THE IMPORTANCE OF GM CROPS FOR UK AGRICULTURE?

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It is not often that opinion in a developed society splits profoundly. It happens on some issues of great significance but rarely more than once or twice in a decade or so. The debate over genetic engineering in agriculture is not one of these issues. Society is not split - there are pockets of bewilderment, some indifference and there is some pro-GE opinion - but by and large public feeling seems to be more or less anti.

Clearly this is not so for individual environmentalists and farmers - although possibly amongst the latter group there is a large number who have a fatalistic "que sera, sera" sort of attitude. It is very definitely not the case with government, with research bodies, with industry, with farming organisations, environmental and consumer groups and other NGOs. There are fundamental differences of opinion to be found here: much of it revolving around different perceptions of risk and the need for precaution.

The fact that there is so little clear scientific evidence in the public domain on these questions sharpens the differences. All sides can find something to support their case and this fuels the much-needed debate. This can be seen from the reports coming from the US - for example the reports from the NCFAP and the USDA which appear to flatly contradict each other. The results from the FSE trials here in the UK are more likely to inflame the dispute than deliver clarity.

The Farm Scale Evaluations

In 1998 the Government announced the farm scale evaluations (FSE), which was to be a four-year programme (the first year being a pilot) to investigate the impact of growing genetically modified herbicide tolerant (GMHT) crops on biodiversity.

The FSE was to be representative of UK farms (types and geography) and the crops included were fodder maize, winter and spring oil seed rape and fodder and sugar beet.

The FSE was undertaken by the Scottish Crops Research Institute, the Centre for Environment and Hydrology and the Institute of Arable Crops Research, overseen by a steering committee of stakeholders.

The results from the trials will be published in July 2003. There have been no interim results released, as it was believed that a full body of data should be collected and analysed before publication. Nevertheless some important observations can be made from the information that is already in the public domain.

It has always been accepted by the scientists, although not always understood by the politicians and media, that the information obtained from the trials will have relevance only to the GMHT crops that are within the trials and then only on their effect on biodiversity. If and when other GE crops (e.g. drought, pest and disease tolerance etc) are brought towards commercialisation, they too will need to be thoroughly tested to ensure that they are safe.

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Our knowledge of how to grow GE crops commercially is limited. The GMHT crops in the trial are being grown as directed by the producers of the GE varieties. However, there is evidence from the US and Canada that these initial directions are not commercially realistic and are not followed by farmers after commercialisation because they result in reductions in yields.

The UK government accepts that we do not understand enough about how to grow GMHT crops and is funding a separate project called BRIGHT (Botanical and Rotational Implications of Growing Modified Herbicide Tolerance) that is addressing this specific issue.

The FSE is essentially a herbicide trial. It is investigating the effects of two herbicide regimes in an intensive production system. What is being compared is a regime that is proven to be poor for biodiversity (conventional agriculture) and an approximation of a possible GE production regime. There has been no production system included that has an accepted benefit to biodiversity, such as organic farming. Even if there were to be benefits to biodiversity in the GE relative to the conventional regime, how would this compare with more environmentally benign production systems?

The inherent limitations of the FSE are illustrated by the way in which the crop yields are not measured but estimated by the farmer. Estimation of yield is notoriously difficult but yield would be an overriding factor in the decision as to whether a farmer would grow the crop in the first place. There is also the possibility that the FSE may indicate that the GMHT crop will produce an improvement in biodiversity but that yield is so reduced that it is not an agriculturally viable crop.

The first, pilot, year of the trials was used to develop methodologies to undertake the work on biodiversity. This was a mammoth task because we do not know what is important on a field and landscape basis.

There is a range of biodiversity indicators being measured, but the limited time period of the trials (each site is studied for one year only with a limited follow-up in the following season in some cases) means that only effects that become evident in one to two seasons can be detected. This is a critical assumption as environmental effects are likely to develop over a long period of time. This must also be borne in mind when the FSE findings are published.

