

## World Agriculture & Trade



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# Biotechnology: Implications for U.S. Corn & Soybean Trade

The introduction of biotechnology into the U.S. food and fiber system has raised questions about possible effects of the new technology on U.S. agricultural trade and the U.S. agricultural marketing system. Producers of major field crops such as corn and soybeans have rapidly embraced bioengineered varieties because of their ability to enhance yields and reduce pest-management costs. Nevertheless, these farmers have begun to face uncertainty in marketing bioengineered products abroad, in part because of potential limitations from government policies and the direction and intensity of consumer preferences. Consumer preferences regarding biotech products have been cited as a factor in the performance of U.S. exports.

The Biosafety Protocol—an environmental agreement aimed at protecting biodiversity—was adopted by more than 130

countries on January 29, 2000, in Montreal, but must be ratified by 50 countries before it can go into effect. This process could take 2-3 years. The scope of the Protocol does not cover food safety. To a large extent, the Protocol will not alter the status quo for bulk commodities containing a biotech component. Countries may, as many currently do, require approval of new biotech crop varieties under their national laws and regulations.

The European Union (EU) approval process for imports of bioengineered varieties has been a particular source of consternation for U.S. exporters. Although some bioengineered corn varieties have been approved by the EU, a number of other corn varieties approved and planted in the U.S. have yet to be accepted by the EU, and a de facto moratorium currently exists on EU approvals. To date, however, the one biotech soybean variety commercially grown in the U.S. is approved in the EU market.

While only a small fraction of U.S. corn acreage has been planted to these non-EU-approved corn varieties, fears of having shipments delayed or halted if unapproved varieties are commingled with approved varieties has prompted some U.S. corn exporters to forego the EU mar-

ket altogether. Meanwhile, a number of countries around the world have announced plans to move forward with labeling requirements for bioengineered foods, generating concern that the U.S. might lose export markets or that U.S. food processors will face significant labeling-related costs.

These circumstances suggest the need to take stock of the potential impact of biotech trade restrictions on U.S. commodity exports and markets. An examination of the global markets for corn and soybeans—which are similar but which differ in some significant ways—can highlight factors that may be key to assessing the degree and nature of potential effects. Key factors include the importance of trade as a share of demand for U.S. commodities, trading partners' inclination to buy from the U.S. rather than competing suppliers, flexibility in the U.S. marketing system to respond to “differentiating” demands of importers, and regulatory actions taken by governments.

### *Most U.S. Corn Remains Stateside*

In marketing year 1998/99, the domestic corn market claimed more than 80 percent of total corn use (use equals total supply less stocks). With such a large domestic component—consisting of feed use (61 percent), food use (8 percent), and ethanol and sweeteners (13 percent)—the U.S. corn market should be cushioned significantly from international biotech issues.

The export component of U.S. corn use is 18 percent, with shipments going to countries throughout the world but nearly evenly distributed among four countries or regions: Latin America, Japan, “other East Asia,” and Africa and the Middle East. These four markets account for 94 percent of total U.S. corn exports. EU purchases—about 300,000 tons in 1998/99—represent less than 1 percent of U.S. corn exports, a drop from 4 percent prior to biotech-related problems. The EU has remained relatively self-sufficient in corn, indicated by the large volume of trade among member countries (intra-EU trade) relative to imports from nonmembers.

The EU represents the one documented loss of U.S. corn exports resulting from

#### About the Data

U.S. trade data are calendar year, from *Foreign Agricultural Trade of the U.S. (FATUS)*, ERS/USDA. Other countries' calendar year trade data are from the United Nations FAOSTAT and COMTRADE databases. In this article, use equals supply minus stocks.

World Agriculture & Trade

issues related to biotech products. The volume of corn exports to the EU fell more than 90 percent in 1998, a decline due largely to delay in the EU regulatory approval process. Moreover, this market represented an import quota to compensate trading partners for the loss of market when Spain and Portugal joined the EU. However, this market opportunity has been virtually eliminated by delays in the EU regulatory process.

