The Food Industry

SUSAN HARLANDER
BIOrational Consultants, Inc.
New Brighton, MN

Since their commercial introduction in 1996, genetically modified (GM) crops have been rapidly adopted in the United States. Because the Food and Drug Administration (FDA) considers them "substantially equivalent" to their traditional counterparts, GM crops require no special labeling and are managed as commodities with no segregation or identity preservation. This is not the case in other parts of the world where products containing genetically modified ingredients must be labeled if their content exceeds specified threshold levels. This dichotomy creates challenges for the food industry in complying with various labeling guidelines in the countries in which they conduct business. Compliance with such guidelines requires the availability of identity-preservation systems and robust, accurate, specific, reliable, standardized, and validated testing methods to ensure compliance with established threshold levels for GM ingredients. Some food companies have indicated that they will avoid the use of some or all GM ingredients in their products, although the majority have not followed suit. Various consumer-interest groups are calling for labeling of all products containing GM ingredients. The implications of such labeling will be discussed. The food industry has been monitoring the opinions of their consumers on the GM issue for the past several years, and the results of these surveys will be shared.

ACCEPTANCE OF GM

Genetically modified crops are ubiquitous in the United States. In 2001, it is predicted that 26% of the corn, 68% of the soybeans, and 69% of the cotton grown in this country will be GM varieties. They have gone through rigorous food- and environmental-safety tests; the FDA has reviewed fifty-nine GM crops. Numerous scientific organizations and United States and international regulatory agencies have endorsed their safety.

Examples of GM crops include insect-resistant (Bt) corn, cotton, potato, and tomato; herbicide-tolerant soybean, corn, rice, sugar beet, flax and canola; and virus-resistant squash, papaya, and potato. Advantages of insect- and virus-resistant crops include improved yields and reduced use of pesticides. Advantages of herbicide-tolerant crops include improved weed control, reduced crop injury, use of short-lived herbicide, reduction in foreign matter, reduced fuel use, and significant reduction in soil erosion. For these reasons, GM has become the most rapidly adopted technology in the history of agriculture.

Genetically modified crops are managed as commodities in the United States, and thus have made their way through commodity-distribution channels into thousands of ingredients used in processed foods. Examples of soy-derived ingredients include oil, lecithin, protein isolates, and mono- and diglycerides. Examples of corn-derived ingredients include oil, starch, flour, meal, dextrose, and high-fructose syrup. It has been estimated that 70 to 85% of processed foods contain one or more ingredients potentially derived from GM crops.

Acceptance of GM products varies throughout the world, creating a challenge for multinational food companies that have made commitments to take into account consumer preferences when making decisions regarding the ingredients in their products. Many countries have or are developing mandatory GM-labeling guidelines. Retailers in the United Kingdom have banned the use of GM ingredients in their private label products, causing major food companies to respond in kind. GM-labeling guidelines differ throughout the world, creating a complex situation for food manufacturers.

LABELING OF GM FOODS

Most food manufacturers are avoiding the use of GM ingredients in those countries that have instituted mandatory GM-labeling, because consumers perceive a label as a warning. To avoid such labeling requires the use of ingredients derived from non-GM varieties that have been identity-preserved throughout the entire supply chain: from seed to final product. Identity-preservation (IP) systems add cost and complexity to the supply chain, and are reliant upon adequate chain-of-custody documentation and GM-testing systems. Unfortunately, there are few good estimates on the cost of IP ingredients, but they may range from 5% to 150% over farm-gate prices. Food manufacturers must develop new specifications for non-GM ingredients, and audit systems to ensure compliance by ingredient suppliers. Manufacturers must understand the complete profile of all primary and secondary ingredients used in their products. For example, cornstarch is frequently used as a carrier of vitamins in fortified products, but may not be identified as an ingredient in the vitamin mix.

Mandatory labeling also demands the availability of robust standardized and validated sampling and GM-testing systems that are quantitative, reliable, accurate, and reproducible. Adventitious contamination due to cross-

pollination is inevitable; therefore, quantitative assays will be required for setting tolerances or threshold levels of contamination. Tests must be simple, inexpensive, and capable of detecting GM contamination in the range of products in the marketplace. Unfortunately, validated and standardized sampling and testing methods do not exist, except for a protein test for Roundup Ready® soybean. Authenticated reference standards are not available, and testing protocols vary from laboratory to laboratory. False-positive and false-negative rates are unacceptably high. There is no standardization on how the results are reported to food companies. The food matrix has a dramatic impact on extractability of DNA and protein, and protocols will need to be developed to take this into account. Since labeling is not required in the United States, detection methods have not developed as rapidly has as GM technology. This deficiency will cause significant issues as disputes arise about GM status of foods.

Most food companies have decided to remove GM ingredients from products marketed in countries with mandatory GM-labeling laws. Some companies are sourcing raw agricultural commodities from countries (*e.g.* Brazil) that have not yet approved the commercial cultivation of GM crops. However, this does not provide adequate assurance of non-GM status, since it has been estimated that 13% (some estimates are as high as 25%) of Brazil's 7.5 million acres of soybean are planted to GM varieties, even though their use is not approved in that country. Some companies (*e.g.* Gerber and Heinz) have decided to remove GM ingredients from baby foods marketed in the United States. Frito Lay has instructed its farmers not to grow GM corn varieties, and McDonald's will avoid GM potatoes. Neither Frito-Lay nor McDonald's has said that it will avoid other GM ingredients in its products, or that it will advertise or label its products as non-GM.

