



Agricultural Biotechnology

**An Executive Summary of the
Critical Issues and Recommended Responses
from the Land-Grant Universities**



AGRICULTURAL BIOTECHNOLOGY: Critical Issues and Recommended Responses from the Land-Grant Universities

INTRODUCTION

With the advent of genetic engineering 20 years ago it became apparent that agriculture had much to gain from the new biotechnologies. But today some traditional foreign markets for our agricultural products are resisting the importation of these genetically engineered foods. Farmers are now asking if they should continue to produce the products of biotechnology. If produced, will they be able to sell them?

To address this situation, the Experiment Station Committee on Organization and Policy (ESCOP) and the Extension Committee on Organization and Policy (ECOP) of the National Association of State Universities and Land-Grant Colleges (NASULGC) formed an Agricultural Biotechnology Task Force. The Task Force was to provide a factually based, independent assessment of the issues surrounding the market acceptance of foods that have been genetically engineered, and make some recommendations for immediate actions that could be undertaken by the land-grant university (LGU) community.

ISSUES

Seven issues were identified by the Task Force as directly relevant to the current controversies surrounding the market acceptance of the products of agricultural biotechnology.

1. The Environment:

Public discussions have raised a number of concerns about potential environmental effects of the use of crops derived from agricultural biotechnology.

Among the most prominent are concerns that:

- The flow of genetic material from genetically engineered crops to weed species will improve weed fitness;
- That genetically engineered varieties can help improve environmental quality by reducing the use of chemical pesticides may not be valid claims;

- That the development of pest resistance to introduced genetic material will undermine the efficacy of widely used pest control products; and
- That the use of marker genes will accelerate the spread of antibiotic resistance.

2. Food Safety:

Due to perceived health risks including increased toxicity, increased allergenicity, and antibiotic resistance, 20 U.S. lawmakers will introduce legislation in 2000 that would require mandatory labeling for foods containing genetically engineered ingredients. Thus, food safety is inextricably linked to the concerns of agricultural biotechnology.

3. Trade, Business, and Economics:

One concern raised repeatedly about agricultural biotechnology is that the introduction of crops modified for specific quality attributes will lead to an increase in vertical coordination (e.g., contract agriculture) due to buyers' need for quality assurance. Many fear that farmers operating under contracts will lose their independence and become mere low-level employees of giant agribusinesses.

Intellectual property rights (IPRs) are temporary monopoly rights granted to man-made inventions and discoveries. IPRs are said to have a significant influence on the structure of commercial agriculture for a variety of reasons. Some of these structural changes may alter the face of American agriculture as we have known it.

4. Industry Structure and Consolidation:

A barrage of mergers and acquisitions (M&As) in the seed and biotechnology industries executed by few large biotechnology and agrochemical companies at sensational prices has attracted much attention over the last few years. These M&As coincided with the commercial introduction of first-generation agricultural biotechnology products, which were adopted at unprecedented rates. For some these changes raise significant concerns about increasing market concentration and power.

5. Regulations:

Since 1986, biotechnology products in the United States have been regulated under the Federal Coordinated Framework for Regulation of Biotechnology. This regulatory system has had the effect of providing reasonable assurances of public safety and environmental protection while allowing the research, development, and commercialization of the products of agricultural biotechnology to go forward. But the system is not fully compatible with regulatory systems of our major trading partners. In Europe biotechnology regulation is focused on the process, not the products, of biotechnology. This has led some foreign governments to consider extending regulatory consideration beyond safety, efficacy, and quality to questions such as "Do we need it?" This "fourth criterion" has been strongly resisted in the United States as inappropriate to our system of regulatory authorities. But it remains a contentious trade issue.

6. Product Labeling:

To deal with differences in consumer acceptance of agricultural biotechnology products, some have argued for food labeling as the means of informing the public about the process (i.e., agricultural biotechnology) by which a food has been created. This strategy has become standard in Europe and is under review in the United States.

7. Values:

The bases for variation in consumer acceptance of food biotechnology remain somewhat conjectural. Four key areas of personal values bear on this issue.

- **Religious Views and Freedom of Conscience:** Many of the world's religions stipulate dietary rules as a part of religious practice, and some contain specific injunctions against crossing species lines. Religious doctrines about food consumption and preparation, including procedures for holidays and special events, may be interpreted to preclude genetically engineered foods. Constitutional protection of religious liberties in many countries is generally interpreted so as to protect individuals' rights to judge and act on the basis of their personal belief system, at least in terms of assuring that their actions do not harm others, or endangers public safety.
- **Comparative Politics:** Some of the most obvious variations in attitudes to food biotechnology break down on national lines. Part of the variation here may be the result of religious beliefs, but there are many other possible contributing factors, including legal systems, voting rules and political structures, the press, and consent by individuals *versus* the community.
- **Risk:** Recent or particularly memorable events lead people to increase their estimate of risk for new proposals. Furthermore, the manner in which science-based information is presented to the public affects the perception of risk.
- **Human Research:** Opponents of some forms of animal biotechnology appear to be concerned with the potential applications of the results to humans. A better set of guidelines is needed on where agricultural biotechnology should "draw the line" before research work on livestock is permitted.