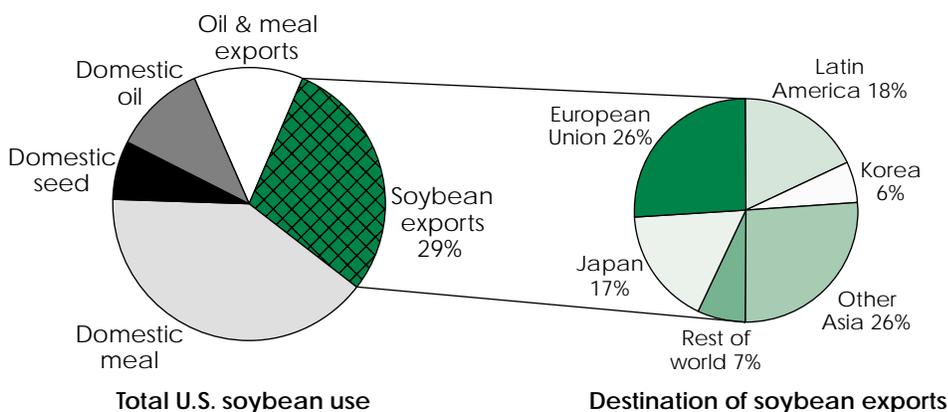
Patterns in world trade over time depend on a number of factors, including relative proximity, historical trade ties, and degree of price sensitivity in a market. The biotech issue is another factor that may influence world trade flows. Global commodity markets are composed of many bilateral trade flows linking individual country markets. A high degree of price sensitivity means that small price differentials arising between competing suppliers may generate dramatic changes in trade flows. This is illustrated by examining bilateral flows of corn in the pivotal period between 1995, when U.S. corn exports totaled 60 million tons, and 1998, when corn exports had fallen back to 41 million.

Most of the drop in U.S. corn exports from 1995 to 1998 is attributable to a fall in shipments to "other East Asian countries," including China. U.S. corn exports to this region plunged from 20.4 million tons in 1995 to 8.6 million tons in 1998, largely because of increased global supplies and weak demand when China, a net importer in 1995, became a net exporter in 1998. Fierce price competition among competing suppliers to the East Asian market generally plays a major role in import decisions, causing strong shifts in trade relationships.

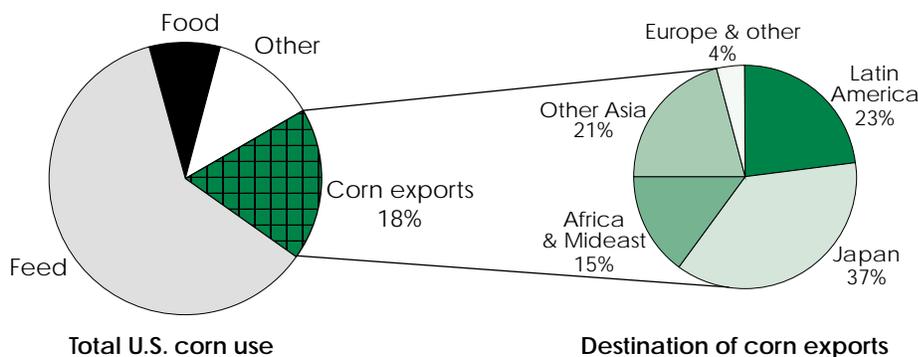
Malaysia, which imported most of its corn from the U.S. in 1995, made a dramatic switch away from U.S. corn in 1998, as China, a long-time supplier, once again became the dominant supplier by offering lower prices. Malaysia substitutes corn from China with relative ease because of its historical bilateral ties with China and its relative proximity.

The Malaysian example typifies the general price sensitivity of trade relationships in East and Southeast Asia. Japan, howev-

**One-Fourth of U.S. Soybean Exports Went to the European Union In 1998/99. . .**



**. . . But Nearly All U.S. Corn Exports Went to Non-European Countries**



Use = Supply minus stocks. Fiscal year, October 1, 1998 - September 30, 1999. Source: 1999 World Agriculture Outlook, Food and Agricultural Policy Research Institute (FAPRI), for use data.

Economic Research Service, USDA

er, stands apart from other East Asian countries with regard to its importing decisions, because of the strong government role in managing food imports. The U.S. has remained the dominant supplier of corn to Japan, and the U.S. share of Japan's imports has been roughly the same over time despite major disruptions in the corn market, because Japan favors a reliable and stable trade relationship.

Mexico provides an example of an importer that has consistently relied on the U.S. as its dominant supplier because of market conditions. This strong bilateral tie is explained by geographic location and shipping logistics, as well as the reluctance to incur large transaction costs

of switching to nontraditional suppliers—e.g., negotiation of contracts with new suppliers and exposure to risks of an unfamiliar supplier. Mexico's reliance on the U.S. as its sole supplier of corn provides continuity in foreign demand similar to the stable demand from the U.S. domestic market. While total U.S. corn exports fell dramatically from 1995 to 1998, Mexico's imports from the U.S. actually increased 80 percent. Colombia's relatively close proximity to the U.S. also seems to explain its stable trade pattern. More than 60 percent of Colombia's corn imports come from the U.S.

