Economic Risks of Genetically Engineered Foods in International Trade

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Abstract

The controversies surrounding the use of genetically engineered ingredients in processed foods have sparked global public interest debate regarding the safety of the food system. The debate has raised concerns about the possibility that the consuming public will reject foods with genetically modified ingredients. Such rejections carry economic and political risks that could create disruptions in the food production, distribution and processing system with the potential to inhibit international trade. This paper identifies some of the issues that have fueled the genetically modified food debate and evaluates the economic risks of genetically modified organisms (GMOs) in the food system.

Introduction

Agricultural biotechnology is the application of science and engineering in the direct or indirect use of living organisms, or parts or products of living organisms, in their natural or modified forms. Biotechnology uses genetic engineering in the transference of specific genetic information or material from one organism to another. GMOs (with numerous variants of the name)[1] are organisms whose genetic materials have been altered by any technique including natural processes, mutagenesis, genetic engineering or others (http://cbc.ca/news/in-depth/foodfight/hachey.html). A genetically modified plant=s cell nuclei contain artificial laboratory-inserted gene or set of genes which are then taken up by the receptor=s chromosomes. The inserted genes may come from a different species, like a bacterium. Bt corn, for example, contains a sequence of genes from the bacterium, Bacillus thuringiensis (discovered at the turn of the century), which causes it to produce its own biopesticide (Center for Life Sciences, Colorado State University, available on the World Wide Web or the Internet at http://www.cnn.com/).

Genetically Modified Organisms (GMOs) in manufactured food products made their debut into the food system less than a decade ago, but they may have already generated more controversy than that associated with the entire green revolution. Much of the discussion on GMOs have focused on issues that are related to the moral and ethical dilemma associated with the unnatural transfer of genetic materials between species that could not otherwise occur naturally, the release of artificially created crops into the environment with incomplete or limited consideration of long-term health and environmental effects. Opponents of GMO technology have claimed, also, that genetic modification could bring about a reduction in crop diversity and generate long-term nutritional uncertainty of the effects of diets containing GMOs. Long-term effects of GMO-based nutrition may be different from what may be expected from traditional foods. The legal and ownership issues related to genetic material are also important issues in GMOs.

Although the number of countries growing GM crops doubled, from 6 to 12 between 1996 and 2000, only three, the United States, Argentina, and Canada, account for 98% of total worldwide acreage planted to all genetically modified crops (ISAAA, 2000; Belsie, Laurent. 2000, http://www.plant.uoguelph.ca/safefood/archives/agnet-archives.htm, December 21; Table 1). About 100% of the GM crop seeds planted in 2000 involved four main crops: soybeans, corn, cotton and canola that

[1] Other names for Genetically Modified include: Genetically Engineered, Genetically Altered, and Genetically Manipulated, among others. These labels are used interchangeably throughout this paper, and overs the general term, Aagricultural biotechnology@.

have been modified for herbicide tolerance (73% of area planted), insect resistance (22%), and unstacked traits of herbicide tolerance and insect resistance (5%). In the 2000 planting season, genetically modified soybeans accounted for 58% of the total area sown to GM crops, maize (corn) accounted for 12%, cotton accounted for 12%, and canola accounted for 7%. According to the ISAAA (2000), worldwide, GM crops accounted for 34% of the 72 million hectares cultivated to soybean, 16% of the 34 million hectares planted to cotton, 11% of the 25 million acres planted to canola and 7% of the 140 million hectares planted to maize (corn). Overall, about 16% (43 million hectares) of the world=s total crop area (273 million hectares) are planted to transgenic crops. For example, Monsanto=s genetically modified seeds are planted on 87% (86 million acres) of the total number of acres devoted to GM crops worldwide in 1999, an increase of 48% from the 1998 figure of 58 million acres (available online at http://www.rafi.org). Worldwide, about 42.7 million hectares were planted to genetically modified crops compared to only 1.7 million hectares in 1996 and sales of genetically modified crops rose from $75 million in 1995 to almost $2.3 billion in 1999. In spite of this trend, consumers in countries trading with the U.S. have registered their unhappiness with having modified ingredients in their foods (Prideaux, 2000; Vidal, 2000; Gaskell, 2000; Loader and Henson, 1998).

