

Beauty or the Beast

Today's food crops are very different from their wild ancestors. But it's not just because of the recent boom in use of genetic modification; humans have been selectively breeding crops since cultivation began, over 10,000 years ago.

Plants were chosen because they had, for example, bigger seeds. Then different characteristics were combined by cross breeding samples in attempts to create offspring with improved flavour, yield, and digestibility, while avoiding weak stems, production of toxins or susceptibility to disease and drought.

Nowadays, thanks to an improved understanding of genetics, and the development of techniques for manipulating DNA, new plant varieties can be created in the laboratory by inserting known genes into a plant genome. Crops can be modified more quickly, more precisely and less randomly.

Plant breeders use these genetic modification (GM) techniques to introduce a wide range of characteristics into different crops. Thousands of new GM varieties have been approved for field trials and, in some countries, several are being used in agricultural production.

But this GM technology has sparked highly charged debate with many moral and ethical concerns.

Ethics and morality

Most people form moral views on various subjects. The view may be constructed through careful consideration of the principles, or it may arise from a gut reaction. It may be from fear of the unknown or lack of knowledge and understanding of the implications.

Ethics looks at moral issues by analysing the arguments and trying to make the issues clearer. For people to make their own considered judgment about GM technology they need some understanding of the science, of the possible risks and of the potential benefits. It's a challenge faced by many technological advances.

Two main streams of thought

Some people reject GM technology as intrinsically wrong (perhaps based on religious convictions or strong feelings that it doesn't respect the environment) and others look at extrinsic concerns, that is, the way in which it is used.

Intrinsic concerns

Intrinsic concerns about crop biotechnology might apply to other methods of crop breeding, but many are specific to GM crops. Some of them relate to the nature of the gene transfer and how 'natural' people think this process is.

Here are three examples for consideration:

Genes that can resist rust have been transferred from wild varieties of wheat to commercial varieties. In this case classical breeding methods are complimented by gene technology to identify important genes in the species and transfer them to another variety of the same species.

Potatoes have been made resistant to blight by the transfer of genes from a tobacco plant, which is from the same plant fam-



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ily as the potato. In this case the genes have been taken from a closely related species, which has natural disease resistance. Potato blight can devastate potato crops if not controlled by chemical fungicides.

The gene for Bt, a bacterial toxin used as an insecticide by organic farmers, has been transferred from bacteria into maize to make maize that's resistant to the European cork borer, an insect pest that can cause huge crop losses if chemical insecticides are not used. In this case genes that give resistance to one organism are being transferred to a different, unrelated, organism.

Extrinsic concerns

Other ethical issues are raised concerning the purpose and consequences of genetic modification. People have concerns about safety and risk; the interests of the 'developed' versus the 'developing' world; multinational companies versus farmers; or the rights and wrongs of patenting life and exploiting genetic resources.

GM food may be used to feed the starving and improve peoples' health. But what if it's intended to make larger profits for multinational seed companies at the expense of the farmer?

Here are a few more examples to consider:

New crops with resistance to pests and diseases could reduce the need to use fungicides and pesticides.

Herbicide resistant maize and soya beans are grown in many parts of the world. Introducing genes for resistance to a specific herbicide (sold by the same agrochemical company as the seeds) means that the herbicide can be used to control weeds and improve yields.

Research is underway into transferring a gene for an extra protein into cassava that will improve its rather poor nutritional value; 500 million people depend on cassava as a staple food.

A variety of rice that can make a precursor to vitamin A is being developed. Millions of people in developing countries, particularly children, suffer from the consequences of vitamin A deficiency, which include susceptibility to serious illness and blindness.

Genes that improve resistance to cold have been transferred between varieties of soya bean in order to develop a cold tolerant commercial variety. Crops that are more tolerant of stresses such as poor soil and climate could be grown in less favourable conditions.

Considering the risks

To consider the risks of GM crops we need to understand the science and the way technology is regulated. With socio-economic issues we need to examine several different viewpoints. For this, you'll need to check out the numerous sources of information – interested bodies that produce booklets and web based materials for public information, for example. Some attempt to put across factual, non-technical information in an unbiased way, others have an axe to grind and use emotive language and influences attitudes.

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What you need to do:

GM technology in agriculture is a very wide field with a lot of resources available, depending on the time allocated it is probably best to concentrate on the issues surrounding one example of the use of this technology.

The challenge is to:

Look for information on crop biotechnology from several different sources (textbooks, research institutes, drug companies, pressure groups).

Separate the science from the myth. Identify the information necessary to understand the issues.

Compare the language and imagery used by different information providers.

Identify and examine the ethical issues raised by the chosen example.

In order to:

Either: Make a presentation (any medium) to communicate, in an entertaining but thought provoking way, the facts and balanced arguments about the chosen application of this technology to a specific group. The aim would be to enable members of the audience to form their own opinions.

Or: Communicate, using appropriate language, the arguments for and against the application of this technology from several different perspectives.

Resources that might help you:

Free publications (also available on the www):

GM agriculture in the UK?

Ethics, morality and crop biotechnology by Roger Straughen and Michael Reiss

Both are available from the Biotechnology and Biological Sciences Research Council (BBSRC), Tel: 01793 413302 or www.bbsrc.ac.uk (via the 'Science and Society' link)

GMOs and the environment

available from the Natural Environment Research Council (NERC), Tel: 01793 411750 or www.nerc.ac.uk (via the 'Schools' link)

For some background science:

The main sites of BBSRC and NERC (see above) have good materials.

www.jic.bbsrc.ac.uk/exhibitions/bio-future/index.htm

www.ifrn.bbsrc.ac.uk/public (the 'In the Community' link leads to 'Food Information Sheets')

www.ncbe.ac.uk

www.eibe.org (see *Transgenic Plants I*)

For the use of drama in controversial issues:

www.wellcome.ac.uk (follow the 'Schools' link to 'Science Centrestage')

www.ytouring.org.uk

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www.eibe.org (see *Transgenic Plants: Economy, Environment and Ethics* and *Biotechnology Education through Drama*)

A few particular viewpoints:

www.greenpeace.org

www.foe.co.uk

www.syngenta.com

www.monsanto.co.uk