INVITED PAPERS

Trends in Consumer Acceptance and Awareness of Biotechnology

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The promise of agricultural biotechnology has become reality. Foods produced through biotechnology will become increasingly common in the food production and distribution system. Consumer reaction to these foods will be an important factor in determining the ultimate success of the biotechnology enterprise. This paper reviews trends in U.S. consumers' awareness and acceptance of biotechnology. Results of several national surveys show that biotechnology has not been an issue for the vast majority of consumers. Most have a positive attitude about biotechnology. This paper also presents some implications for future research and educational programs.

Agriculture and food processors have always relied on technology to feed a growing population. A new era has arrived with recent advances in biotechnology. The tools of biotechnology offer a number of important opportunities for improving food production in the United States and around the world. Modern biotechnology has ancient roots. For thousands of years, people have been selecting and raising plants and animals to produce food. They have also relied on technology to bake bread, brew beer, and make cheese.

The potential benefits of agricultural biotechnology have been promised since the early 1980s. The year of 1994 will be remembered as a watershed year in the development of agricultural biotechnology. This was the year when biotechnology's potential became reality, as evidenced by the following products:

1. Bovine somatotropin (BST) was approved for use by American dairy farmers. This supplement to the naturally-occurring hormone increases milk production by an average of 10 to 20 percent when administered to dairy cows.
2. The Flavr-Savr^{tm} tomato was approved for commercial sale in the United States. These tomatoes look and taste better than the usual produce (especially in the winter) because they are allowed to stay on the vine until they are ripe.
3. Seven additional biotechnology-produced plants (including tomato, cotton, soybeans, and squash) completed the Food and Drug Administration's consultation process. These plants were found to be substantively equivalent to their currently available counterparts. These include varieties of plants that are protected from insects and disease, as well as plants that are not damaged by specific herbicides.

Biotechnology will provide farmers and food processors with a number of tools to enhance the quantity and quality of foods they produce. Some of the first commercial plant products of biotechnology are aimed at protecting crop plants from disease and insect damage. Progress is also being made on developing crops that have enhanced flavor and nutrition, as well as processing characteristics. These products have important implications for all participants in the modern food production and distribution system -- from the research lab to the consumer. As the main contact with consumers, food retailers and other distributors will need better understanding of consumer attitudes about biotechnology.

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One criteria for success of food biotechnology will be the level of consumer acceptance. Consumers will have an influence over the future of biotechnology through their market behavior. Stenholm and Waggoner (1992, p. 28) conclude that: "The ultimate judge of emerging technologies will be the consumer -- whether that be the farmer, homemaker, or general public. It is they who will appraise the merits of a particular product or process and determine its success or failure."

Biotechnology is developing within a larger context of sustained public interest in health and the environment (Foreman 1990). The Office of Technology Assessment (1992: 17) summed up the situation, as follows: "Society in general is more skeptical of the need for new technologies. Scientific illiteracy combined with a lack of knowledge about agriculture and biology leads some people to misunderstand how and why these technologies will be used." The current social and cultural context indicates a clear need for educational and marketing programs to pave the way for the products of biotechnology (Hoban 1989). Such efforts need to be based on an understanding of consumer knowledge and attitudes.

Government policies and regulations will also influence the future direction of biotechnology (Gore 1992). As a relatively new set of tools, biotechnology has received extensive review by a number of government agencies and independent experts. Government officials and the scientific community agree that just because foods are produced through biotechnology does not necessarily result in any unique safety concerns. As with other foods, those produced through biotechnology are, therefore, regulated on the characteristics of the product, rather than the process used (in this case biotechnology).

Experts also agree that future progress in biotechnology will be vital to meeting global needs for food, fiber, and even fuel (Office of Technology Assessment 1992). Developments in biotechnology will provide significant benefits to farmers, the food industry, and consumers. However, the full promise will only be met if consumers accept the products. Decision makers in the public and private sector need to understand and remain sensitive to public perceptions. This paper summarizes and interprets trends in public awareness of and attitudes about biotechnology in the United States.