The debate over whether GE crops are important to UK agriculture is even less informed than the debate over the risks to the environment. It is not just that information about the likely performance of GE crops in commercial situations is contradictory; it is virtually non-existent. There is a good deal of speculation based on extrapolation of the putative agronomic claims - for example maintaining high yields with lower input costs - but even if one accepts these claims they are never set in the context of the likelihood of a more rigorous regulatory system, nor considered against regional faming structures or - crucially the shape of UK agriculture as CAP reform unfolds.

The most cursory glance at the status of limited range GE crops that are currently being developed and have any sort of chance of being commercialised in the UK in the foreseeable future raises questions about whether any of these developments are going to make any significant difference to the viability of UK farming in a global market. Will GE maize for example do that much to make dairy farmers in the South West more competitive on the world market? Will apples engineered for better storage quality save UK orchards? Is the economics of growing oats going to be significantly changed by genetically engineered viral resistance?

Clearly some specific developments might prove to be beneficial to specific sectors - sugar beet growers might well argue that genetically engineered herbicide tolerance could make a difference to their costs. But that would only affect a proportion of the cropping of a relatively small number of farmers producing one crop for a monopoly buyer and just how significant would that be for "Agriculture UK"?

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It might be argued that all of these individual and limited developments might incrementally make up into a real difference. Possibly, but there is no evidence to support that view and the reality is that CAP reform, the equity of global trade and government policy on agricultural support and the place of farming in society are far more critical issues to UK agriculture than is the question of the commercialisation of GE crops. Indeed that question can only be addressed sensibly in the context of those issues.

Why Might GE Crops Be Important For UK Agriculture?
Nonetheless, claims are made that commercialisation of GE crops is important if not essential for UK agriculture. The arguments put forward include:

Increasing farmer profitability: it is argued; that GE crops will be able to maintain yields with lower input costs e.g. through the use of less pesticides and fertilisers; that new and better varieties will be produced which can increase yield, quality and storage enabling farmers to produce more closely to market requirements and thereby increasing returns.

Ensuring crop protection: one line of thought has it that as natural resistance to pesticides develops, genetically engineering crops to either increase resistance or to tolerate higher pesticide applications will be the only way farmers will be able to protect their crops.

Improve environmental protection: it is argued that genetic engineering will allow crops to be bred that are tolerant of less environmentally adverse agro-chemical inputs which can be then be used more often, more precisely or both and allow reduction in cultivations.

Looking further ahead it is argued that:

Novel crops for industry, pharmeucticals, healthcare and as source of alternative energy will give farmers new markets and will be a source of cheap raw materials for other sectors.

Newly engineered plants will have built in disease and pest resistance, draught resistance, salinity tolerance and best of all non-legumes will be able to supply their own nitrogen so changing the whole nature of farming.

New varieties and novel crops will be able to grow in, and clean up, polluted soil.
On a wider structural level it is argued that biotechnology will be a main driver of a new "knowledge based" national economy. From this perspective agricultural biotechnology will generate inward investment, create Small Medium Enterprises, new ventures and jobs.

Do Any Of These Arguements Hold Up?

The problem with these arguments is that some of them contradict others; some are so out of step with where the technology currently is that they are speculative at best and so far in the future that they should be discounted as wishful thinking; and in general the potential benefit that is claimed has only a narrow agronomic perspective and wider environmental, regulatory and economic factors have not been fully considered.

To Be More Specific:

There is a real doubt as to whether genetically engineered crops will reduce the overall use of agro-chemicals. Indeed some reports from the US and Australia indicate that there has been an increased use in some crops in some regions. There might be a change in the nature of herbicide use from selective to broad spectrum but it is contentious whether this is beneficial or more damaging to biodiversity. The

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first wave of GE crops has mainly focussed on developing tolerance to agro-chemicals - a strategy that accords with the interests of the leading GE companies who are also at the forefront of the pesticides market. Future genetic engineering might produce crops with enhanced pest and disease resistance but if this is achieved by inserting pesticides into the crop (as in the case of BT) under field conditions it could pose environmental and biodiversity threats that will have to be dealt with at some cost; for example it might have the effect of inducing greater pesticide resistance in the pest population.