Objectives of paper

This paper (1) provides a general background to issues surrounding the debate on GMOs in the food system, (2) examines the economic risks and other marketing issues surrounding the GM foods controversy, and (3) explores policy issues and consequences for domestic and international trade.

Data and Methodology

Data used for this paper come from government and non-government publications. Food and Agricultural Organization (FAO), the United States Department of Agriculture/Foreign Agricultural Service/Economic Research Service, and the U.S. Department of Commerce publications and data are used in accomplishing the stated objectives of this paper. Descriptive and qualitative methodologies are applied to data collected.

Findings and Discussions

The issues surrounding the introduction of GMOs in international agricultural trade are quite complex and promise to have significant trade and other micro and macro economic effects. What effects, the extent of the effects, when and how these effects can be measured will pose significant challenges to scientists, politicians and lawmakers in countries that have been part of the international trading system for the last few decades. For example, although the European soybean market still represents a lucrative $1.1 billion to U.S. producers, loss of the European Union corn market has been estimated to cost the U.S. $200 million per year since 1998. The following discussion focuses on the economic risks of GMOs:

- **Producer/consumer economic risks**

American farmers are quite worried about who will buy their genetically modified crops and food products. In a December 11, 2000 story in the NY Times, David Barboza noted that genetically modified corn promises to change the dynamics of the grain industry. Grain elevators must now be able to divide,

sift, weigh, grind and sniff corn samples and check for Cry9C, for example, a protein found in some genetically modified corn varieties. These checks have put tremendous burdens and additional testing costs on the nation=s grain handling system -- Aa logistical nightmare@ for traditional elevators which were built to handle a lot of corn with processing capabilities that are not designed for this kind of grain segregation. Push for testing and segregating GM corn from non-GM corn is prompted by consumer demands in Japan, Canada, Europe and other parts of the world. To illustrate how far-reaching the grain segregation issue is, grain elevators have already issued warnings to farmers that they will no longer be accepting GM corn because of pressures from big companies such as Archer Daniels Midland Corporation that it will no longer accept GM corn that do not have worldwide approval (Barboza, 2000). Unilever, UK and Nestle, UK, recently dropped GM ingredients from their products, although their North American counterparts have not yet done so. Ontario=s McCain Foods, as another example, refused to accept potatoes with inserted genes designed to kill the Colorado potato beetle (Hill, 2000). So, farmers are sitting on millions of bushels of GM crops harvests that are worth little and pondering whether or not to use GM seeds for next year=s planting. H. J. Heinz had to replace ingredients in 37 of its product lines after it found that many of the products in its baby food line contained GMOs. Heinz also had to find new non-genetically modified supply sources for its cheese, corn and soy byproducts (Lajoie, 2000). In Brazil, a local poultry company, Avipal, was fined 500,000 Reais ($250,000) for importing 9 tonnes of GM corn from Argentina.

In the U.S., some 450 million bushels of corn in storage may contain StarLink, not approved for human consumption, implying that they are only fit for use in animal feed or ethanol production. Any corn that contains the Cry9 protein in 1 kernel out of 2,400 kernels is considered unfit for human consumption. A most recent effort by the USDA will compensate US seed companies for up $20 million for corn mixed up with unapproved genetically modified variety through a program to buy back 300,000 to 400,000 bags of corn (Washington Post, 2001). Therefore, the USDA using funds that are traditionally used to assist farmers facing natural disasters, assisted in reducing the economic impact from contamination from genetically modified corn in the food system. These kinds of situations pose economic challenges with the potential of creating major disruptions for producers and consumers in international agricultural trade. Grain merchandisers are forced to keep track of the countries to which they can export products containing GMOs and those to which they cannot. These situations pose serious economic risks to producers, consumers and processors.

C Economic risks arising from labeling

Labeling is controversial (Runge and Jackson, 2000; Caswell, 2000; Unnevehr and Hasler, 2000) and although there are no universal standards for acceptable GMO content in food products, there are enough philosophical differences to create trade disruptions when countries with labeling regulations/guidelines start to implement them. Non-tariff barrier to trade such as labeling could be used to restrict world agricultural trade. In the United States, efforts have been made to address the issue of labeling in food products (Caswell, 2000). In the United States, the Nutrition labeling and Education Act (NLEA) of 1990 was intended to address food manufacturers= pervasive, and sometimes unsubstantiated, disease fighting claims about food. The law also mandated more nutritional information on food labels. In 1994, the Dietary Supplement Health and Education Act was passed as a result of political pressure from the dietary supplement industry. The laws allowed companies to make claims for supplements without

