BRIEFING NOTES ON THE GENETIC MODIFICATION OF PLANTS

What is genetic modification (GM)?

- GM is the alteration of genetic material (DNA) in a way that would not occur outside the laboratory.
- GM includes a range of techniques that allow specific DNA to be moved with a high level of precision, usually between different organisms.

Why do people genetically modify plants?

- GM enables plant scientists to achieve things which cannot be done via conventional breeding such as introducing complex characteristics without introducing unwanted ones. It can be used to transfer genetic material between species that cannot be crossed using conventional breeding.
- Conventional breeding can also achieve results which GM can't: the approaches are complementary.
- Introducing desirable traits to crops offers potential benefits to farmers, such as more fruitful and durable crops, as well as consumers, such as enhanced nutritional value and lower prices.
- GM technology does not guarantee benefits, so each case must be addressed individually.

Where and how are GM plants grown and used?

- The first GM seeds were planted in the USA in 1996, and no adverse health impacts have been documented from the consumption of GM crops.
- In 2011, the total global area sown with GM crops was estimated as 160 million hectares in 29 countries – about three times the area of Spain and approximately 10% of the world's food crops.
- No GM crops are currently being grown commercially in the UK
- Only one GM crop is licensed for cultivation in the EU, a variety of maize which produces Bacillus thuringiensis (Bt), a chemical toxin which makes them resistant to particular pests.
  - Authorisation for a GM potato with enhanced starch content was annulled in December 2013.
- GM crops can also be imported and used to produce ingredients for human consumption and for animal feed. There are currently 47 varieties of GM plant which can be imported into the EU and UK.

Where does the scientific community stand on GM?

- The overwhelming majority of plant scientists recognise the use of GM as a legitimate research tool, and its contribution to current and future plant breeding.
- GM is widely used by agricultural scientists, including conventional breeders.
- There are some UK plant scientists who have reservations about corporate control of GM crops.
- In the broader scientific community there are a few who express concerns about the safety of GM. It is not possible to generalise about safety, either for human consumption or the environment: the technology is not inherently dangerous, and individual uses must be judged on a case-by-case basis.

Why do people oppose the use of GM?

- Some farmers, consumers and environmentalists oppose the use of GM for a complex range of reasons. The following concerns are expressed by those who oppose GM crops and are addressed overleaf:

Contamination
Environmental impacts
Control by big business
Human health impacts
Claims for alleviation of poverty and hunger
Tolerance to pest resistance

Concerns expressed about GM crops

Contamination

Three separate issues get referred to as 'contamination': (i) GM crops growing outside the field, (ii) genetic crosses with non-GM crops and (iii) the mixing of GM and non-GM seeds in the food chain. Like conventional crops, most GM crops die quickly outside the field as they can't compete with wild plants. Genetic crossing with non-GM crops or wild plants is possible, but this possibility varies between species and their processes of pollination. Some seed mixing can't be ruled out due to farming, transport and trading practice, though this does not pose a risk to human health (see below).

Environmental impacts

Individual uses of GM technology should be assessed case-by-case for environmental impact. For example, there have been cases where herbicide tolerant GM crops have resulted in negative environmental impacts due to overuse of pesticides and the resulting decline of insect life; on the other hand Bt resistant crops reduce the need for pesticides, leading to a greater diversity of insect life.

Big Business

Large corporations control the seed trade, whether GM or not, and it is common practice to insist farmers pay royalties to save or replant seeds. This issue is separate to the use of GM technology. There is an increasing amount of publicly funded GM research producing varieties that benefit consumers and farmers, and corporations contribute only a small fraction of the funding for all major UK plant research centres.

Terminator seeds: Monsanto owns the patent for producing infertile second generation seeds, referred to as 'terminator seeds', but this was never developed for commercialisation.

Indian farmer suicides: Suicides by Indian farmers growing Bt cotton are used to demonstrate the exploitative nature of seed corporations that push GM. While there are conflicting assessments of whether Bt cotton has had a positive or negative overall impact on Indian subsistence farmers, the first year Bt cotton was released, severe drought led to high suicide rates among farmers growing both Bt and standard cotton.

Alleviating poverty and hunger

The proponents of GM crops have been said to over-claim for the potential GM crops hold for alleviating poverty and hunger. GM technology is one tool in the box for addressing food security, and the vast majority of farmers growing GM crops are in the developing world (over 90%), where surveys have shown attitudes are predominantly positive (http://www.nature.com/nbt/journal/v28/n4/pdf/nbt0410-319.pdf).

Human health impacts

All studies to date have found no greater risk from consumption of existing varieties of GM crops than from conventional crops. Any GM or GM derived product intended for sale in the EU undergoes safety assessment by the European Food Safety Authority. GM technology has the potential to produce crops with positive health benefits, with existing examples including crops with enhanced nutritional content.

Tolerance

The evolution of tolerance to a pest control measure by the insects being targeted can be a problem in both GM and conventional, chemically-sprayed crops.

Links to further information:

A background summary of the regulation of GM from the Food Standards Agency.

http://www.food.gov.uk/safereating/gm/gmanimal

Summaries of the use of GM crops for food security in Europe and developing countries.

www.parliament.uk/briefing-papers/POST-PN-386.pdf
www.parliament.uk/briefing-papers/POST-PN-412.pdf

The European Association for Bioindustries is the voice of biotech industry at the EU level and has written several position papers on the use and regulation of GMO.

http://www.europabio.org/

The Panel on Genetically Modified Organisms at the European Food Safety Authority (EFSA) deals with genetically modified organisms and genetically modified food and feed.

http://www.efsa.europa.eu/en/panels/gmo.htm
http://www.efsa.europa.eu/en/topics/topic/gmo.htm

ISAAA is an international not-for-profit that shares the benefits of crop biotechnology, particularly to resource-poor farmers in developing countries.

http://www.isaaa.org/

GMO Compass is an EU based website that demystifies the current policies and practices regarding GMOs, as well as their safety and regulation.

http://www.gmo-compass.org/

The following is information on GMOs produced by public-sector scientists active in biotechnology research and by farmer organisations.

http://greenbiotech.eu/

These Briefing Notes have been written by the Science Media Centre in consultation with a number of scientists, science press officers and broadcast journalists. They are not intended as a comprehensive summary on a subject, but rather a snapshot of the basics, of points of controversy and a pointer towards sources of more detailed information. They are subject to change and will be updated as and when the science moves on.

For more information about our Briefing Notes, please contact the Science Media Centre on 020 7611 8300 or email smc@sciencemediacentre.org.

Science Media Centre is a registered charity (no. 1140827) and a company limited by guarantee (no. 7560997).
Registered in England and Wales. Registered address: 215 Euston Road, London, NW1 2BE.