Consumer Acceptance

Issue

Consumer responses to genetically engineered (GE) foods have varied widely worldwide. How commonly held are specific consumer preferences with respect to GE products? What impact do they have on domestic policies and consumption of biotech crops? What implications do policies and differences in policies have for trade in agricultural products?

Context

U.S. consumers have voiced little objection to genetically modified foods, while EU consumers have been vocal in their disapproval. Attitudes of consumers in Japan and Australia in the mid-1990's were generally favorable toward biotech crops, although Australian consumers generally regard biotech crops as risky. These attitude differences have resulted in differences in regulatory policies and in the potential for trade disputes.

In response to increases in calls to consumer helplines, vocal consumer concern, and the initial actions of one or two retail chains, a number of the major European grocery chains and food processors are attempting to eliminate GE ingredients from their foods. Reaction in other countries has not been quite as severe. Some food processors in Japan are worried enough about consumer perceptions that they have begun trying to use non-GE ingredients in their food products. In the United States, only a few protests have been heard and few major food manufacturers have reacted. Australian opinion polls indicate a desire for benefits and positive characteristics but a fear of the risks.

Results of attempts to measure these differences with opinion polls within and across countries have varied. Leopold and Hoban (1996) both note differences across EU countries. Some of the EU survey results are similar to those for the United States.

One can draw a few conclusions from the results of the surveys. Surveys that asked the same questions of both EU and U.S. consumers generally elicited less favorable responses toward genetic engineering in food from EU consumers than from U.S. consumers (see the Environics and *Economist* polls). Greater approval is associated with survey questions in which the surveyors suggested that the food would have desirable characteristics (Hoban, 1993, 1998) (compare table 4 with tables 5 and 6). Zechendorf and Frewer, Howard, and Shepherd note that specific applications really make a difference in determining public acceptance of biotechnology—for example, consumers support medical applications more than food applications.

With respect to the existence of GE foods in the marketplace, Hoban and Katic found that 37 percent of U.S. respondents did not think that GE foods were currently sold and that 23 percent did not know whether or not they were sold. The 1999 International Food Information Council (IFIC) poll found similar results. IFIC's May 2000 poll, however, indicates that only 23 percent do not think that GE foods are sold, while 34 percent do not know. Hoban's work also indicates that genetic engineering of animals is less accepted in the United States than engineering of plants (table 7) (Frewer, Howard, and Shepherd).

Finally, Australian and European consumers seem more likely to attach risk to genetically modified foods (table 8). A 1995 Food Marketing Institute survey indicated that most U.S. and European consumers are much less concerned about risks from biotechnology than about risks from pesticides and other food safety hazards (Hoban, 1998). The percentages were closer in Australia: 71 percent considered GE plants a big concern, and 79 percent considered pesticides that way (Kelley).

There are many possible reasons for increased concern in Europe compared with the United States. The Bovine Spongiform Encephalopathy (BSE), or Mad Cow Disease, crisis in England and other food safety scares, like the Belgian dioxin scare, have raised con-

cern about food safety and have increased distrust of government assurances of safety.[5] In these cases, the national governments either originally underestimated the extent of a foodborne health problem or delayed giving the public information about it.

[5]In spring 1999, dioxin was introduced into the Belgian food supply, including exports, via contaminated animal fat used in animal feeds supplied to Belgian, French, and Dutch farms. Hens, pigs, and cattle ate the contaminated feed, and high levels of dioxin were found in meat products and eggs.