Trends In Public Attitudes and Awareness

During the past few years, several major national telephone surveys have been conducted that examine public perceptions of agricultural biotechnology. The first project, funded by the U.S. Department of Agriculture (USDA), was a national telephone survey conducted in 1992 with 1228 respondents (Hoban and Kendall 1993). Eight focus groups were also conducted as part of that project to further assess consumer reactions to biotechnology and identify educational needs. More recently, a similar study was conducted for the Grocery Manufacturers of America (GMA) that involved 1004 telephone interviews completed in January 1994 (Hoban 1994). This paper also presents selected results from two national surveys conducted in early 1995 for the Food Marketing Institute (Food Marketing Institute 1995). The random samples for these four studies are representative of the country as a whole. In all cases, professional telephone interviewers were used. Key findings will be highlighted in this section.

Acceptance of Biotechnology

The bottom line from these studies is that most people have a positive view on the use of biotechnology. As shown in Figure 1, two-thirds of the respondents to both the USDA and GMA survey supported the use of biotechnology in agriculture and food production. Even more (82 percent) supported its use in the development of new medicines when asked on the GMA survey. As might be expected, even the use of biotechnology in human health care is unacceptable to a small segment of the public. Even so, almost three quarters of the USDA respondents in 1992 agreed that "Biotechnology will personally benefit people like me in the next five years." On a related statement, more than two thirds agreed that "Government should fund more biotechnology research because of the potential benefits."

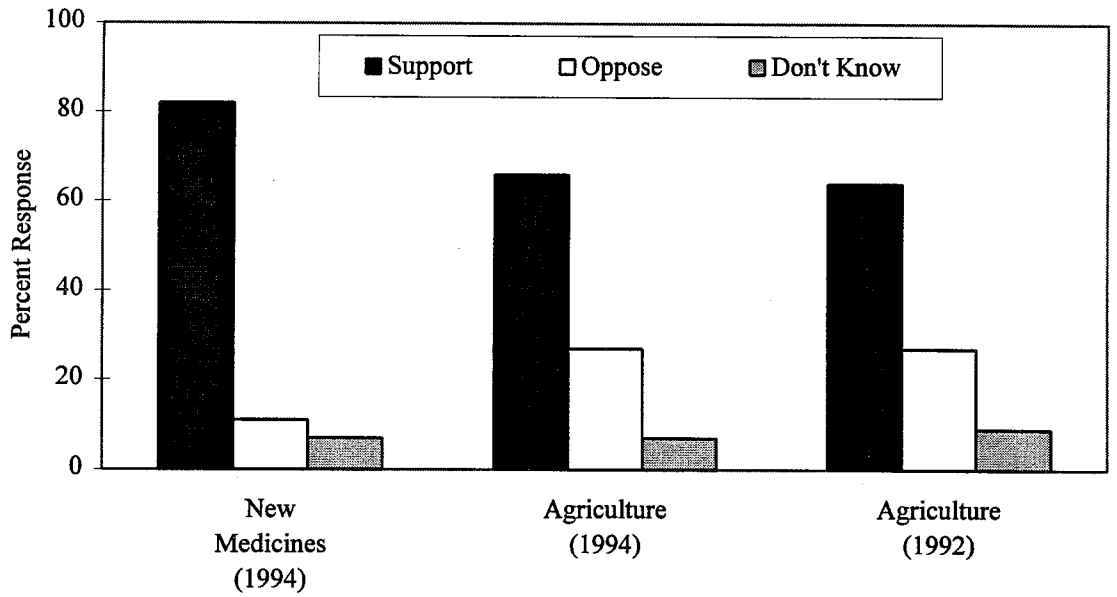
As with any group of food products, those developed through biotechnology will vary in their acceptability to consumers. In both the 1992

and 1994 surveys, respondents were asked to rate the acceptability of selected applications of biotechnology (Figure 2). The results are remarkably consistent between the two time periods. Two crop applications of biotechnology proved very acceptable to most consumers: cotton plants that resist damage from weed control chemicals (i.e., herbicides) and food crops that are protected from insect damage. These two plant applications were acceptable to almost two-thirds of the respondents. Another fifth of the sample were neutral. As a point of comparison, note that these two agricultural products were almost as acceptable as the production of human medicines through biotechnology. Three other applications of biotechnology were rated as less acceptable: farm animals that resist disease; food ingredients such as flavorings; and sport fish that grow larger.

Results of two 1995 national telephone surveys conducted by the Food Marketing Institute further indicate that foods produced by biotechnology should meet little resistance as they enter the marketplace. Results from the 1995 "Trends" telephone survey of 1011 respondents indicate that most consumers will purchase new fruits and vegetables once they are available (Figure 3). Almost three quarters (74 percent) would be likely to purchase a new variety of produce (such as a potato or tomato) that had been modified by biotechnology to resist insect damage, thus requiring fewer pesticide applications. Almost two thirds (62 percent) would buy the produce if it had been modified by biotechnology to taste fresher or better.