The FDA recently published draft guidance on the voluntary labeling of foods containing or not containing GM ingredients. In this document, the FDA affirmed that mandatory labeling is not required for bioengineered food, unless the food is "materially different." Since the majority of bioengineered foods reviewed by the FDA are substantially equivalent, no labeling is required in the United States. For manufacturers who wish to voluntarily label their products, the agency provides the following guidance: labels must be truthful and non-misleading, therefore, data are required to substantiate label claims. The FDA provided advice on terminology; "genetically modified" is not recommended since it is not technically accurate; all food has been genetically modified through conventional plant breeding. "Genetically modified organisms" is also misleading as most foods do not contain viable organisms. The FDA believes that it would be misleading to label a food as "GM-free" due to the potential for adventitious contamination due to cross-pollination. They did not establish a threshold level of contamination because accurate and reliable testing methods do not exist. A statement that a food is not bioengineered nor does it contain

bioengineered ingredients may be misleading if it implies the food is superior to foods that are not so labeled. Further, to make a "non-bioengineered" claim, all ingredients in the product must be from non-GM varieties, and if no bioengineered varieties of that category of foods or ingredients are marketed, such a claim would be misleading. Some companies are overtly labeling their products as GMO-free or non-GM. They procure ingredients from suppliers who certify that non-GM varieties have been used for ingredient manufacture. However, a recent study by the Wall Street Journal reported that, of twenty products labeled "non-GM," sixteen contained measurable quantities of GM DNA. Therefore, even under best-case scenarios, it is very difficult to guarantee that the "non-GM" label is truthful.

"Organic" and Other Concerns

Organic growers have expressed concern that cross-pollinating GM crops such as corn can jeopardize their crops. The USDA Organic Guidelines preclude the use of genetic modification for anything to be labeled as organic. Since it is impossible to prevent cross-pollination, it may be necessary to establish a tolerance or threshold level for adventitious contamination.

Genetically modified foods do not appear to be as big a consumer issue in the United States as in other parts of the world. Food manufacturers have been monitoring their 800 numbers for an indication of how their consumers feel about GM foods. To date, the number of calls on biotechnology remains very small (0.1% to 0.2%) for most major food companies in this country. Awareness has increased slightly over the past 18 months, and consumers are evenly divided between support and opposition. Calls increase during periods of intense media coverage. Companies targeted by activist groups report periodic increases in numbers of calls. If a brief explanation of biotechnology is provided, acceptance increases significantly, indicating that education is an important factor in consumer acceptance.

Most food companies in the United States are not avoiding bioengineered ingredients for domestic production. In general, the food-processing industry has confidence in the safety of bioengineered foods. Because GM crops have been readily adopted in the United States, availability of non-GM crops has been limited and these ingredients are more expensive. Even when efforts are

Most food companies in the United States are not avoiding bioengineered ingredients for domestic production. In general, the food-processing industry has confidence in the safety of bioengineered foods.

made to procure non-GM ingredients, adventitious contamination is an issue, and IP systems have not been perfected as was illustrated with the StarLink™ incident in 2000. The food industry would need to be able to accurately forecast their supply needs for non-GM ingredients so farmers could be instructed on the quantities required. In addition, the food industry lacks separate storage, processing, labeling and transportation capabilities required to ensure separation of GM and non-GM raw materials and final products. There is little confidence in the adequacy of current GM sampling and testing methodology to substantiate label claims and there is substantial liability if label claims are inaccurate. Finally, the food industry hopes that the next generation of bioengineered products will deliver compelling consumer benefits.

The food industry hopes that the next generation of bioengineered products will deliver compelling consumer benefits.

Future of Ag and Food Biotech

The next generation of bioengineered foods will focus on "output traits" that provide processing advantages and tangible consumer-relevant benefits. Biotechnology can be used to remove allergens, natural toxicants and antinutritional factors from foods like peanuts, soybeans, rice, and wheat. Taste, texture, aroma, ripening time and shelf life of fresh fruits and vegetables can be improved. It will be possible to improve the nutritional quality of foods. Examples include modification of the saturation level of oils to produce products high in mono-unsaturated fatty acids that are more stable, resist oxidation, do not require hydrogenation and reduce cholesterol levels when consumed. It is possible to increase the content of vitamin E and other antioxidants, and to insert the capability of producing plant-based omega-3 fatty acids into oil seeds. Biotechnology can be used to elevate levels of vitamins A, C, and D, and folate, and enhance iron bioavailability in vegetables, fruits and grains. It is also possible to increase levels of various phytochemicals in plants that have been associated with disease prevention, e.g. lycopene in tomatoes and sulfurofane in broccoli for reducing cancer risk, and lutein in vegetables for reducing risk of macular degeneration. The advancing fields of human and plant genomics and proteomics will identify additional plant-based compounds that could have positive effects on human health. These are the kinds of products that excite food companies and ultimately will excite consumers.

The advancing fields of human and plant genomics and proteomics will identify additional plant-based compounds that could have positive effects on human health. These are the kinds of products that excite food companies and ultimately will excite consumers.

The future of agricultural and food biotechnology will depend on a number of factors including continued grower support, food-industry and retailer unanimity on policies regarding the use of GM ingredients, government consistency, documentation of tangible consumer benefits without undue risk, and consumer education and acceptance. Additionally, until there is international harmonization on GM foods, turmoil in the marketplace will continue. Without consumer acceptance and a coordinated approach across all segments of the food-supply chain, the promises of agricultural and food biotechnology could be limited.