The September 1999 Gallup poll indicated that 61 percent of Americans place "a fair amount" and 15 percent place a "great deal" of confidence in the Federal Government to ensure the safety of the food supply. European results are more mixed. When asked what gave them certainty about a food's safety, 66 percent of European consumers reported national controls to be a factor (*Eurobarometer* 49). More chose national controls than any other

Table 4—Survey results on consumer attitudes toward biotechnology in agriculture

Country	Year	Question/issue	Response
United States	1988/89	Plant GE (asked to assume not harmful to humans or environment) (Hoban, Woodrum, and Czaja)	54 percent said desirable, 23percent neutral, 23 percent undesirable
Australia	1993	Would you eat genetically modified foods? (Kelley)	56-66 percent said yes, depending on the food
United States	1999	Biotechnology used in agriculture and food production (Gallup)	51 percent strongly supported or moderately supported
United States	1999	Would they be more or less likely to buy a food because it was genetically modified? (*The Economist*)	57 percent said less likely
United Kingdom	1998	GM products (Greenberg)	51 percent said unacceptable
Germany	1999	Would they be more or less likely to buy a food because it was genetically modified? (*The Economist*)	95 percent said less likely

Table 5—Survey results on consumer attitudes toward biotechnology to improve foods

Country	Year	Question/issue	Response
Japan	1995	Biotechnology used to develop improved crop varieties (Hoban, 1996)	10 percent strongly supported, 72 percent supported
United States	1992, 1994, 1997,	Biotechnology used in agriculture and food production to improve foods (Hoban, 1998)	2/3 support
United States	1995	Biotechnology used to make foods taste better, stay fresh longer, prevent disease (Hoban, 1996)	75 percent support
United States	1997, 2/99, 10/99, 5/00,	How likely to buy produce modified by biotechnology to taste better or fresher? (IFIC, 10/99, 5/00)	55 percent likely/somewhat likely, 62 percent, 51 percent, 54 percent
Europe	1996	Genetic modification to change food characteristics (*Eurobarometer* 46.1)	53 percent said useful, 47 percent said risky, 40 percent said morally acceptable
Australia	1993	Genetic modification to change food characteristics (Kelley)	64-82 percent said "good idea," depending on the food

determinant. However, when asked whether various institutions tell the whole truth, part of the truth, or none of the truth about food safety, 52 percent of European consumers chose the whole truth for consumer associations, while only 26 percent chose that option for government authorities (*Eurobarometer* 49).

Another reason for increased European concern is that Europe's dense population places population and farming centers very close to wildlife centers, which creates concerns about encroachment. Many European countries have very vocal Green parties, and environmental concerns about crops produced with biotechnology are thus at the forefront of policy discussions.

Table 6—Survey results on consumer attitudes toward biotechnology to make plants resistant to pests or herbicides

Country	Year	Question/issue	Response
United States	1992	GE used to make cotton plants resistant to herbicide (Hoban, 1993)	70 percent said acceptable
United States	1999	Do you favor the use of biotechnology to grow pest-resistant crops that require fewer farm chemicals? (Environics, *The Washington Pos*t)	78 percent favor/somewhat favor
United States	1997, 2/99, 10/99, 5/00	How likely to buy produce modified by biotechnology to be protected from insect damage and require fewer pesticides (IFIC, 10/99, 5/00)	77 percent very/somewhat likely, 77 percent, 67 percent, 69 percent
Europe	1996	Genetic modification to make crops disease resistant (*Eurobarometer* 46.1)	68 percent said useful, 53 percent said risky, 63 percent said morally acceptable
France	1999	Do you favor the use of biotechnology to grow pest-resistant crops that require fewer farm chemicals? (Environics, *The Washington Post*)	52 percent favor/somewhat favor

Table 7—Survey results on consumer attitudes toward biotechnology in animal production

Country	Year	Question/issue	Response
United States	1992	GE used to make larger sport fish (Hoban, 1993)	35 percent said acceptable
United States	1988/89	Animal GE (asked to assume not harmful to humans or environment) (Hoban, Woodrum, and Czaja)	26 percent said desirable, 21 percent neutral, 53 percent undesirable

Table 8—Survey results on consumer attitudes toward biotechnology in agriculture as a health hazard

Country	Year	Question/issue	Response
Australia	1993	GE food plants might be a danger to human health over time (Kelley)	71 percent said a big worry
Europe	1995	Genetically modified crops as health hazards	33-50 percent in each country said health hazard
United States	1999	Does food produced using biotechnology pose a health hazard to consumers? (Gallup)	27 percent said yes, 53 percent said no

Consumer advocacy groups have been more vocal in their complaints about crops produced with biotechnology in the EU than in the United States. Some have suggested that Nazi emphasis on eugenics during World War II caused Europeans to regard genetic manipulation with suspicion (Davison, Barns, and Schibeci). In several studies in the U.K., Frewer, Howard, and Shepherd found that British consumers view minor food changes as frivolous or unnecessary.