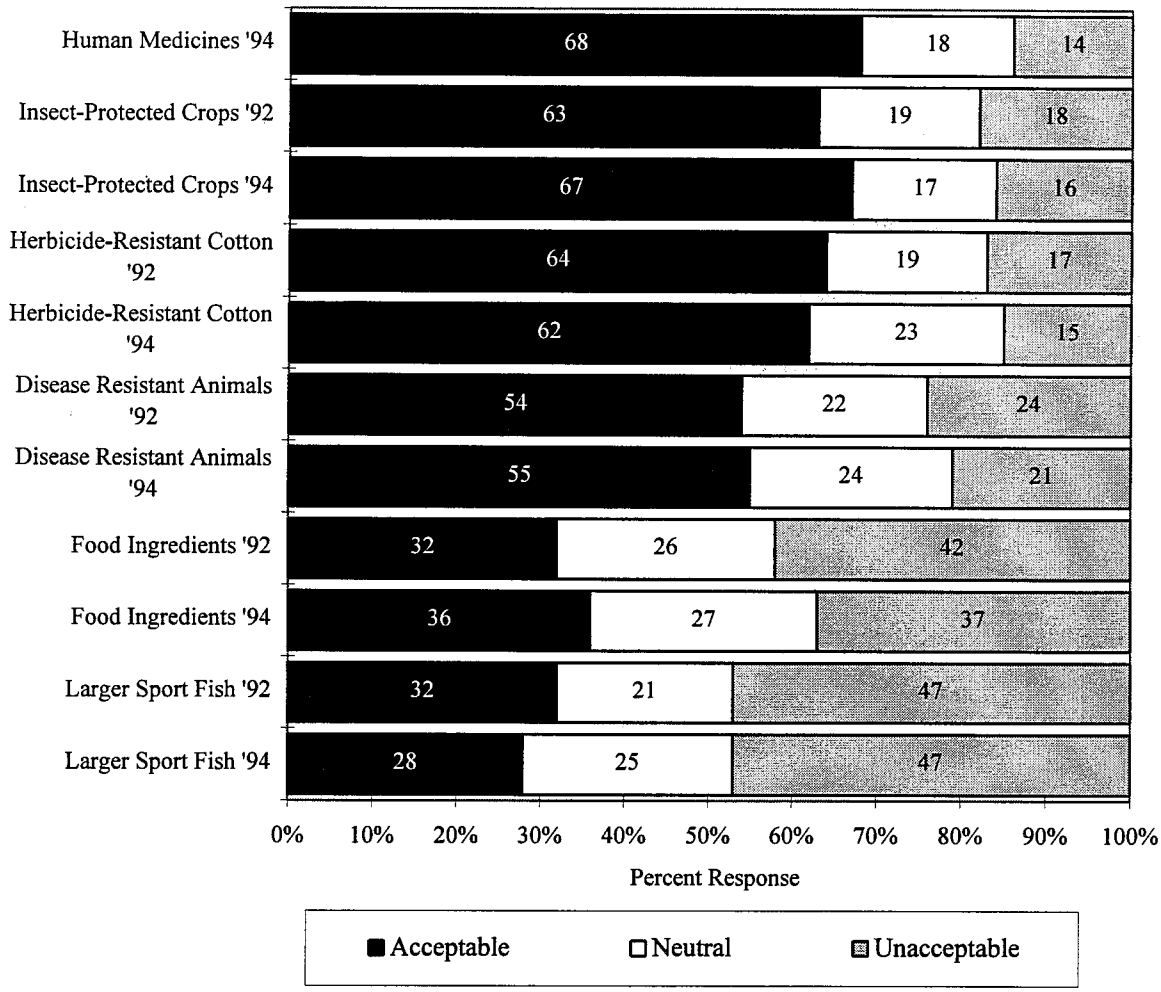
In another 1995 FMI study, conducted with Prevention magazine, 1443 American consumers were asked how acceptable they would find each of five different uses of biotechnology (Figure 4). Almost 80 percent said the use of biotechnology would be acceptable if the goal is to lower the fat content of foods. Three quarters found biotechnology acceptable if used to grow foods that taste better or to produce foods that include substances that may help prevent disease. Just over two-thirds would accept foods developed through biotechnology that stay fresh longer in the grocery store. The same number would accept foods that are resistant to pests.

