POLICY PLANNING AND IMPLEMENTATION

9. Agricultural Biotechnology

DFID Department for International Development

The purpose of these *Key Sheets* is to provide decision-makers with an easy and up-to-date point of reference on issues relating to the provision of support for sustainable livelihoods.

The sheets are designed for those who are managing change and who are concerned to make well-informed implementation decisions. They aim to distil theoretical debate and field experience so that it becomes easily accessible and useful across a range of situations. Their purpose is to assist in the process of decision-making rather than to provide definitive answers.

The sheets address three broad sets of issues:

- Service Delivery
- Resource Management
- Policy Planning and Implementation

A list of contact details for organisations is provided for each sub-series.

Overview of the debate

The term 'biotechnology' covers a wide range of techniques and processes. Some are uncontroversial and are used widely in both North and South. Molecular biology enhances conventional plant breeding by increasing our understanding of the genetic basis of crop performance, developing molecular markers, and allowing more rapid detection of plant pathogens. Cell biology and tissue culture speed the multiplication of disease-free planting material. Genetic modification – introducing specific genes to a crop plant from virtually any species, producing 'transgenic' or 'genetically modified' varieties – is more controversial. This is the main focus of this key sheet.

Four main issues relate to the potential role of agricultural biotechnology in the South:

- relevance to poverty reduction;
- environmental and food safety;
- control of the technology; and
- the role of the public sector.

Key issues in decision making

Relevance to poverty reduction There is a sharp contrast between the current uses of biotechnology in the industrialised agriculture of the North and the potential applications for resource-poor farmers and consumers in the South.

Transgenic crops are currently grown in only a few countries, mainly in the USA and Canada. The principal growers in the South are Argentina, China and South Africa. Current transgenic crops are designed to address a narrow set of problems (mainly herbicide tolerance and insect resistance), largely reflecting the priorities of commercial agriculture in the North. A growing amount of research involves virus resistance and consumer qualities such as improved shelf life. There are also prospects for genetically modifying crops to produce pharmaceuticals or plastics.

There is no strict division between the types of transgenic crops appropriate for the North and the South: small farmers in a few countries already use commercial transgenic varieties (e.g., insect-resistant cotton in China, Mexico and South Africa). However, if biotechnology is to benefit resource-poor farmers, a significant shift in focus, to tropical crops and smallholders' problems, is needed. There is great potential for developing resistance to major pests and diseases in the tropics. New varieties are being developed with improved nutritional quality (e.g. vitamin A rice), and there is hope that research can address production problems such as salinity, drought and low soil fertility.

Environmental and food safety The major concerns include:

- transgenic crops might cross with wild species;
- herbicide tolerance might spread to other varieties or species;
- transgenic virus resistance might lead to unforeseen diseases or new plant viruses;
- transgenic pest resistance might induce resistance in pest species or damage non-target species;
- transgenic crops might be allergenic or have other food-safety risks.

Although there is little hard evidence to date on these risks, most observers agree that the new technology requires careful regulation. This consensus is reflected in the Cartagena Protocol on Biosafety to the Convention on Biological Diversity. Transgenic crops must be subject to carefully controlled tests, and released only if a review of environmental and human health factors concludes that it is safe to do so. Establishing regulatory regimes raises a number of issues:

- Countries wanting to benefit from the potential advantages of biotechnology will need to formulate guidelines and laws to govern the development, import, testing, and commercial release of transgenic crops.
- The release of a transgenic variety may involve seed regulation, environmental and health agencies. All must be competently managed; in some cases co-ordination among agencies may be sufficient, while in other cases a new regulatory authority might be established.
- Regulations must be enforced through appropriate structures and sanctions, and with adequate funding.
- Skills and training in biosafety and risk assessment must be developed.
- More research is needed on the possible effects of transgenic crops on the production systems of farmers in developing countries.

Labelling requirements in the North will affect export possibilities for transgenic crops from the South. Labelling means segregating products throughout the production and marketing chain; the costs of segregation are proportionately higher in the South. Any labelling system must be consistent, transparent and enforceable, and should not be imposed from outside. Consumer education is needed so that people can make informed choices.