RECOMMENDED LGU ACTIVITIES

EDUCATION/EXTENSION

Education is vital to inform producers, consumers, and leaders about the full range of challenges and opportunities associated with modern agricultural biotechnology. This includes the need to explain the science behind biotechnology as well as the reasons it is being used. Such education is challenging because it now must be done in a climate of controversy and growing suspicion about biotechnology. The LGU system is in a unique and important position to serve as a third-party source of factual and credible information to help balance the discussions on agricultural biotechnology.

Points to Consider:

Whom should we educate? The range of target audiences for education is wide. In general, it will be most effective to reach the public by focusing on the key opinion leaders who shape the public's perception and understanding of issues.

What do people want to know about biotechnology? Consumers are quite interested in learning about the benefits of biotechnology—why it is being used and what is in it for them as consumers, and for society.

What are the most appropriate terms to use in describing biotechnology? Research has consistently shown that certain terms such as "genetic engineering" are perceived as much more negative than terms such as "agricultural biotechnology." In fact, the term "genetically modified organism" is the most negative term for consumers.

How can we educate about biotechnology? There are clearly some significant limitations associated with using mass communication for educational efforts. In fact, many consumers have become quite skeptical about the media's credibility on controversial issues.

Who should provide people with information about biotechnology? An effective educational program will require an ongoing partnership among government, industry, universities, consumer groups, and others.

How should the LGUs maintain credibility and neutrality? It will be important that the data be collected and interpreted in a systematic and unbiased manner to maintain trust in our LGU system. However, many of the issues that are also of concern to the public will not be addressed through the use of biological or natural sciences -- they require more attention to social science. These include ethical and societal issues, as well as some of the key issues related to labeling and consumer choice.

A new set of materials better suited for a mass audience is essential. They should include audiovisual materials (such as videotapes) as well as publications. One government agency, such as the USDA's Economic Research Service or the National Agricultural Library, should serve as a clearinghouse for visuals and other educational materials. These could then be made available on-line and through other means.

RESEARCH

For the products of biotechnology there is a small set of human health and environmental safety topics that have been widely identified as having the most pressing need for further research. These topics are:

Allergenicity: One of the most widely cited concerns about genetic engineering is that it will introduce into foods with no known allergy problems genes that trigger allergic reactions.

Pleiotropic effects of gene insertions: A second area in need of research attention is the positional (pleiotropic) effects of gene insertions, especially when gene expression may not be predictable.

Secondary plant metabolites: A third widely cited concern about genetic engineering is that the introduction of novel genes will result in unanticipated and/or enhanced expression of secondary plant compounds with potential toxic activity.

Gene flow: The most widely cited ecological concern about genetically engineered plants is that gene flow from crop plants to wild relatives could lead to substantial improvements in fitness, i.e., the emergence of "superweeds" or plants that negatively impact natural populations.

Environmental benefits: It is often argued that the use of crops genetically engineered to express pesticidal compounds can improve environmental quality by reducing reliance on chemical pesticides. Impact assessment research is needed to verify whether such claims are accurate and, if so, the extent and circumstances under which such reductions are achieved.

Unintended Consequences: More needs to be known about the collateral impacts of using genetically engineered resistance to pests, such as Bt injury to non-target insects, and the development of pesticide resistant pests.

Benefits and costs from use of bioengineered crops: Net economic benefits have likely been generated by the market introduction of bioengineered crops. The magnitude of economic benefits and costs as well as their distribution among technology providers, farmers, merchants and consumers is not known. Research is needed to assess the economics and distributional impacts of agricultural biotechnologies.

Benefits and costs of labeling: Labeling foods made with biotechnology products is often put forward as a simple matter of providing information that would allow consumers to make better choices. However, labeling is costly and little is known about the benefits or costs of labeling. More information is needed on the costs of segregating biotechnology crops throughout the marketing channel and the costs of monitoring compliance.

Structural impacts of biotechnology: Concerns over potential structural impacts of biotechnology in agriculture and the agrifood supply chain have been raised repeatedly. Improved understanding of the role of various corporate and public strategies in biotechnology on market structure and change is needed to facilitate policies that improve social welfare and minimize displacement.

Social values and institutional environments: A better understanding of the social values and institutional environments that spawn opposition to food biotechnology is needed for understanding public criticisms and concerns. It is also essential for accommodating the widest possible divergence of personal, social, and religious values and for arriving at socially optimal solutions.

The Task Force has referred these education, extension and research items to ESCOP and ECOP for planning and implementation.

The full report is available at:

<http://www.escop.msstate.edu/committee/agbiotec.pdf>

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