Figure 1. Overall Reaction to Biotechnology



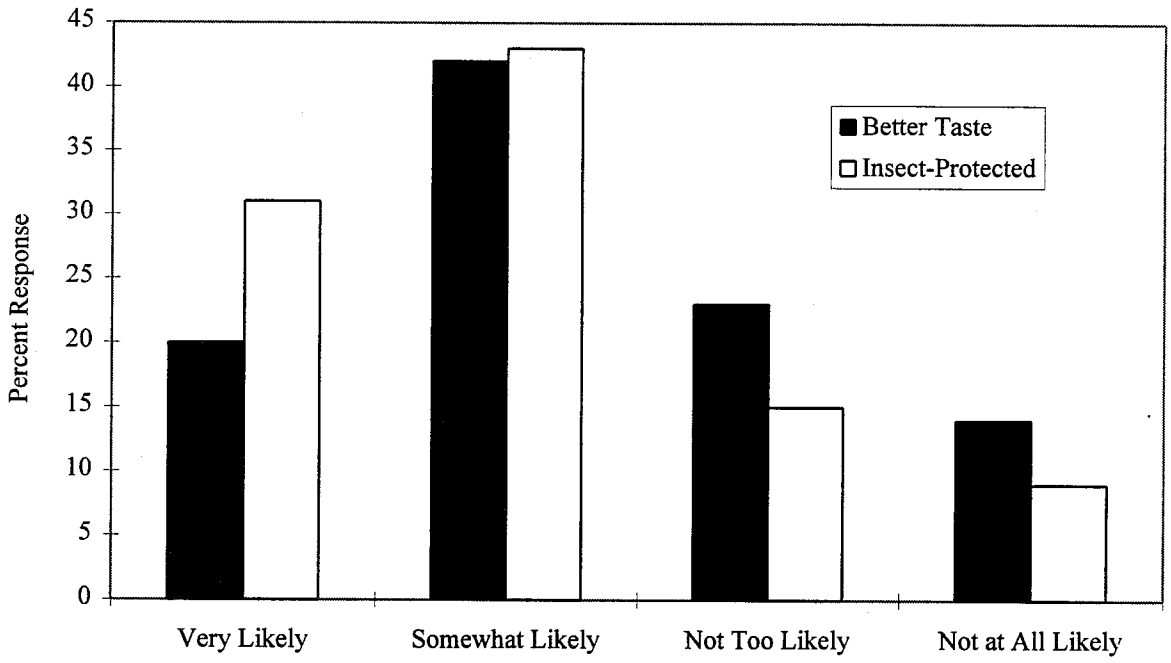
Source: USDA, 1992 and GMA, 1994.

Figure 2. Acceptance of Biotechnology Products.



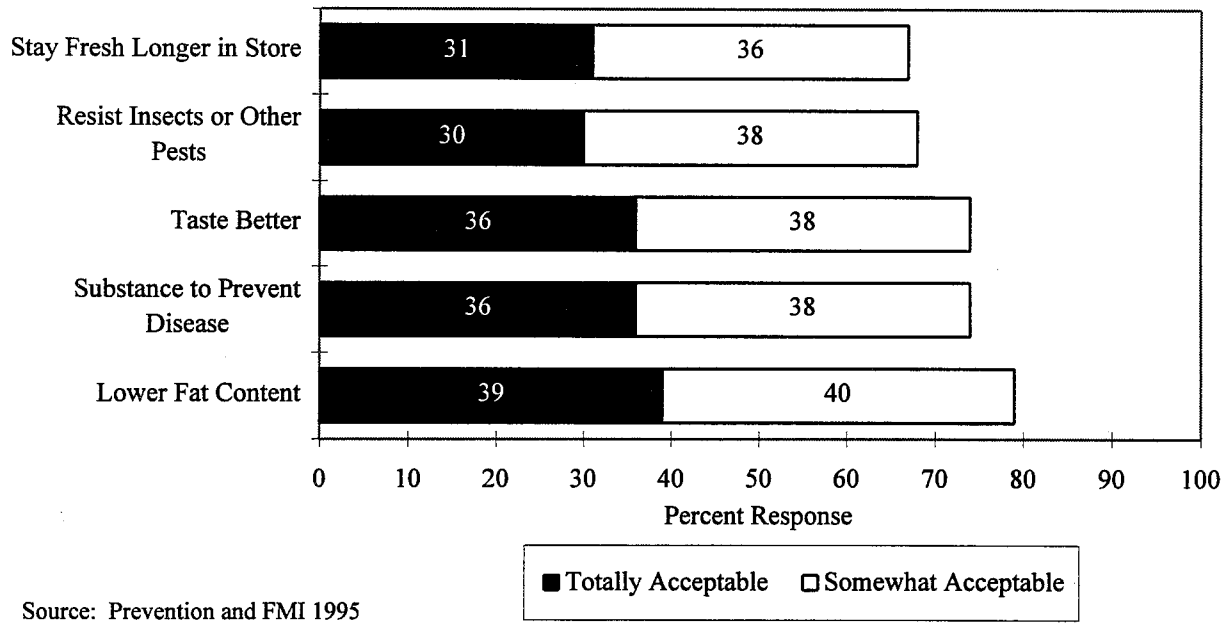
Source: USDA, 1992 and GMA, 1994.