submitting evidence to the FDA. In 1997, the Food and Drug Administration Modernization Act allowed companies to make disease-fighting claims as long as they had endorsement from federal research agencies. Under the provisions of the law, companies could by-pass FDA approval to make the claims. Although these regulatory efforts may have helped the consuming public, more still needs to be done in the area of food labeling (Greenberg and Graham, 2000). Other rules and major events in US food labeling chronology is offered in Golan et al., 2000. The National Food Processors Association, the voice for the $460 billion food processing industry supports the FDA=s guidelines for voluntary labeling of foods have/have not been derived through biotechnology. Voluntary labeling can be used by processors to offer consumers additional information about their products although care must be taken to educate consumers as to the fact that it is the plant sources of foods and food ingredients that are developed through biotechnology and not the ingredients themselves, a rather delicate distinction. This implies that labels such as AGMO-free@, Anot genetically modified@, and Afree of genetically modified organisms@ may be inaccurate and/or misleading, or may not be well understood by consumers. Even traditional plant development techniques may result in products that are Agenetically modified@.

Delays in authorization to import some Bt corn from the US by France cost US exporters about $300 million in exports to the European Union (Cunningham and Unnevehr, 2000), to name a few. Only about 2 million tons of the 42 million tons of US corn exports went to the EU in 1997. In 1998, only 0.3 million tons of the 41 million tons went to the EU. Factors that have been used to explain the declines include bans of GM corn by France, Austria and Luxemburg (Cunningham and Unnevehr, 2000: 642). Similar declines have been documented for soybeans. Only 9 million tons (out of 26 million tons) of US soybean exports went to the EU in 1997 and only 6 million tons (out of 20 million tons) were exported to the EU. Despite resistance to GMO soybean, the EU remained a significant market for US exports. US corn exports to selected regions and countries are presented in Table 2.

In November 2000, a two-year old lawsuit filed by activist groups led by the Center for Food Safety based in Washington, D.C., aimed at forcing the FDA to require labeling of foods containing genetically modified ingredients was dismissed by a district court judge. The court did not find that the FDA violated any laws in not requiring such labeling. The agency had earlier called for voluntary labeling and required marketers of genetically modified foods to have these products reviewed, a process that had been also largely voluntary, at least up to now (Tomkies, 2000). Recently, the American Medical Association=s (AMA) Council on Scientific Affairs recommended voluntary labeling as a way to increase consumer acceptance and knowledge of agricultural biotechnology, but indicated that Athere was no scientific justification for special labeling of genetically modified foods@ (The Alliance for Better Foods, 2000 on AgNet, Dec. 20; full report, CSA Reports, Report 10 of the Council of Scientific Affairs I-00 online at http://www.ama-assn.org/ama/pub/print/article/2036-3604.html). The AMA, however, noted that government, industry, the scientific and medical community has tremendous responsibilities to educate and make unbiased information on biotechnology research available.

The U.S. delegation, at the meeting of the Codex Committee on Food Labeling, also indicated that there was Ano scientific basis for systematic labeling of foods containing or obtained from genetically modified organisms, and that only foods that differ significantly from their conventional counterparts in terms of composition, use, or nutritional quality should be specifically labeled@ (Caswell, 2000b: 672). On April 5, 2000 the US National Academy of Sciences issued a report that suggested that biotechnologically-based

food products were no less safe than those produced with conventional crops (http://www.wlf.org; also archived on the Internet at http://www.plant.uogu-elph.ca/safefood/archives/agnet-archives.htm, December 21, 2000). The circumstance outlined above probably helps explain why the European Parliament rejected an EU law that would make GM producers legally responsible for any environmental or public health damages caused by their products (Morris and Powell, 2001). Acceptance of this law would be another setback for the European agribiotech producers. The new millennium round in trade negotiations will have impact on world trade relationships and any discussions of GMO should be done within this context.