Policies

Approval Policies

Most industrialized countries require crops produced with biotechnology to be assessed for both their environmental impacts and their safety as foods. Regulation of GE commodities in the EU has been conservative, involving considerable scrutiny and featuring separate regulations for different types of GE crops. Overall, fewer varieties of GE crops are allowed in Europe than in the United States (table 9).

The United States has incorporated regulation of biotech crops into its current regulations for foods, plants, and pesticides. The fact that the plant has been genetically altered is less important than the specific effects of the alteration. The United States requires just a few additional regulatory steps for GE varieties where the food, its donor organism, and its host organism are generally regarded as safe for consumption and the environment. As with other types of foods, the regulatory agencies would pay much more attention to genetically modified varieties that are significantly different from currently available foods.

The Food and Drug Administration (FDA), regulating food applications of crops produced with biotechnology, relies on current laws, which hold manufacturers of foods responsible for providing safe foods. FDA considers a GE crop safe if it is substantially the same as its non-GE version and the genetic modification does not cause the crop to produce a substance that is new or used in a new way or that is present in much larger amounts than in currently safe food. If the genetic modification produces a new substance that is not an approved food additive, the safety of the new substance as a food must be proven. If natural levels of toxins are increased or if allergens are transferred to a new variety, FDA recommends that the firm consult with it on safety procedures (*Federal Register*, May 29, 1992).

FDA has a consultative process that it recommends to all manufacturers of food produced with biotechnology, and thus far, all manufacturers have used the process. Firms submit data on the genes, the host plant, and any quantities of various proteins that are different than in foods already on the market. FDA then examines the data (*FDA Consumer*). As of May 2000, with the Clinton Administration initiative, this consultation process became mandatory White House Press Release).

USDA's Animal and Plant Health Inspection Service (APHIS) regulates the planting and cultivating of the crop. Companies notify APHIS that they are planning a field trial of a GE plant. In addition, APHIS can require more careful isolation if the plant might become a pest (*Federal Register*, May 2, 1997). To grow a GE crop commercially, a company can petition for unregulated status for the crop. The application

Table 9—Regulation of agricultural biotechnology by agency

Item	United States	EU
Release into environment for commercial production, field tests	Regulated by USDA's Animal and Plant Health Inspection Service	Regulated by member state governments, with input, if members disagree, from Scientific Committee, European Commission, and possibly the Council, under Regulation 90/220
Food safety	Regulated by FDA	Regulated by member state governments, with input, if members disagree, from Scientific Committee, European Commission, and possibly the Council, under Regulation 258/97, the Novel Foods Act
Pesticidal or herbicidal varieties	Regulated by EPA	Subsumed under one of the processes above

must include descriptions of plant pest risk, weediness, and transfer of genetic material, as well as field trials (*Federal Register*, May 2, 1997).

Finally, if the plant has been engineered to produce a substance that "prevents, destroys, repels or mitigates a pest"—or example, an insect herbivore—EPA regulates the substance as a pesticide and determines how much of the substance may be present in food. The level that may be present in food is called a "tolerance." EPA also has the authority to exempt a pesticide from the requirement of a tolerance. When an exemption is granted, no limit is set on the amount of the pesticide that may be present in food. EPA may exempt a pesticide from the requirement of tolerance only if the pesticide is safe for consumption. EPA also regulates pesticidal substances to ensure that they do not present unreasonable risk to the environment. EPA has the authority to require that data be developed and submitted to ensure that there is no harm to human health and no unreasonable risk to the environment.