Figure 3. Intentions to Buy Produce Items Developed through Biotechnology.



Source: FMI 1995.

Figure 4. Acceptance of Different Foods Produced through Biotechnology.



Source: Prevention and FMI 1995

Results of the eight focus groups conducted in Raleigh and Denver provide additional insights into consumer acceptance of biotechnology (Hoban and Kendall 1993). Results confirmed that foods developed through biotechnology will be acceptable, especially if consumers recognize personal or societal benefits. Most consumers seemed eager to try foods that promise enhanced flavor or nutrition. Consumers also value products that are friendly to the environment or benefit farmers. It will, of course, be important to consumers that independent scientific experts and government agencies have determined that the foods are safe and nutritious. In general, consumers will evaluate foods produced through biotechnology in the same way as they now evaluate any food. The most important factors in their decisions are taste, price, safety, and nutrition. The process used to develop the foods is relatively unimportant.

Biotechnology Awareness and Interest

The surveys show that most people need and want more information about biotechnology (in general) and specific food products. Respondents were asked to rate their own understanding and awareness of biotechnology in three of the studies (Figure 5). In the 1992 USDA survey, just a third had heard or read a lot or something about biotechnology prior to the interview. Responses were almost the same two years later in the GMA study. In fact, survey respondents seemed to have even less awareness of biotechnology (despite two years of active media coverage). Even given recent publicity and the approval of some specific products, awareness of biotechnology remained low in 1995. Again, just about a third had heard or read a lot or something about biotechnology. Almost two out of three consumers expressed little or no awareness of biotechnology on all three surveys. Awareness has not increased, even though media coverage grew over time. On a related point, the 1992 survey USDA survey shows that consumers also have relatively little awareness or understanding of traditional breeding practices.

Results do indicate that most people are interested in learning more about biotechnology. One in five respondents to the USDA survey had a lot of interest in learning more about biotechnology. Almost half reported some interest. In 1994, about one quarter reported a lot of interest and more than a third had some interest. In both years, less than one-in-five reported no interest in learning about biotechnology. Respondents who reported at least "a little" interest in learning more about biotechnology were asked what they would like to learn. The main area of consumer interest involves a better, general understanding of biotechnology -- what it is, why it is needed, and what the benefits are. Another important area of interest involves information about the safety of foods developed through biotechnology. Respondents also expressed interest in the government regulatory process. Most expressed relatively little need to know about the technical or scientific aspects of biotechnology.

One of the keys to acceptance of products developed through biotechnology is the extent to which people receive information from a trusted source. Information sources vary in their credibility to consumers. Figure 6 presents the ratings different information sources received from respondents to the 1994 survey. The six most trustworthy sources of information included a number of independent scientific organizations and government agencies. The American Medical Association is the most credible, even relative to the other independent scientific sources. Five other groups were also seen as quite credible: National Institutes of Health, Food and Drug Administration, American Dietetic Association, university scientists, and state Departments of Agriculture. Five sources received moderate trust ratings: registered dietitians, farmers, the Extension Service, television news reporters, and biotechnology companies. Finally, four sources appear to have fairly low credibility with consumers: packaged food manufacturers, chefs, activist groups, and grocery stores. Ratings on this question were similar in 1992 (where fewer sources were included). One significant change was that environmental activist groups dropped significantly in their credibility over the two-year period. During the same time, government credibility tended to rise.

