International Acceptance of Agricultural Biotechnology

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The promises of agricultural biotechnology are becoming reality. It is exciting to watch this field develop. Farmer acceptance of transgenic crops has been phenomenal. It took hybrid corn about fifteen years in Iowa to become completely accepted. Anything takes time, but the use of biotechnology crops has been limited mostly by seed availability.

We have recognized for a number of years that consumer acceptance is really the ultimate determinant of the success of these products (Hoban and Kendall, 1993). We also now realize that the products must be acceptable in the international marketplace. In some European countries, interest groups have expressed opposition to the products of biotechnology.

Education is very important, but it must be based on an in-depth understanding of public knowledge and public attitudes. This paper will review some of the trends of public perception or consumer acceptance of biotechnology as we have tracked it for almost a decade (Hoban, 1996; Hoban and Katic, 1998). It will also present some very new information about consumer attitudes and awareness around the world (Einsiedel, 1997; European Commission, 1997; Hoban and Miller, 1998).

OVERVIEW OF RESEARCH PROJECTS
The US Department of Agriculture (USDA) sponsored our first study in 1992 (Hoban and Kendall, 1992). We did a national telephone survey of more than 1,200 people in the US. A couple of years later I followed up with a study focusing on the then hot topic of bovine somatotropin (BST) (Hoban, 1994). I also have worked over the years with another group in Washington, DC — the Food Marketing Institute (FMI). They included some questions on biotechnol-
ogy in their US surveys (Food Marketing Institute, 1996) and the same questions on their 1995 European survey.

I conducted a national study of Japanese consumers in 1995 and in 1998 (Hoban, 1996a). In March of 1997, I worked with the International Food Information Council (IFIC) on a study of American consumers’ attitudes (Hoban and Katic, 1998). The objective of that project was to determine any impact from the report of cloning sheep and the related issues. Some very new information is just becoming available from an international team of scientists. A contingent of European researchers conducted a survey in Europe of more than 16,000 consumers (European Commission, 1997), as part of a periodic Euro-barometer study. A Canadian researcher conducted the same survey in Canada with 1,000 consumers (Einsiedel, 1997). Jon Miller, a colleague of mine, and I recently conducted a US survey of more than 1,000 consumers (Hoban and Miller, 1998). Some very interesting information was obtained, particularly country comparisons since there were many common questions.

**CONSUMER ATTITUDES ABOUT BIOTECHNOLOGY**

It is important to compare results from surveys of consumers in the US over a fairly long time period. Throughout the past decade there has been remarkable stability of people’s opinions on biotechnology in the US. These results are as close to identical as you can find from a series of surveys. In all three years we asked towards the end of each interview, as a summary comment: “Tell me whether you support or oppose the use of biotechnology in agriculture and food production.” In 1992, 70 percent said they supported it, a few did not know, and less than twenty percent were opposed. In 1994, during the height of the controversy over BST, 72 percent said they were supportive of it. In 1998, we again found 72 percent supportive.

We wanted to determine if there were demographic differences among groups. Two key ones stand out. Men are clearly more positive than women are in their evaluation of biotechnology, and this has occurred over the years in response to a variety of questions. There is a narrowing of this gender gap in 1998. This difference is important because women set the family food policy. They serve as food gatekeepers in our society as far as what is acceptable food for the family.

There are also significant differences based on formal educational level. In all three surveys from 1992 to 1998, respondents with a college degree were much more likely to support biotechnology than those with only a high school degree. College tends to provide an opportunity to be exposed to a variety of different ideas. However, not all college graduates have a good understanding of science.

Two FMI studies and the 1997 IFIC survey provide additional data over time in the US. Three out of four people would be willing to buy potatoes or tomatoes developed through biotechnology to require fewer pesticides and be
protected from insect damage. This finding is remarkably consistent over time. A majority of consumers would also be willing to buy produce that tasted fresher and better through biotechnology.

There is a comparison of three questions in 1995 across the countries in Europe, as well as the US, Canada, and Japan (Figure 1). The vast majority of European countries were above 50 percent in terms of consumers’ willingness to buy insect-protected produce. There are only two countries where acceptance is very low: Austria with only 22 percent consumer acceptance, and Germany with about 30 percent. Europe is not a homogeneous market. The European willingness to buy fresher and better tasting produce follows the same basic pattern, but is a bit lower in all countries than for insect protection.