In 1994, EPA published a statement describing its policy for substances in living plants that prevent, destroy, repel, or mitigate a pest (*Federal Register*, November 23, 1994). Because herbicides are pesticides, EPA establishes tolerances for herbicides used on herbicide-resistant biotech crops. EPA also regulates the use of the herbicide in the environment. Through this regulation, EPA can evaluate aspects of the trait endowing the plant with the ability to resist the herbicide.

The United States has subsumed regulation of biotech crops under its established food and environmental regulations, while the EU has designed regulatory processes specifically for biotech crops, and each GE crop is evaluated, regardless of similarity to existing varieties. In the EU, Regulation 90/220 currently regulates release of biotech crops into the environment (European Union, 1997). Regulation 258/97, established January 27, 1997, and known as the Novel Foods Act, requires that all biotech crops sold as food go through an approval process (European Union, 1990). Both regulations require an environmental impact assessment and follow a similar pattern. The approval process came to a halt in 1999 as the EU began redesigning its regulations.

Japan, like the United States, regulates biotech crops by dividing the responsibility among established agencies. Companies submit field tests to the Ministry of Agriculture, Forestry and Fisheries (MAFF) for an environmental impacts assessment. The Japanese MAFF also assesses the safety of the product as a feed, while the Ministry of Health and Welfare assesses the safety of biotech crops as food (Japanese Ministry of Agriculture, Forestry and Fisheries).

Biotechnology and the Environment

Some consumers and interest groups have expressed concern about the potential effects of large-scale release of biotech crops into the environment.

The following are frequently mentioned areas of concern:

- Potential spread of transgenes into other plants, resulting in unintended harmful consequences—that is, development of resistant weeds and contamination of non-GE or organic crops.
- Development of Bt resistance by the target insects.
- Unanticipated harmful effects on nontarget organisms in the ecosystem.

There is little evidence, thus far, of any environmental damage from the release of biotech crops; however, planting of GE crops has been widespread for only 4 years. While field tests show no evidence similar to that of the highly publicized Monarch butterfly laboratory studies, the associated concerns suggest the need for continued monitoring and testing of the environmental impact of GE crops in actual field situations. These concerns have led USDA to propose the establishment of regional centers to monitor long-term effects of biotech crops on environments.

Concern about the environmental safety of GE crops suggests the need for comprehensive risk assessments of GE products. Risk analysis of biotechnology is very complex, as the situation is unique for every crop, each genetic modification, and each environment. Comparing any risks associated with biotechnology with risks of competing technologies is important—that is, chemical pesticides versus Bt crops, increased use of glyphosate versus other herbicides, or planting a GE crop with increased productivity versus bringing new land into production for a standard variety with lower productivity. Risk assessment that enhances consumer confidence and trust is likely to contribute to the smooth running of markets.

Labeling Policies

A number of governments require or are considering requiring that foods with genetically modified ingredients be labeled as such. The United States requires labeling only if GE versions of foods are substantially different from their traditionally bred counterparts—for example, if allergens are added or nutritional content is changed. The EU requires that all foods containing biotech commodities be labeled. Japan, Australia, and New Zealand have draft legislation for labeling, and other countries are considering requiring labeling (New Zealand Ministry of Health and Australia New Zealand Food Authority).

Deciding what to label has proven difficult for retailers and regulators. Some consumers would like to buy GE-free products, and firms would like to provide them. However, if the same trucks, containers, ships, or processing plants have been used for both non-GE and GE varieties, cross-contamination can occur. Thus, regulations specifying what must be labeled as containing GE material or what can be labeled "not genetically engineered" will have to specify some minimum tolerance level for GE material. Otherwise, "not genetically engineered," while technically possible, will be a prohibitively expensive standard to attain (Lin, Chambers, and Harwood). The EU, for instance, has enacted a 1 percent tolerance level (European Union, 2000).