Results from the eight 1992 focus groups concerning awareness and educational needs were quite consistent with the telephone survey data.

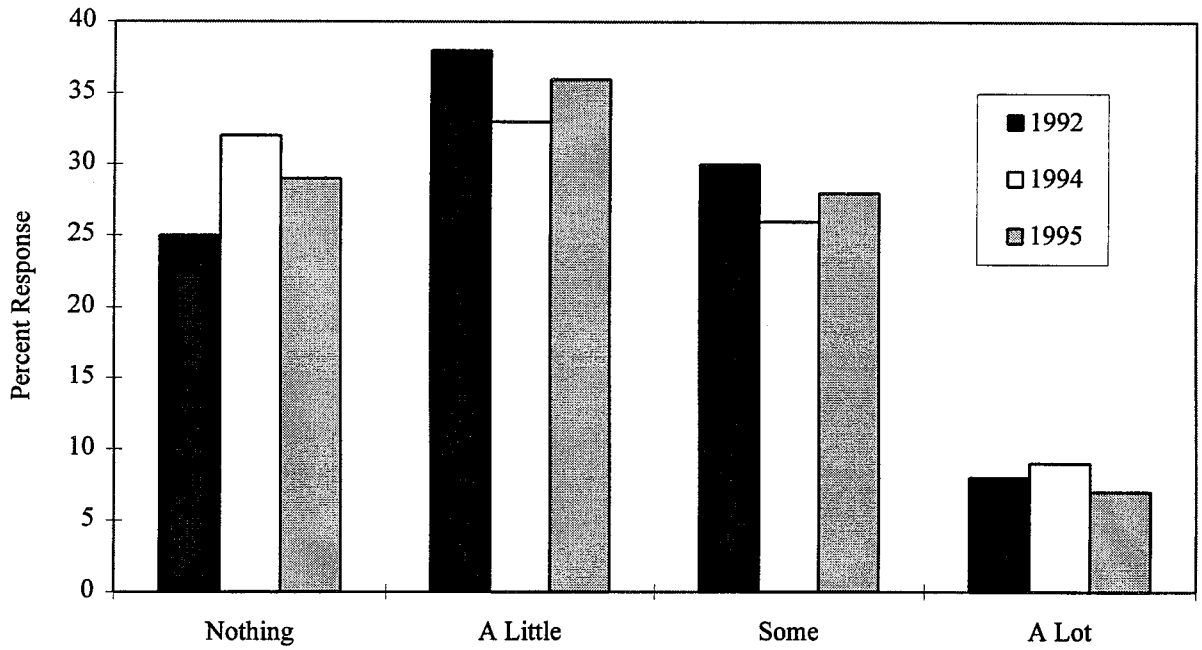
Most consumers who participated had little knowledge about biotechnology (or even traditional food production techniques for that matter). Some said they had heard of a "new type of tomato" which had been in the news prior to the focus groups. Most were very interested in the subject and wanted to receive more information. They generally asked for the same types of information as they would for any food. They mainly wanted to know how foods produced through biotechnology would taste and what they would cost. Information on safety and nutrition of specific products was also seen as important. Focus group participants were also most likely to trust independent health organizations and university scientists.

Influences on Public Acceptance of Biotechnology

Additional analysis of the 1992 and 1994 surveys provides insights into the types of consumers who will be most likely to accept products of biotechnology. As with other food issues, women generally had more questions and concerns about biotechnology than men. However, the majority of women still were positive on biotechnology. Respondents with higher income were more likely to find the products acceptable. Those with more education were more likely to accept biotechnology than respondents with less education. Greater general interest in science and technology was related to greater acceptance of biotechnology.