The recently completed surveys in Europe, Canada, and the US asked consumers to evaluate six different applications of biotechnology. Two of them related to food, two to animals, and two to human health care. As you might imagine, human health care is acceptable and seen as valuable to about 85 percent of people around the world. The insect-protected crop plants were seen as third most acceptable, right after human medicine. Canada is very positive, as is the Netherlands, Italy, the UK, and Finland. The only country that is quite negative is Austria. They have a lot more organic farmers and low government support for biotechnology.
Figure 2 provides a summary to whether or not consumers agreed or disagreed that insect-protected crops developed through biotechnology should be encouraged. The results are generally positive. Support among Canadian and US consumers is very strong. Consumers in Finland, France, Italy, the Netherlands, and a number of other countries are also quite positive about plant biotechnology. Half the German citizens felt these products should be encouraged. That is a very different story from the perception that all of Europe is negative on biotechnology. In fact, the data show that only Austria is very negative. There certainly are groups within some European countries that are negative, but these results are a random sampling of citizens, not the opponents who get all the media attention.

It is important to put attitudes about biotechnology in perspective. Figure 3 shows US consumers' relative perceptions of whether biotechnology is a risk to their health compared to other concerns. The one that gets the most attention in the media (and probably the one most consumers ought to worry about) is microbial contamination that was identified by three out of four people as a serious hazard. Consumers then identified pesticide residues, which actually
declined in recent years as a risk. Antibiotics and hormones, irradiated foods, additives, and preservatives were identified next in decreasing risk. Foods developed through biotechnology are lowest on the list of potential health risks perceived by the US public.

European consumers have similar perceptions (Figure 4). They see “genetic engineering” as slightly more risky than artificial coloring, nitrites, cholesterol, and fat, and well below the others that are of more concern to them. These issues need to be kept in perspective. Greenpeace would make you think that genetic engineering is the biggest food concern of European consumers; it is not.

There are some striking country-by-country differences (Figure 5) with Sweden, Austria, and Germany having the higher levels of concern. In most other countries, less than half the consumers saw biotechnology as a serious hazard. Portugal is an unusual case with very high acceptance and very high perceived risk.
**Biotechnology Awareness**

Our surveys in the United States have tracked public awareness over time. Respondents were asked “How much have you heard or read about biotechnology?” Two thirds of US consumers (Figure 6) had heard only little or nothing about biotechnology between 1992 and 1996. In fact, awareness seemed to have gone down slightly in recent times. Then, in March of 1997, almost half of all respondents reported “a lot” or “some” awareness. Awareness in the US increased substantially with all the news on cloning the sheep, but as shown previously, attitudes about plant biotechnology had not changed, with willingness to buy foods from biotechnology remaining high.

Respondents to the most recent surveys in the United States, Canada, and Europe were asked “Have you heard or read anything about biotechnology in the past three months?” In the US and Canada just over half the respondents said they had. Awareness was higher in Austria, Finland, Sweden, and Germany. Other countries tended to be relatively low in terms of awareness and media coverage. This does reflect the extent to which biotechnology is an issue. If people are really interested in a subject they will talk to somebody about it.

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That may be a family member, friend, physician, or even a scientist. Figure 7 reports how many claimed to have ever talked to someone about biotechnology in each of the countries. If they have not discussed it, they are not very concerned or interested in it. There are some major differences. Germany is the highest, followed by Sweden, Austria, and Finland. When something is controversial, there is a tendency to talk about it more. Some of the countries (such as Ireland and Spain) have not had much discussion about biotechnology.

European awareness reveals some interesting contradictions. The two countries that were lowest in their willingness to buy biotechnology produce were Germany and Austria (Figure 1) yet a relatively high awareness was also reported. This observation does not, however, mean that education doesn’t work. It depends to a large extent on what people have heard or read. People who have done media analysis in Germany and Austria have found mostly negative reports. The opponents had the chance to tell their story in 1996 without much balance. So, consumers read a whole lot more about it in those countries, but what they had heard or read was very negative. There is some evidence that this has changed in the last year with more positive media coverage.

