



# GM crops and sustainability 2009

## The role of GM in sustainable food and farming

The UK needs to meet the ever increasing demand for food while mitigating the effects of agriculture on greenhouse gas emissions, and climate proofing crops.

To sustain an ever-growing population while reducing CO<sub>2</sub> emissions, we will need to use a variety of tools and technologies to reflect the new challenges before us. The use of GM alone cannot address these significant challenges but it can be a significant part of the solution.

### Cutting carbon emissions

- In the UK, agriculture accounts for 7% of all carbon emissions and the use of GM can help in reducing the environmental impact of farming in a number of ways. One of them is to decrease the need to plough the soil another is to reduce the need to spray, helping farmers adopt less intensive agricultural methods.
- According to a recent study (2008), the fuel savings associated with reduced ploughing and making fewer spray runs (relative to conventional crops) resulted in permanent savings in CO<sub>2</sub> emissions. In 2006, this amounted to about 1.2 million tonnes (arising from reduced fuel use of 442 million litres). Between 1996 and 2006, the cumulative permanent reduction in fuel use was estimated to be 5.8 million tonnes of carbon dioxide (arising from reduced fuel use of over 2 billion litres).<sup>1</sup>



### Reducing other harmful gases released into the atmosphere

- The 2006 Stern Review estimated that nitrogen fertiliser accounts for one-third of the greenhouse gases generated by agriculture. Reduced fertiliser use will mean less nitrogen pollution of ground and surface waters.
- The application of Nitrogen Use Efficiency in crops such as rice, soybean and oilseed rape is currently under development, reducing the amount of fertiliser used and the amount of nitrogen leaching into the air, soil and watercourses.

### Increasing and maintaining yields

- In many cases, GM technology increases yields compared with conventional crops and their management.
- A study by the European Commission's Joint Research Centre published in June 2008 showed that Spanish farmers adopting GM maize experienced higher average yields than conventional maize growers over the three year study period. In the province of Zaragoza, an area of high insect pressure, the yield increase was as much as nearly 12% even while reducing the average number of insecticide treatments.



### Case study: USA

#### Reducing fuel consumption

A 2008 report found that from 1996 to 2006, as the area of soyabeans grown in the USA increased by 4.58 million ha, the average fuel usage fell 10.1% (from 29.0 litres/ha to 26.1 litres/ha). A comparison of GM versus non GM production systems shows that in 2006, the average tillage fuel consumption on the GM planted area was 25.2 litres/ha compared to 32.6 litres/ha for the conventional (non-GM) crop.<sup>1</sup>

<sup>1</sup>GM crops: the first ten years - Global socio-economic and environmental impacts, Barfoot, P. and Brookes, G. (2008)

## Mitigating the effects of climate change

GM crops are being adapted to withstand varied and often adverse environments where agricultural production is being threatened by a changing climate.

Climate change poses a real challenge in terms of the future availability both of agricultural land and of fresh water. Agriculture uses huge amounts of available fresh water and this is likely to increase as temperatures rise. In a warmer climate, plants will react to stresses such as drought by spending large quantities of energy normally used for growth and seed production.

Water shortages around the world are already costing billions of pounds a year in crop shortfalls, and are likely to grow ever more costly. **This could have a significant impact on prices of basic commodities in Europe.**

However, in some cases, the use of GM can help overcome these problems. This will be absolutely essential for farmers in developing countries as well as in some developed countries (for example, in southern Europe) where yields would be affected substantially.

For example, a number of crop varieties have been developed which are **stress tolerant**, so enabling areas of semi-arid land to be used to cultivate food crops, with huge potential benefits. Tolerance to water shortage and salinity is complex but promising results have been obtained in trials currently underway. Plant scientists in California have developed a 'salt-proof' tomato which can withstand saline conditions fifty times greater than normal plants.

In addition, genetic modification is also already being used to develop crops **tolerant to drought conditions**. Maize, oilseed rape, wheat and rice are likely to be the first important crops benefiting from these emerging technologies.



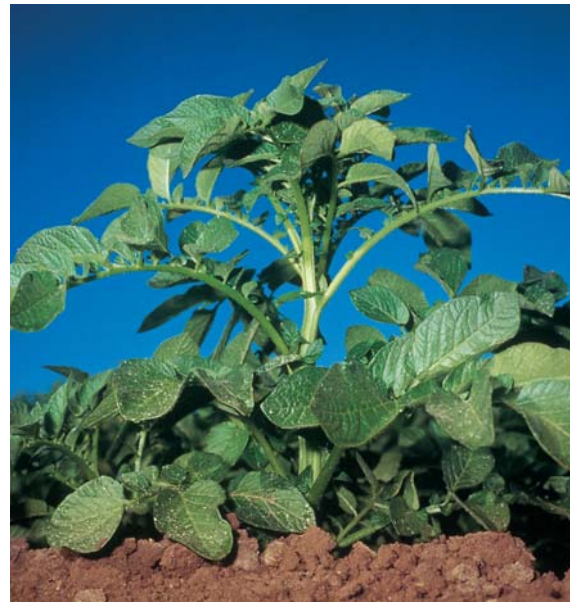
### Case study: Drought tolerant crops

#### Oilseed rape

- Oilseed rape has been engineered to reduce the levels of a key stress-related protein in plants. The resulting crop is far better able to survive drought.
- Field trial results for summer 2006 harvest showed **relative yield increases of up to 44%** compared with non-drought tolerant varieties.
- Successful field trials of drought tolerant crops such as oilseed rape suggest that, as the technology progresses, yields can be maintained in water depleted situations. This will be of relevance to farmers in East Anglia as well as to their counterparts in East Africa.

#### Maize

- Hybrid maize crops have been developed to tolerate drought and periodic water deficits.
- A type of GM drought tolerant maize has been submitted for regulatory approval in the USA.
- In addition, a major multi-partner, public-private consortium is developing drought tolerant maize hybrids suitable for cultivation by smallholder farmers in Africa, via the African Agricultural Technology Foundation (<http://www.aatf-africa.org/>).
- Maintaining yields during water stress will help preserve farmers' incomes and yield more grain as well as reducing the need for irrigation.



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