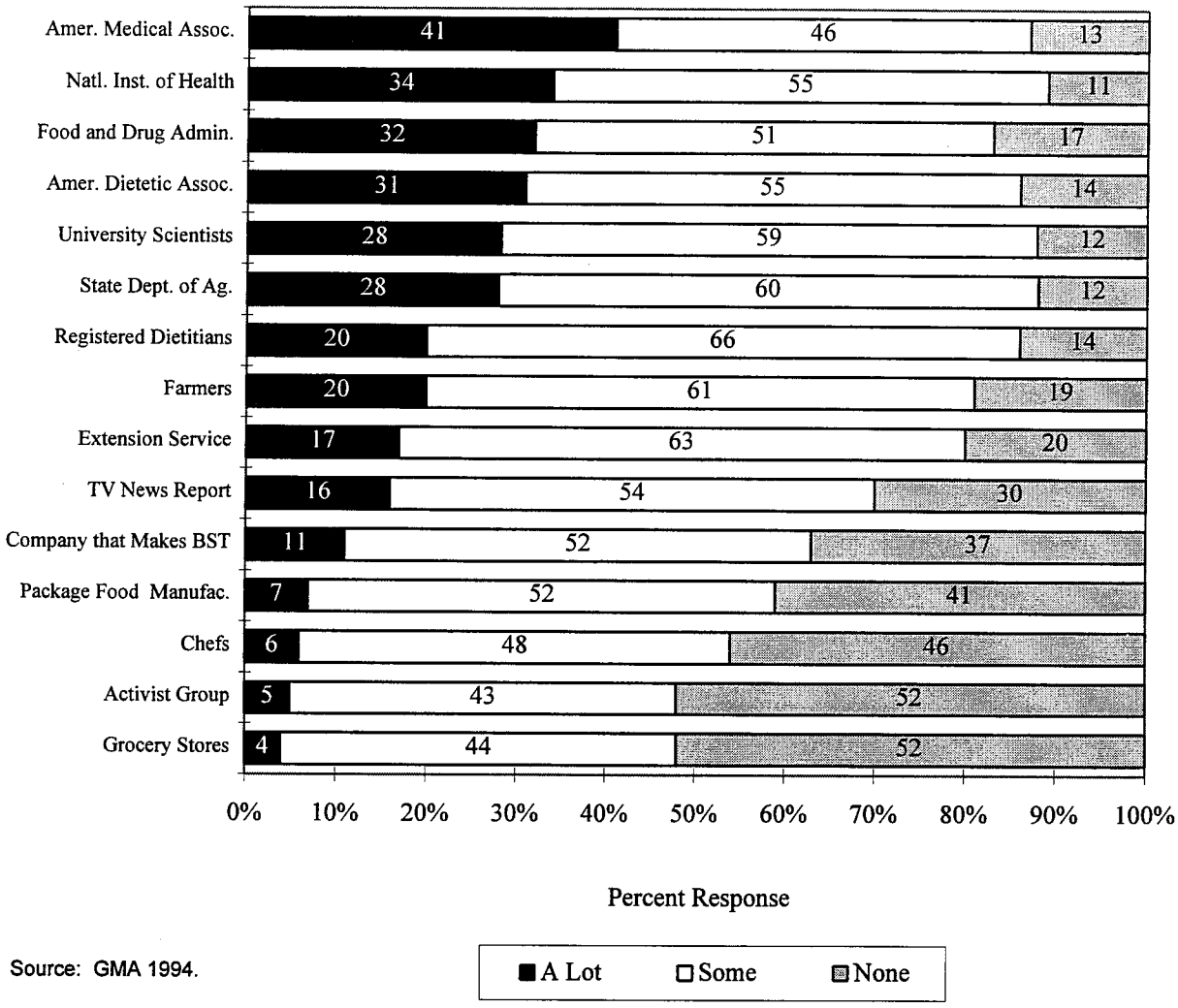
Awareness and knowledge of biotechnology generally has a major influence on acceptance of products. Survey respondents who had read or heard more about biotechnology were much more likely to find the products acceptable than those with less awareness. Similar patterns are evident with increased interest in biotechnology. Confidence in government and trust in information sources prove to be very important. As confidence and trust increased, consumers' acceptance of biotechnology rose dramatically.

Figure 5. Amount Heard or Read about Biotechnology.



Source: USDA 1992, GMA 1994, and FMI 1995.

Figure 6. Trust in Information Sources.



Source: GMA 1994.

Implications and Recommendations

The results of four independent surveys in the United States clearly show strong and enduring support for the use of biotechnology. Biotechnology has been widely used in the health care and pharmaceutical industry for at least the past decade. Public support for agricultural biotechnology is almost as high as for that established and important area. Results consistently show that most American consumers will accept foods developed through biotechnology.

The fact that trends are stable indicates that the increased media coverage and attempts by activists to create controversy have not swayed public support. Given that awareness has not increased over time, it is reasonable to conclude that food biotechnology has not been (and never will be) an issue for the vast majority of people. Most people prefer to focus on what is important to them -- characteristics of the product, rather than the process used to produce the food.