There is a question as to whether the claimed financial benefits to farmers from higher yields, better marketability or lower costs will actually materialise. The US experience casts considerable doubt. The recent USDA report "The Adoption of Bioengineered Crops" states "Perhaps the biggest issue raised by these results is how to explain the rapid adoption of GE crops when farm financial impacts appear to be mixed or even negative". Other studies from Iowa State University and the University of Nebraska come to similar conclusions. As discussed above, a consideration of the GE crops that are likely to be applicable to commercial agriculture in the UK leads to the conclusion that any financial benefits to farmers will probably be sectoral at best, possibly marginal and certainly not the economic safe haven that many visualise.

The “dream ticket” claims - such as growing exotic crops in colder climates, cereals fixing their own nitrogen, winning the pest and disease battle once and for all - should be discounted from any commercial considerations for the foreseeable future. Genetic engineering technology is not at the point where it can successfully deal with the complex interactions that underpin such characteristics.

Crops engineered for pharmaceutical purposes are closer to commercial development. For example, Maize containing properties to combat cystic fibrosis is already being field trialed in the US. However, regulations - in Europe at least - governing the production and distribution of such products cannot sensibly be less rigorous than those governing the production and sale of drugs from a bottle and if produced in an open field environment should be considerably greater. The point is, even if crop "pharming" is technically possible only a limited number of farmers in limited situations are going to be able to do it commercially. Again making its commercial importance sectoral and limited.

Undoubtedly some individual farm businesses could benefit from commercialisation of some GE crops but the evidence is not strong that UK agriculture as a whole will gain. Nor is there any real evidence that the wider agricultural economy will benefit. Activity in crop biotechnology is dominated in the UK - and the rest of the world - by 6 foreign owned companies who also dominate the agro-chemical and seed industries (Bayer, BASF, Dow, Dupont, Monsanto and Syngenta). There is no significant SME activity in agriculture or crop biotechnology in the UK, probably less than 40 companies. BBSRC spends over £17 million per year on R&D in this area yet is not aware of any spin off or venture capital companies that have been formed to capitalise on its research. It might be argued that if commercial GE cropping were allowed this situation would change but intuitively one feels that, given the economic fundamentals of agriculture in the developed world, most venture capital attracted to biotechnology would find a more lucrative home with a faster return elsewhere.

Might GE Crops Damage Or Hinder UK Agriculture?

Leaving aside any consideration of the possible damage that might occur to individual farm businesses that take up GE cropping and then find that the benefits do not materialise, it is clear that there would be adverse effects on UK agriculture (as well as any potential benefit) from allowing its commercialisation.

Because of the inevitable spread of GE material some sectors would be profoundly affected. Beekeeping and honey production would be dramatically affected right from production, to labelling to marketing. Even with rigorous zoning it might well prove impossible to produce UK honey without

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levels of GE material in the product. There might also be a reduction in pollinating insects that will knock on to other sections of agriculture and horticulture.

Organic farming could similarly be affected. Strict production zones and cropping agreements might enable some degree of co-existence but this would inevitably limit the potential increase of UK organic farming. The heightened risk of GE contamination of organic produce will pose a threat to consumer confidence and this may boost imports from countries that do not allow GE crop commercialisation. There would also be added costs to producers and processors in monitoring and inspecting both the production system and the final product, which will inevitably result in lower profitability or higher prices to the consumer or both.

Conventional farmers wishing to avoid GE crops would face similar problems. Local marketing which is often based on the desire for food that is produced traditionally from non-intensive production would be threatened and the costs would rise in a similar way to those in the organic sector as producers sought to allay the concerns of consumers that what they were buying was uncontaminated by GE material.

