Workshop Report

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This workshop dealt with several general "themes" of the environmental impact of biotechnologies. Of greatest concern were the indirect and long-term effects, such as possible reduction in levels of biodiversity from some applications. These effects are less understood, most difficult to measure and are, therefore, more difficult to quantify and to control. The direct effects, and particularly those measurable immediately, such as change in pesticide use, are potentially more easily dealt with. But there was not general consensus within the group that even these potential impacts are being adequately assessed. The workshop participants represented a broad cross-section of interests, including persons from institutions at the federal and state levels, environmental activists, public policy advocacy participants, educators, farmers and representatives from organic and other alternative groups.

PRIORITY ISSUES

There was strong agreement on the importance of integrated production systems (IPS) in minimizing adverse environmental impact from agriculture. Those systems must preserve soil productivity, contain and recycle nutrients, optimize crop and animal growth, and have appropriate diversity and structure to moderate pest and disease occurrence to levels which can be controlled with environmentally acceptable levels of additional inputs. The group disagreed over the degree to which such integrative effects could be made effective, with opinions ranging from modest utility to a minority viewpoint that most, if not all, production problems could be solved through structuring and integration, as in organic agriculture. There was strong agreement that biotechnology should be directed toward solution of problems within a context of integrated systems, and that such technologies should then be applied within the context of sustainable systems. Good technologies inappropriately applied can often cause environmental problems. A major concern of indirect effects of biotechnology having adverse environmental impact was the possible reduction of diversity within production systems, leading to greater genetic or cultural

uniformity. If the genetic base for herbicide-resistant or disease- or insect-resistant cultivars is narrow or the released varieties displace a range of cultivars, the resulting lowering of genetic diversity will increase risk of pest or pathogen outbreak. Likewise, if a narrowed range of economically viable options for cultural practices is available, genetic shifts in weeds, pests or diseases may be accelerated. The group felt that biotechnologies must increase, not decrease, viable options for farmers and for farming systems.

A second theme for discussion concerned assessment of short-term, direct effects of biotechnology on the environment. Examples of questions raised by participants included: Will the technology lead to greater or less pesticide use? Do biotechnology-based transfers of pest resistance usually involve single-gene or other forms of resistance which lead to greater rates of pest resistance development? Will nutrient loss to surface and groundwater be enhanced or reduced as a result of changed crop nutrient use or nitrogen-fixation capacity?

A third area of concern centered around long-term impacts on the ecosystem of engineered genetic materials becoming a part of the natural "gene bank." It was felt that for most new genetic materials it is not a question of *if,* but of *when* such materials become a permanent part of the ecosystem. For some materials the time span is long, perhaps measured in decades, while for others it may be a few years. There was disagreement among participants as to the availability of scientific data on the rate of spread, on extent and eventual gene frequency, and on the eventual impact of such genes within the ecosystem. For some of the more common transgenic plant technologies, such as the use of insecticidal proteins from *Bacillus thuringiensis (Bt),* there is a better database. Where such materials are either new to the plant or animal kingdom or from exotic sources, the long-term spread and impact are less known. It seems apparent that research in the area of gene spread, as well as knowledge about the scientific capability to assess such impact is not widely known to scientists working in related fields, and certainly not by the public-at-large.

The final thematic area concerned that of "public" education concerning environmental risk and biosafety. There is need for education and information flow at several audience levels, including scientists, activist leaders, policymakers, science educators and the general public.

RECOMMENDATIONS

These general areas include most of the concerns voiced within the workshop. These were then consolidated in the second phase of discussion into specific priority issues, with recommendations for each.

Integrated Production Systems

There is need for both scientists and farmers to know how and when to use biotechnology products in IPS. If a decision is made to use products, how

will they be managed within the context of an IPS so that environmental stewardship objectives are met?

The public sector should fund and conduct more systems research and testing on the potential positive and negative environmental, economic and social impacts and consequences of biotechnology products. The results of the research must be effectively communicated to producers and consumers in a timely and objective manner (as results are available).

Cooperative Extension Service directors and other appropriate public agency administrators should be given a mandate to devote resources to assist producers in a manner consistent with environmental stewardship (e.g. through comprehensive crop and animal management advancement programs that deal with whole-enterprise management and offer continuing educational update). Biotechnology options should be presented within this systems framework.

Environmental Impact

Agricultural biotechnology is not simply science but has social and political implications. Therefore, it is imperative that a public role be recognized in the debate over areas where biotechnology should be focused and how its products should be incorporated into sustainable agricultural systems. Moreover, the public must be involved in the consideration of safety, of environmental protection and/or stewardship and the myriad social issues. To improve agricultural products and benefit society, scientists working on biotechnology products should:

Identify, evaluate and anticipate risks prior to release. Safety claims should be supported with both public and private research. Assessment criteria should be used.

Focus on development of agricultural biotechnology processes and/or products that will promote long-term environmental health by:

- *Maintaining biodiversity*
- *Enhancing soil, water and air quality*
- *Increasing reliance upon renewable energy sources*

Recognize the public's concern for this new technology and work with them to understand its complexity and potential. Bring biotechnology products to the market with reasonable expectations.

Public and private funding institutions, including U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), the National Institutes of Health (NIH) and private foundations should take action to identify means and instruments to promote biodiversity as a key objective of publicly-conducted agricultural biotechnology research and development.

Resulting integrated production systems should maintain high biodiversity.

Public policy should be made consistent with these goals.

(Note: All recommendations for the two areas above had strong but not unanimous consensus.)

Assessing Long-Term Effects

How can the long-term environmental effects of biotechnology products be assessed? There was strong consensus that long-term impact assessment is essential. There was little agreement on how this should be done, and not sufficient time was available for negotiation. There were strongly held but diverse opinions on all sides of this issue.

A tax should be placed on biotechnology products to ensure long-term public support for research on ecological risk assessment. (The majority of workshop participants opposed this recommendation, based partly on opposition to product taxation in general, and partly on the assumption that lack of funds may be only one reason why the research is not now being done.)

The U.S. President should appoint a broadly representative blue-ribbon panel to establish a binding regulatory framework for dealing with agricultural biotechnologies. (The majority opposed this recommendation.)

Education and Communication

Major public effort is needed to enhance education and communication relative to the role of agricultural biotechnology in environmental stewardship. The goal would be to improve the ability of diverse groups to participate in the decision-making process about the impacts of biotechnology and their role in environmental stewardship.

The Cooperative Extension Service and the Agricultural Experiment Stations, under the auspices of the National Agricultural Biotechnology Council, should form a committee to develop a public education plan for biotechnology education.

The participants should include grassroots members of various communities—consumers, producers, activists, local government, media, retailers, extension staff members and educators.

The subjects of the workshop-focus group discussions should include a basis of information about the environmental issues and solicit reaction to these issues from the participants.

The information gathered at these workshops should be accumulated by NABC and published for distribution to statewide and national decision makers.

Also special effort should be made to package and distribute this information to K-12 educational institutions.

The committee should reconvene each year for a minimum of two years and then review accomplishment each year after at the discretion of the focus group.

This effort should lead to a systematic and sustained educational plan to help the public debate and understand the issues surrounding agricultural biotechnology. (A majority favored the recommendations on this issue, but there was dissent, based partly, at least, on the broadness of the recommendations.)