Several knowledge questions were asked on the recent European, Canadian, and US surveys. These also reflect the types of impressions people have of biotechnology. Consumers need a basic understanding of how food is produced.
Respondents were asked if it was true that “Yeast for brewing beer consists of living organisms.” Results are shown in Figure 8. Remember, this is a random sample of consumers not scientists. In the US and Canada, three out of four people gave the correct answer. A number of people admitted they did not know. About 10 percent actually said it is false (that yeast is not a living organism). There is some variation in Europe, (e.g., in Spain, less than half of the people recognized this as true). Consumers in Sweden and the UK tend to be among the highest in terms of their understanding of basic biological principle.

The questions got more difficult, and more specific to biotechnology. Consumers were asked whether or not the following statement was true or false: “Ordinary tomatoes do not contain genes, while genetically modified ones do.” As shown in Figure 9, there is a lot of uncertainty on this question. Not many people gave the right answer, and many people, including almost half the Americans, did not know. This has important implications because if consumers think that genetically modified tomatoes have something “different” in them, concerns will be raised. We have to be sure to educate consumers about the basic principles of biology at an early stage. There are major differences between European countries in knowledge.
Another question asked if eating genetically modified food would change a person's genes. Figure 10 shows a great amount of variation in responses to this statement. There is a better understanding in some countries (like the Netherlands, Canada, and the US). On the other hand, 40 percent of Austrians believe it to be true. This false impression may explain some of the perceived risks and fears.

One to the key issues for education is to identify and use sources of information that consumers trust. We asked US consumers whom they would trust as sources of information about biotechnology. The American Medical Association (AMA), the National Institutes of Health (NIH), the Food and Drug Administration (FDA), the American Dietetics Association, and university scientists (which are third party scientific groups) tend to be the most trusted (Figure 11). Groups like TV news reporters, biotechnology companies, packaged food manufacturers, chefs, activist groups, and grocery stores tend to have lower credibility. The lowest three are also the ones who have been most negative on biotechnology. In the European countries, this is basically reversed. Environmental and consumer groups are at the top of the list. Government and industry are both quite low in credibility. This is not surprising in light of the “mad cow” controversy and other recent problems.
LABELING ISSUES

The last set of findings seeks to determine whether or not consumers want foods developed through biotechnology to carry special labels. When surveys have simply asked “Should foods be labeled?” the majority say “yes.” But, we get a very different answer if we ask about support for the FDA policy. In this case we describe the FDA policy in a shorthand way (i.e., that foods will be labeled if they have been changed in a material way, otherwise no special labels will be required.) In the 1997 IFIC survey, almost 80 percent supported the FDA position on labeling. We believe the approach of explaining the FDA policy to consumers and then asking if they support it provides a more valid answer on the need for labeling.

In 1992 we conducted eight focus groups where a lot of time was spent talking to consumers about labeling issues. Consumers started out by saying they wanted information about everything. But then we learned that they only expect a label if the food has been changed in some way. In response to the example of recombinant chymosin, which is essentially the same as the rennet traditionally used to produce cheese, consumers said there was no need for special labels. The labels just say “enzyme,” not how the enzyme is made.

We found an interesting difference in whole versus processed foods. A consumer would want to differentiate a whole, fresh tomato so they can pick out the genetically enhanced ones. This becomes important if they are being charged a premium for that particular product. Next we asked about the case where processors blend together a range of different tomatoes to produce ketchup. The first thing a consumer would generally ask is “What do you mean that they blend together different kinds of tomatoes to make ketchup?” There is not a clear understanding that some varieties are higher in solids or some are sweeter. Processors blend them together to get the taste or consistency they want. Consumers would agree there wasn’t much need to label such processed food. Then we asked “What about tomato paste used on a frozen pizza.” By that time, consumers said they didn’t care if the tomato had been genetically modified because it is already processed.

The other thing we found was that consumers don’t place much value on labeling. We asked if they would be willing to pay more if it cost extra to keep the food segregated. People generally said, “No, we should not have to pay, just let the food companies pay for it.” However these costs would be passed on to the consumer. Labeling is not education. The recent Nutritional Labeling and Education Act (NLEA) states that information on a label should be clear, meaningful, and consistent. All labeling should start with this premise.