C Political risks

There are tremendous political pressures on who will be the first to implement any new agricultural biotechnological innovation with revenue-generating potential. On December 12, 2000 European leaders agreed to license new genetically modified foods for use in the European Union in February 2001. In an agreement by European Union (EU) Ministers of Parliament (MP), clearance will soon be issued for 14 new genetically modified crops (including maize, potatoes, tomatoes and processed oils, for example) pending EU licensing laws expected to take full effect in 2003. According to one EU MP, Awe must keep Europe in the fast lane on biotechnology. We have GM products gathering dust on shelves in the European Commission waiting for licenses. The danger for Europe is that it gets left behind as America forges ahead in the biotechnology race ... we must ensure that companies which meet these standards can put their products on the market as soon as possible@ (Mead, 2000, p. 1). Important in this statement is recognition of the fact that whoever can strategically position itself to be the first to go to the market with a technologically improved commodity, stands to reap the benefits associated with such early entry. In 2000, four companies with sizeable control of the agricultural biotechnology market were: Monsanto, Aventis, Syngenta and BASF in a descending order of size (http://special.northernlight.com/gmfoods/index.html#major). Obviously, the Europeans would also want to be the first in the agric-technology race, but so does everyone else. How far along a country is on agricultural biotechnology will obviously affect its perceptions of biotechnology. There are greater chances of acceptance where the country has considerable experience with the new technology.

International Trade and Marketing Issues

There seems to be enough opposition of GMOs in most of the world to disrupt any potential trading involving the new crops. Japan, for example, has already put in place a mandatory screening program for producers requiring them to screen foods that contain GMO by April 1, 2001 (Prideaux, 2000). Consumers in Russia, China, France and Australia have already expressed concerns about the safety of GMO ingredients in their food system (Vidal, 2000). In November 2000, the administrator of the USDA=s Foreign Agricultural Service acknowledged that fears that US corn shipments may contain the engineered variety have had significant impacts on US exports. Japanese and South Korean purchases of US corn dropped significantly since the discovery of the StarLink bio-corn in the food supply system in September 2000 (Fabi, 2000). It is not a matter of if these expressions of concern will affect world trade in agricultural products, it is rather a matter of when, how and how large a scope. The differences in GM food policies between Europe and North America have led to what has been considered the AAtlantic Divide@ because North America lacks experiences such as the transmissible Mad Cow Disease (bovine spongiform

ecephalopathy or BSE) of the 1980s and 1990s and the contamination of many food and animal products in Belgium from the carcinogenic Dioxin of June, 1999 and are willing to do anything to keep their food cost as low as possible (Cummingham and Unnevehr, 2000).

Policy issues and consequences for domestic and international trade

Labeling promises to be a very sore point between the United States and European governments who hold the key to any regulations. There have been numerous articles for and against labeling (Runge and Jackson, 2000; Caswell, 2000a,b; Unnevehr and Hasler, 2000), to mention a few. Different labeling policies Aact as non-tariff barriers, altering the relationship between trading partners@(Jackson, 2000: 661). Although there seems to be no universal standards for acceptable GMO content in food products, there exist enough philosophical differences to create huge trade disruptions when countries with labeling regulations/guidelines start to implement them. For example, while the American Seed Trade Association would like a 1% content of genetically enhanced materials before labeling seed bags for rejection, the European Union advocates for a 0.5% content as the standard (Bernard, 2000). A successful challenge of labeling a non-tariff barrier to trade (Caswell, 2000a) could end up dragging many countries in the little tested WTO mechanism for resolving disputes. One of mandates of the WTO is to ensure that countries do not use unreasonable regulations to disrupt flow of international trade. Labeling, according to Caswell (2000b: 671), is Aparticularly important if it is linked to regulatory approval and market access. @ Labeling of GMOs and GM foods are regulations that could disrupt trade since they act as non-tariff barriers to trade. According to Perdikis, Kerr and Hobbs (2000), A[O]ne of the responsibilities which has been mandated to the WTO is determining when non-tariff barriers to trade are legitimate and when they are being used capriciously to protect domestic vested interests@ (p. 692). The highlights of the Uruguay Round of the GATT (1986-1993) were the Agreement on the Application of Sanitary and Phyto-Sanitary Measures (SPS) and the Agreement on the Technical Barriers to Trade (TBT). The GATT was supposed to deal with import quotas (non-tariff trade barriers) and domestic regulations pertaining to consumer protection, such as labeling, safety specifications, (technical barriers to trade). Under the SPS and TBT negotiations, the best available scientific information should be used as the criteria for establishing objective border measures. Science-based criteria would prevent countries from establishing regulations to protect domestic producers lobbying for protection. Under the agreements, safety and risk assessment were recognized as Arelative@ concepts, allowing countries to specify their acceptable risk levels with the requirement that these levels were not unnecessarily more stringent for imports than for same or similar domestic products. The WTO has designated three existing International Standards Organizations (ISOs): the Codex Alimentarius Commission (food safety), International Office of Epizootics (animal health), and the Secretariat of the International Plant Protection Convention (plant health) to develop standards, provide technical guidelines and, through consensus building approaches provide recommendations for implementation. Under the TBT, the standards imposed from food labeling must not be unduly cumbersome relative to the benefits for consumers. The goal here being that of preventing governments from imposing high regulatory costs on importers without commensurate benefits to consumers. Unfortunately, none of the agreements were supposed to deal with GMOs as was the case in the EU-US and EU-Canadian beef hormone controversies.