However the major burden that will be placed on UK agriculture by the commercialisation of UK cropping arises from the uncertainty that surrounds the risks posed by geneflow and contamination from GE material to the environment, the farming system including livestock, food and health. Even those people convinced of the benefits of this technology and believe that the risks will prove to be minimal would sensibly accept that in the absence of firm and unequivocal evidence, more comprehensive regulation and monitoring procedures will need to be introduced before this most invasive of technology is allowed into the UK environment.
The areas in which more information is needed are many and varied and the R&D, the monitoring, the regulatory structures - even at a modest level - will require considerable resources, which will certainly impose a necessary burden on the industry.
Failure to do this will incur the biggest cost and the greatest damage of which will be the loss of consumer confidence. It could be argued convincingly that any sort of commercialisation of GE crops will have that result but to allow it to go ahead without rigorous monitoring and regulation will make it a certainty.

Is There A Scenario In Which Not Growing GE Crops Might Benefit UK Agriculture?

We argue elsewhere (see page 8) that genetic engineering is not the only route that UK agriculture can take. Other options can work, can be profitable and can utilise the skills and expertise that is to be found at all levels - research institutes, universities and colleges, advisory bodies and most of all on the farms. These options are not Luddite and they can use exciting new scientific advances to help understand biology and ecology. Nor does taking a decision not to commercialise mean that research in this area has to stop.

The scenario of a GE free UK agriculture offers great potential. Such a policy would help to restore trust between farmers and consumers or citizens, it could open up new markets at home and abroad and most of all help to engage people in the effort to give food and agriculture a central position in our society with all the benefits to the health of the environment, farming and man that that could bring.

Conclusion

There is a significant lack of evidence that GE crops will be widely important to UK agriculture in the realisable future. There are hopes and dreams that they might be but even the claimed potential benefits are to a large degree unclear and uncertain. Neither is there any robust evidence to justify claims that commercialisation of GE crops will give either the agricultural or the wider economy boost. However,

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there is reason to be concerned that it will damage some sectors such as organic farming and further undermine consumer confidence in UK farming and food.

There is solid evidence and it is widely accepted that the spread of GE material into the environment through pollen and gene flow is inevitable if commercial plantings go ahead. The scientific evidence of the degree of risk this poses to the environment is limited by the few studies that have been done and contentious as the assessment of this risk inevitably depends on the perception of the assessor. If commercialisation goes ahead a major effort will need to be made in further regulation, monitoring and R&D to check and assess these risks and to act if they prove to be problematic.

Our conclusion is the GE crops are relatively unimportant for UK agriculture; the benefits are open to question at best and can probably be achieved in other ways; the risk to environment is disproportionate to the potential benefits. Not proceeding with commercialisation at this time will not damage UK agriculture and would allow the chance for further risk assessment and evidence to be gathered.

It will also enable a GE free UK agriculture to develop which could well be better in terms of markets, a boost for genuine sustainability, and help to re-establish trust between farmers, consumers and citizens.

Source Material For This *Bulletin* and Further Reading:

Cabinet Office Strategy Unit; Consultation Document (Jan 2003); The Costs and Benefits of Genetically Modified Crops. http://www.strategy.gov.uk/2002/gm/downloads/industry.pdf

Looking ahead. An AEBC Horizon Scan (April 2002), SA publication - Seeds of Doubt. http://www.aebc.gov.uk/aebc/ horizon_scanning_report.html

The JIC/EFRC report is final report for DEFRA funded project OF0193: A review of knowledge of the potential impacts of GMOs on organic agriculture. www.efrc.com under Research: Current Projects.

EFRC/FIBL dossier on Organic Farming and Genetic Engineering.

US National Centre for Food and Agricultural Policy report (Plant Biotechnology: Current and Potential Impact For Improving Pest Management In US Agriculture) http://www.ncfap.org/ 40CaseStudies.htm .

The USDA report)The Adoption of Bioengineered Crops) http://www.ers.usda.gov/publications/aer810/

Natural Law Party; Wessex Region website
www.btinternet.com/~nlpwessex/Documents

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