CONCLUSIONS AND IMPLICATIONS

Labeling is still the “hot button” issue for activist groups. The FDA requires labeling when there is a significant change. For most consumers, that is all that’s really meaningful. The costs and logistical problems with segregating
commodities are considerable. If there is no real benefit for a consumer, it will be very hard to recover these additional costs. A label on a processed food that says it contains genetically modified organism (GMO) ingredients is not going to be helpful to consumers. It will raise anxiety and confusion about what the statement means. There will be niche producers of non-biotech crops if there is a premium market.

The majority of US consumers have positive attitudes about biotechnology. They perceive benefits and will buy the products. The NatureMark™ potato did quite well in market tests when they were labeled and put next to others. Consumers perceived a benefit of the reduced use of pesticides. There was a very clear preference among British consumers for tomato paste from genetically modified tomatoes. Biotechnology is not a high priority issue for consumers. When studies ask “What is the major problem facing our country?” no one says “biotechnology.” Maybe one percent will say “the environment.” Nobody even says “food.” The biggest concerns are crime, the economy, and breakdown of moral values. We have conferences like this where everybody is interested in the subject. However, the average consumer is just not interested or concerned.

Consumers’ attitudes about biotechnology are closely related to their general beliefs about science, technology, and food. In the US, there is a strong public support for and appreciation of science. People recognize that they have received major benefits from science and technology. The public may feel there is a potential down side, but overall they are very supportive of new developments. People are pragmatic about food. With any food product, consumers mainly want to know about taste, nutrition, safety, convenience, and price. Those are the main questions a consumer will want answered about food produced through biotechnology or any other means.

The future prospects in Europe are less certain, at least in the short term. Seed companies, farmers, and suppliers in the US and Canada want to make sure the European controversy is short lived. The US government is not going to accept mandatory segregation of crops. That would be a logistical nightmare. The Europeans had a chance to buy elsewhere in 1996 when the transgenic crops were introduced. Now, South American farmers and others are starting to raise crops developed through biotechnology. In fact, more products are going to arrive on the market from around the world. Europe will soon have few options except to pay more for food certified as “GMO-free.” European leaders also have concerns about lost jobs, increased food prices, and other economic costs that are going to result from rejection of biotechnology.

Educational efforts will continue to be very important in Europe. Such efforts are starting to take hold among European leaders and consumers. A meeting sponsored by the Georgetown Center for Food and Nutrition Policy in Washington, DC, a little over a year ago invited leaders from the European Union. They were hungry for information. These were some of the top

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European officials, but most of what they had heard about biotechnology up to that point had come from Greenpeace.

Statistical analysis has helped evaluate what influences people's acceptance of biotechnology (Hoban et al., 1993). At the top of the list is awareness and knowledge. People need to have some level of knowledge about biotechnology. They also need to recognize a societal benefit or feel there is something in it for them personally. They need to view it as ethically acceptable. Ultimately acceptance comes down to confidence in government and trust in the information sources.

The educational opportunities and challenges are very important. There still is a lot of work to do in Europe. In the US, we've been able to effectively reach consumers by educating opinion leaders, including scientists and government officials. The media in the US have had ample opportunity to learn about biotechnology. Through groups like the NABC and the IFIC, they are provided with the latest factual information on biotechnology. Finally, farmers and the food industry need more education. It is very important that food retailers and others who have direct contact with consumers have enough information to answer any questions.

Through education, we need to talk about the benefits and the uses of biotechnology. This will give people a reason to accept the products. We must address consumer concerns, including labeling, allergens, and other questions that are on people's minds. It is also important to tell consumers about third-party oversight and regulations. Consumers want to know that the government is regulating biotechnology. In the US, the FDA and the USDA have done a good job of keeping the public confidence high. Europe has been a much different story.

Finally, it is important to put biotechnology into a historical context. We need to tell people that we have been breeding plants for years. Some consumers seem surprised to learn that scientists have already changed plants. Overall, we need to increase consumer understanding of food production and processing. Most consumers simply think that food comes from the grocery store or, increasingly, from restaurants. These are all part of the educational challenges and opportunities with biotechnology.

REFERENCES