Conclusions

The objectives of this paper had been to provide a general background on issues surrounding the debate on GMOs in the food system, examine the economic risks and other marketing issues in the GMO debate and consequences for domestic and international trade. As this discussion shows, the issue of genetically modified organisms in the food system is a complex one. There are uncertainties as to what will happen when countries have worked through the various policies that will deal with GMOs in trade. Economics risks facing consumers and producers, and political risks will continue to be important in international trade in genetically modified foods.

GMOs in the food system will definitely affect international trade, creating huge economic effects. Researchers are not quite sure of the extent and implications of these effects. The unsuccessful WTO meeting in Seattle was quickly followed by the January 29, 2000 Cartagena Protocol on Biosafety in Montreal which, if ratified by the signatories, will give governments the right to decide whether the country will accept any GMOs and under what conditions. This arrangement would give governments the right to set domestic regulations that disallows GMOs when seen as a threat to health, environment of safety of its citizens (Nielsen and Anderson, 2000). Whether or not such freedom ties the arms of the WTO under the previously negotiated SPS, TBT or the Trade Related Intellectual Property (TRIPS) agreements remain to be seen (Ervin et al, 2000). Some have obviously argued that these previously negotiated agreements were not meant to cover GMOs and consequently have no effect on any previous agreements. Because of the complexities and novelty of GMOs in international trade, the world=s trading partners may need to negotiate a new set of rules that will enhance trade in GMOs and GMO-related products.

Regardless of how it is presented, the issue of GMOs in international trade will generate discussions, debates and controversies for years to come. With the controversies and disagreements among key partners in international trade, there will be disappointments and frustrations about Genetically Modified Foods (GMFs) in the agro-food system. How the disputes arising from GMFs will be resolved will signal a new beginning in the emerging global economy. This paper successfully discussed the issues surrounding genetically modified foods including the economic risks to producers, consumers and governments.

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Table 1. Key Growers of Genetically Modified Crops (GMOs) and Area Under Cultivation

Country	Hectares Planted	Change, 1999 - 2000
United States	30.0	+1.6
Argentina	9.0	+2.1
Canada	3.0	-1.0
China	0.5	+0.2
South Africa	0.1	not available
Australia	0.1	not available
Mexico	not available	not available
Romania	not available	not available
Ukraine	not available	not available
Spain	not available	not available
Germany	not available	not available
France	not available	not available
Total	42.7	+3.1

Source: http://www.isaaa.com

1 hectare is approximately equal to 2.4713 acres

Table 2. U.S. Exports of Corn and Soybeans to Selected Regions/Countries, 1997 - 2000.

	Corn (10^6 metric tons)*			Soybeans (10^6 metric tons)		
Region/ Country	1997 Jan-Dec	1999 Jan-Dec	2000 Jan-Dec	1997 Jan-Dec	1999 Jan-Dec	2000 Jan-Dec
Africa	3.95	6.69	6.46	0.11	0.28	0.23
Asia	27.68	31.45	26.73	11.68	12.14	14.94
European Union	1.56	0.09	0.07	8.96	6.46	6.10
Japan	15.45	15.33	14.87	3.70	3.68	3.58
South Korea	3.44	6.16	2.29	1.25	1.17	1.34
Canada	1.03	0.97	1.49	0.26	0.33	0.33
China (Taiwan)	5.44	4.73	4.72	2.27	1.95	1.93

* 1 metric ton = 2,204 pounds.

Source: ERS/USDA. FATUS Report. Available online at http://www.ers.usda.gov/db/fatus/