At Stake

Consumer preferences and the design of policies to reflect those preferences could affect trade in three areas: approval regulations, labeling, and consumer demand for products. In addition to regulating whether or not products of biotechnology may be sold in a country, a government might enact labeling regulations or voluntary policies. The effect on trade would be dictated by the costs of labeling and by how consumers use the information.

Effects of Approval Regulations on Trade

EU regulations have kept most U.S. corn from entering Europe. Because some GE varieties had not been approved for sale in the EU, U.S. corn exports to the EU fell from $190 million in 1997 to a mere $35 million in 1998 and to $6 million in 1999. This phenomenon has affected all U.S. corn exports to the EU, even exports destined for animal feed. (U.S. corn exports to the EU were only about 4 percent of total U.S. corn exports before 1998.) The most widely used variety of GE soybeans has been approved in the EU, however. In 1998, $1.5 billion in U.S. soybeans entered the EU, and in 1999, $1.2 billion, each making up 33 percent and 27 percent of U.S. soybean exports (U.S. Department of Agriculture, 1998).

Effects of Foreign Labeling Regulations on Trade

The effects of labeling on trade depend on the products that must be labeled and the costs of labeling. As previously discussed, a number of countries have drafted legislation to require that certain products made from biotech commodities be labeled accordingly. When commodity dealers in these countries import U.S. biotech crops, they must consider these labeling requirements.

Specific product requirements for labeling are important in determining the effect of labeling requirements on trade. Of the biotech crops currently produced in the United States, the two most commonly exported are corn and soybeans. Some of the exports are used in food, but most exported corn and soybeans are used for animal feed. Whether or not U.S. exports of these crops are affected by labeling requirements depends on whether the country requires labeling for feed or just for food. In addition, the types of food products that must be labeled can affect trade. Some countries exempt certain products from labeling but require labeling for others. In these cases, the effect of labeling on trade will depend on whether or not U.S. exports to that country are composed of foods for which labeling is required (U.S. Department of Agriculture, 2000).

The cost of labeling could also affect U.S. exports. The cost of simply putting a label on a shipment is not very high. However, labeling could have a number of other costs. For instance, an exporter selling U.S. crop varieties not produced with biotechnology would not have to label the product. However, the usual method of exporting grains is to mix them together to take advantage of grain shipping, storing, and inspecting systems, which keeps costs low by processing grains in bulk. In order to avoid mixing the product with GE varieties and, thus, having to label it, the U.S. exporter who is selling nonbiotech varieties would have to carefully separate the grain from the normal shipping channels and handle it separately. This would result in higher costs (Lin, Chambers, and Harwood).

Effects of Consumer Preferences on Trade

The purpose of labeling, whether mandatory or voluntary, is to provide information to consumers. Consumers then use the information to decide whether or not to alter their purchasing behavior. The size of the impact that consumer demand for GE crops has on U.S. exports depends on how much consumers change their purchasing behavior in response to labeling.

According to consumer surveys, some consumers in some countries may prefer not to eat genetically modified products (table 4). In some countries, some supermarket chains and food processors have pledged to exclude GE crops from their own brands of processed foods. They are doing this by either eliminating corn and soybeans from processed products or buying nonbiotech grain. Finding alternatives to U.S. soybeans as an animal feed has proven to be much more difficult.

In essence, these consumers, by demanding nonbiotech food products, are shifting their demand away from bulk shipments of soybeans and corn, which could contain GE crops. The lower demand for GE grains, if sufficiently large, could reduce the price of bulk shipments. The size of the reduction, however, would depend on the number of customers who wanted non-GE crops, and this currently appears to be a niche market. The price of non-GE crops would be high because of the expensive handling requirements. The market for non-GE grains will exist as long as some consumers' willingness to pay for this type of food is as high as the costs of manufacturing such food (U.S. Department of Agriculture, 2000).

Foreign approval regulations, foreign labeling regulations, and consumer preferences, therefore, can affect trade in biotech crops. The size of the effects will vary, depending on the types of goods and crops considered.

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