutritional difference. Naturally-occurring phytoestrogens are associated with protection against heart disease, osteoporosis (bone loss) and breast cancer.

Foods genetically engineered for a longer shelf-life (e.g. apples and potatoes that don't show bruising) may also mislead consumers by having the appearance of freshness and ripeness, while being deficient in nutrients and/or flavour.

When Chinese researchers engineered rabbits to make them meatier, the animals developed enlarged tongues.

With genetically modified animals there can be unpredictable adverse effects on growth and reproduction – effects that can significantly impact welfare and wellbeing.

Recently, when Chinese researchers engineered rabbits to make them meatier, the animals developed enlarged tongues; similar experiments on pigs led some to develop an additional vertebrae. Sheep gene-edited to produce a particular colour of wool had more spontaneous abortions; calves in Brazil and New Zealand, genetically engineered to reduce heat stress, died prematurely.

A rational response

Because the issue of GMOs can be complex, many people switch off and trust that their regulators will continue to keep them safe from harm. The direction of travel for GMO regulation, however, suggests that switching off is a risky strategy.

Whether the UK leaves the EU or not, it's likely that the level of GMO crops and ingredients in the food chain will begin to increase. This change is being driven by unproven claims for economic benefit while ignoring proven disbenefits of environmental damage, higher costs for farmers, higher pesticide use and reduced consumer choice.

Testing and evaluation of these crops and ingredients is far from transparent, relies mostly on corporate information rather than independent research, and also does not adequately assess emerging direct or indirect health risks.

The only way to stop or slow this momentum is for the pubic to become more aware and show active support for methods of food production – local, smaller scale, organic, biodynamic and permaculture – that work with nature and culture to increase food security.

Public opposition has proved a formidable hurdle for pro-GMO governments in the past, and a considerable and visible constituency opposed to GMOs still has the power to give government regulators pause and force politicians to act according to the majority's wishes.

What does that mean?

The language of genetic engineering can seem impenetrable; here are some useful terms to know

Bioengineering Another term for genetic engineering.

Chromosome A threadlike structure found in the nucleus of living cells, it is made up of DNA strands which carry genetic information in the form of genes.

Cisgenesis Describes organisms that have been genetically engineered using genes from related species.

Clone A genetic replica of an organism created without sexual reproduction.

DNA (Deoxyribonucleic Acid) The main constituent of chromosomes; made up of a sequence of genes that carry biological information for all living things.

Gene A portion of a DNA strand that contains information about inheritable characteristics, e.g. eye and hair colour.

Gene Expression The activity of a gene/genes which influence the biochemistry and physiology of an organism.

Gene Editing Another name for genetic engineering, it comprises a suite of techniques such as CRISPR, TALENs and synthetic biology.

Genetic Engineering Deliberately manipulating an organism's DNA/genes. Involves transfer of genes from one organism to another or altering genetic material in other ways e.g. mutation.

GMO (Genetically Modified Organism) Any plant, animal, micro-organism or virus which has been genetically engineered or modified in a way that can't occur in nature.

Genome All the genetic material in all of an organism's chromosomes.

Microorganism A microscopic organism e.g. a bacteria, virus, viroid, prion, microfungi, microalgae or protozoa, as well as cell cultures of higher organisms.

Mutation Any heritable change in DNA structure or sequence. In genetic engineering, mutations are induced by radiation and chemicals.

RNA (Ribonucleic Acid) Present in all living cells, RNA acts as a messenger carrying instructions from DNA for controlling the synthesis of proteins that act as chemical messengers, switching body functions/characteristics on and off.

Synbio (Synthetic Biology) Re-engineering microorganisms to perform functions they wouldn't do naturally. Can also refer to man-made DNA strands written on computers, printed on 3D printers, and inserted into existing life forms.

Transgenic Describes organisms that have been genetically engineered to contain the genes from an unrelated species.