Experience during 1994 with the introduction of bovine somatotropin (BST) and the first plant product developed through biotechnology (the Flavr Savr^{tm} tomato) provided market-place insights into consumer reaction to biotechnology. Despite an organized activist campaign, milk consumption was not affected by the introduction of BST. The less controversial tomato received a strong positive reception from consumers, even though it was priced as a premium item. Media

and consumer interest in the seven food crops that completed the FDA consultation process later in the year has been minimal and mild. This reaction indicates that consumers today do not object to the modification of crops from biotechnology. In fact, most are interested in the opportunity to try them.

Given continued low awareness of, but considerable interest in information about biotechnology, a significant commitment to education is needed (Hoban and Kendall 1993). Educational programs need to be developed and implemented that provide people with information they need to better understand the biotechnology. This should involve a broad-based approach aimed at consumers, industry, opinion leaders, and others. Various groups and organizations can contribute to educational programs.

Members of the food production and distribution system represent an important audience for educational efforts. At the beginning of the food system, farmers and agribusinesses will need applied information and technical assistance to effectively and efficiently use the latest and most appropriate technology in agricultural production. Information on biotechnology should be integrated into Extension Service programs. Other groups in the food production and distribution system (such as processors and wholesalers) need information about the implications of biotechnology for their businesses. People who manage and own grocery stores and restaurants need to understand the benefits and issues associated with biotechnology so they can make informed purchasing decisions, as well as better address consumer questions. These groups are vitally important because they represent important gatekeepers, as well as the main points of contact with consumers.

Specific types of information that should be disseminated include: the historical context of biotechnology; the potential benefits and risks of alternative technologies; policies and regulations; public attitudes and values; and ethical issues. Much of this information is already available from the public or private sector. Mechanisms must be instituted for efficiently collecting, screening, and cataloging information. Educational programs must be developed at different levels of detail for different target audiences.

In general, education about the use of biotechnology in agriculture and food production is part of a larger educational need. Today, most consumers take their food supply for granted until they perceive a problem. Many people do not recognize or appreciate the past, present, and future role of technology in food production and processing. They need a better understanding of the historical and technical context within which biotechnology is developing.

Land Grant Universities can provide credible leadership for educational programs. Such programs should involve interdisciplinary collaboration among agricultural, social, and food scientists. The university community already has established linkages with a variety of government agencies, farm businesses, industry and other important groups. Interdisciplinary clearinghouses should be established to allow easy access to a broad range of credible expertise on all aspects of biotechnology. The Cooperative Extension Service should provide leadership for such educational efforts.

Although results of the surveys conducted to date show a clear pattern of support for biotechnology, further research is needed. Consumer attitudes about biotechnology can change, especially in response to mass media stories. Greater support is needed for multidisciplinary research efforts. In particular, social science research that examines the educational needs and policy implications of biotechnology needs to be expanded. Such efforts will help ensure that important issues are addressed and key stakeholders are identified, informed, and involved in the decision making process.

It will be important to replicate national surveys at regular intervals in the future. International research will also be important because consumers in other countries will also have the opportunity soon to buy foods produced through biotechnology (Hoban 1996). Future work in the U.S. and elsewhere should be tied more directly to specific food products that become available. Results of an ongoing series of public attitude surveys can provide guidance to help build an integrated program of consumer and leadership education about biotechnology.

Another research opportunity involves surveys of special populations, such as food proces-

sors, retailers, public officials, opinion leaders and educators. Much of the responsibility for educating consumers about biotechnology will rest with a variety of leaders from different organizations and interest groups. It will, therefore, be important to understand the attitudes and knowledge of these leaders, as well as their willingness and ability to educate consumers about biotechnology.

Biotechnology has a number of important implications for the entire food production and distribution system. The benefits will be significant. These include new value-added products that are high quality, less expensive, and widely available. All indications are that consumers will react to these products just as they do to any other food. The products will be a success if they taste good, are perceived to be safe, and are reasonable in price.

From the standpoint of consumer acceptance, the future for crops developed through biotechnology looks bright. However, government, universities, and industry need to work in partnership to provide opportunities for consumers and opinion leaders to learn more about biotechnology. Consumers mainly want someone they trust to assure them that regulations and testing procedures will ensure that our food supplies remain safe, nutritious, available, and affordable. It will be critical that scientists in the public and private sector maintain an atmosphere of openness about what they are doing with biotechnology and why it is important to consumers and the environment.

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