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Missing the big picture

Our understanding of the likely ecological impact of genetically modified crops is incomplete. But these holes in our knowledge are symptomatic of a wider failure adequately to address the science of sustainable agriculture.

GM, or not GM? That is the question … or, at least, that is an important question with which the British government must wrestle over the next few months, and the answer to which will have international repercussions.

More than three years ago, with agribiotech companies pushing to market crops engineered to resist the effects of broad-spectrum herbicides, and UK public opposition to genetically modified (GM) crops reaching feverish levels, Prime Minister Tony Blair's administration delayed a difficult decision. There would, the government said, be no commercial planting of GM crops until the effects on farmland biodiversity of the herbicide applications associated with the crops' cultivation had been evaluated through extensive ecological trials. By the time these were completed, the politicians must have hoped, public opposition would have ebbed away.

Some hope. The results of these farm-scale trials are now being written up, and although the frenzy of 1999 has subsided, the British public shows little sign of warming to GM agriculture. Like it or not, Britain's decision on whether to allow commercial planting of GM herbicide-tolerant crops will be seen as a verdict on the wider future of UK transgenic agriculture. Even if, as seems likely, the farm-scale trials give herbicide-tolerant crops a relatively clean bill of health with regard to biodiversity, they can say little about the benefits and risks of GM agriculture as a whole, as the government's own Agriculture and Environment Biotechnology Commission reported in September 2001.

So, belatedly, Blair's government has launched a wider exercise to consider the merits of transgenic farming. A public debate, including a series of meetings and perhaps a specially commissioned film, is planned. Two expert panels have also been set up, one to assess the economic arguments, the other to review the scientific evidence.

The latter panel, which is to report in the early summer, must review the literature and perhaps unpublished studies, and address questions posed by the public over the Internet. Its report will be an influential document, and not just in Britain. GM agriculture has been accepted in North America, but many countries have yet to embrace the technology. And the developing world, already a battleground for pro- and anti-GM lobbyists (see page 681), is bound to look for guidance to expert panels in leading scientific nations.

Trial run

Anyone surveying the literature with an unbiased eye should conclude that, after years of investigation, there is no convincing evidence that GM crops pose risks to human health, or that they will lead to an ecological meltdown. The farm-scale trials may also provide reassurance that herbicide-tolerant GM crops can be grown without adverse effects on farmland biodiversity. And a study published last month, backed by the agribiotech giant Monsanto, claimed that such crops can even boost invertebrate populations, if combined with specific regimes of herbicide application (A. M. Dewar *et al. Proc. R. Soc. Lond. B* **270,** 335; 2003).

Yet Britain's GM science panel should also acknowledge that the research is lacking in several respects. Take the issue of gene flow from GM crops to wild relatives. Many studies, trumpeted by anti-GM activists at every opportunity, have shown that transgenes can spread beyond the crops from which they were introduced. But despite industry's past tendencies to play down the possible extent of gene flow, we have long known that crops will hybridize with related weeds. The real issue is whether the flow of transgenes has any undesirable ecological or agronomic consequences.

Answering this question will involve creating hybrids between transgenic crops and wild relatives, and monitoring their effects on farmland ecology and crop yields when released in field experiments. Such trials are now under way in North America; one preliminary example, which delivered a reassuring message, was the highlight of a conference on transgene flow in Amsterdam last month (see *Nature* **421,** 462; 2003). But European regulators have not bitten this bullet. A decade ago, they ignored proposals by some far-sighted ecologists to study the consequences of transgene flow. Now they are running scared of public opinion, which has been primed by anti-GM activists to see such trials themselves as inherently risky.

The necessary experiments can be done using male-sterile plants, which shouldn't breed and pose any lasting hazard. But in Europe, GM crops have been demonized so effectively that it is almost impossible to carry out the research to determine whether fears about invasive 'superweeds' have any foundation. Breaching this impasse won't be easy. Some proponents of transgenic agriculture claim that the risks are small, and argue that we should push ahead with commercial plantings. This just isn't good enough. Dismissing legitimate public concerns will only harden opposition to transgenic farming.

Broader view

Ultimately, the answer has to involve placing the arguments about GM crops in a wider context. Meeting the nutritional needs of the world's growing population while protecting the planet's biodiversity is a huge challenge. To meet it, we can ill afford to cast aside entire technologies without testing whether they can be effectively and safely deployed. This applies to transgenics, but also to enhancements to conventional breeding allowed by our growing genomic and molecular-genetic knowledge (see *Nature* **421,** 568–570; 2003).

Shamefully, when it comes to creating new varieties that might help to feed the developing world's growing population, rich countries are now cutting spending on both approaches to crop improvement. And amid all the fuss about GM crops, there's been little acknowledgement that similar questions about biodiversity and gene flow must be asked about conventionally bred varieties. Take a variety of rice that can tolerate saline conditions. Such a crop, created by transgenic or conventional means, would allow the cultivation of soils that are now seen as agricultural wastelands. But might it also spawn superweeds that would choke estuarine habitats? Such questions need answers. At present, however, there seems to be little desire to find them.

Britain's farm-scale trials of herbicide-tolerant GM crops represent an unprecedented effort to study the ecological impact of a change in agricultural practice. They could serve as a blueprint for experiments to study a whole range of farming practices, putting sustainable agriculture on a sound scientific footing. But scientists, regulators and politicians must seize the initiative and widen the debate about the future of farming beyond an obsession with transgenics. ■