Ministerie van Buitenlandse Zaken
Ontwikkelingssamenwerking

Control of the technology Biotechnology research is expensive. Most is done by private firms, which need to protect their investment from uncontrolled use. Most of the genes, techniques and processes (whether publicly or privately developed) are patented. Developing country members of WTO are required by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) to protect patents for modern biotechnological inventions such as the processes to produce transgenic crops. At the same time, WTO members are required to provide protection systems for plant varieties but have the choice of whether to do this through patents or by granting plant variety rights. The precise details of IPR protection regimes need to be tailored to the particular circumstances of individual countries. It remains to be seen if national patent systems and plant variety protection will be adequate to encourage private investment in developing countries.

Protecting intellectual property rights (IPR) raises the prospects of control by a few large companies, and may discourage collaboration among public institutions. Several factors need to be considered:

- Patenting does not necessarily imply restricted access, as a patented gene or process may be licensed by others. But developing countries need their own commercial seed industries in order to take best advantage of the new technology.
- Patent systems need to be implemented so as to ensure a balance between commercial incentives and access. Emerging problems include the need to deal with multiple patent holders, and the tendency to grant unusually broad patents that preclude further innovation by others.
- Overzealous protection of varieties and genes by public research agencies (in the hopes of gaining revenues) would likely diminish the widespread exchange of public germplasm.

The role of the public sector Many of the problems of resource-poor farmers are unlikely to attract private investment. Public research must fill the gap.

- Public research can have an impact on resource-poor farmers where researchers are able to interact effectively with client farmers and other stakeholders, learn about their conditions and priorities, and enable farmers to influence the research process.
- Balanced investments are necessary. Attractive new technologies should not draw investment away from conventional research. Overall funding for agricultural research may have to rise.
- Biotechnology research requires resources that not all developing countries can afford. Larger countries with adequate resources can consider substantial investments; others can use molecular biology to enhance plant breeding, form regional alliances, and use imported technology.
- Public research programmes must acquire capacity in IPR to interact effectively with the private sector, obtain access to technology, and deliver their products through commercial enterprises. Public biotechnology programmes face difficult decisions about the protection and utilisation of their products. Some products may be a source of income, some may be traded for access to other proprietary goods, and others should remain in the public domain.
- Donors need a co-ordinated approach to funding biotechnology research that is guided by farmers' needs, recognises differences in national resources, encourages collaboration, builds regulatory and scientific capacities, and elicits more private-sector contributions.
- The private sector must be encouraged to help develop public biotechnology capacity in the South and to increase access to its products and techniques for pro-poor public research.

Key literature

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Byerlee, D. and K. Fischer (2001) 'Accessing Modern Science: Policy and Institutional Options for Agricultural Biotechnology in Developing Countries', *IP Strategy Today* No. 1-2001 (www.bioDevelopments.org).

Cohen, J. (ed.) (1999) *Managing Agricultural Biotechnology*. Wallingford, UK: CABI.

Nuffield Council on Bioethics (1999) *Genetically Modified Crops: The Ethical and Social Issues*. London: Nuffield Council on Bioethics.

Persley, G. J. and M. M. Lantin (eds.) (2000) *Agricultural Biotechnology and the Poor: Proceedings of an International Conference, Washington, DC, 21-22 October 1999*. Washington, DC: CGIAR.

Experience

- Various projects and studies under DFID's plant sciences, crop protection, fish genetics and animal health research programmes
- DGIS-supported biotechnology programmes for small-scale farmers in Colombia, India (Andhra Pradesh), Kenya and Zimbabwe
- Predicting costs and benefits to livelihoods of the poor in developing countries from 'Terminator' gene technologies (GS Consulting)
- Managing biotechnology and intellectual property (ISNAR)

Expertise in biotechnology policy

- African Centre for Technology Studies (ACTS), Nairobi
- Genetic Resources Action International (GRAIN), Barcelona
- Institute of Development Studies, Sussex
- International Food Policy Research Institute (IFPRI), Washington DC
- International Service for National Agricultural Research (ISNAR), The Hague
- Overseas Development Institute, London
- Plant Research International, Wageningen University and Research Centres
- Zentrum für Entwicklungsforschung, University of Bonn

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Key Sheets are available on the Internet at: www.odi.org.uk/keysheets/
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