Clearly, U.S. corn suppliers face a diverse foreign market, and competitively priced

## World Agriculture & Trade

### U.S. Corn Exports to Most Major Purchasers Fell in 1995-98

		Importers							Total exports
		Japan	Other E. Asia	EU	Mexico	Colombia	Malaysia	Rest of world	
Top exporters		<i>Million tons</i>							
U.S.	1998	14.2	8.6	0.3	5.2	1.3	0.2	11.3	41.1
	1995	16.0	20.4	3.6	2.9	0.9	1.4	14.9	60.1
Argentina	1998	1.3	1.1	1.5		0.4	0.2	7.8	12.4
	1995	0.1		0.6		0.1	0.5	4.6	6.0
European Union	1998		0.1	8.5			0.1	0.5	9.2
	1995			7.0				0.5	7.5
China	1998	0.2	2.6				1.2	0.7	4.7
	1995								0.1
Hungary	1998	0.3		0.4				1.3	2.1
	1995			0.1				0.5	0.6
South Africa	1998	0.1		0.1				0.7	0.9
	1995	0.2	0.1			0.1	0.3	0.8	1.5
Rest of world	1998	0.1	0.2	0.2		0.4		3.7	4.6
	1995			0.2				2.3	2.5
Total imports	1998	16.2	12.6	11.0	5.2	2.1	2.0	25.9	75.0
	1995	16.3	20.5	11.5	2.9	1.1	2.2	23.5	78.2

Totals may not add due to rounding

Sources: For the U.S., *Foreign Agricultural Trade of the U.S. (FATUS)*, Economic Research Service; for other countries, United Nations FAOSTAT and COMTRADE databases.

Economic Research Service, USDA

corn seems to be a larger consideration for some importers than for others. Direct price competition between the U.S. and China will likely continue to be a key factor in U.S. market share in the East Asian market. But proximity and historical trading ties also play a role.

From a global perspective, with the U.S. supplying about two-thirds of total corn trade, importers cannot easily satisfy such large demand with alternative sources. Furthermore, the U.S. does have to its advantage a long history of being a dominant supplier in a number of countries where purchasers would likely be reluctant to incur the costs associated with switching to nontraditional suppliers unless the U.S. were unable to deliver crops that fit their import needs.

Issues stemming from biotech preferences will be a factor to be considered along with other factors in purchasers' import decisions—price, proximity, and historical trading relationships. But unlike sudden shocks the global corn market has historically experienced (e.g., adverse weather

or government policy changes), changes regarding biotech preferences will likely be more gradual, giving producers and grain handlers the opportunity to anticipate and prepare for potential market adjustments (see the following article).

### ***Stiff Competition In Soybean Market***

Exports play a larger role in the market for U.S. soybeans than for corn. Shipments to foreign markets amount to about 42 percent of U.S. soybean use—including meal and oil. A symmetry exists in U.S./EU soybean trade—i.e., U.S. soybeans make up a large share of EU soybean imports (39 percent), and EU purchases make up a large share of U.S. soybean exports (33 percent). If soybean exports were to fall suddenly, there would be significant impact on the U.S. soybean market unless the U.S. were able to quickly find alternative buyers. However, efforts to replace U.S.-produced soybeans would impose higher prices on foreign consumers—at least in the short term. Foreign consumers would also face higher prices as suppliers

sought to recoup costs associated with developing separate marketing channels for nonbiotech crop varieties.

A dramatic drop in U.S./EU soybean trade is unlikely because of EU reliance on imports from the U.S., and because biotech soybeans commercially grown in the U.S. are EU-approved. However, it is unclear how the EU regulatory regime will evolve, particularly in relation to the potential commercialization and approval of new biotech soybean varieties.

As in the case of corn, the global market for soybeans experienced significant changes in recent years. Between 1997 and 1998, U.S. soybean exports fell from 26 million tons to 20 million, although world trade remained nearly constant. The drop in U.S. exports resulted from price competition that led to expanding foreign sales for every other major soybean exporting country and most importer countries switching some purchases to non-U.S. soybeans. Unlike the corn market, where the decline in demand for U.S. exports was somewhat limited to

## World Agriculture &amp; Trade

## While World Soybean Trade Held Fairly Steady in 1998, U.S. Exports Slipped

		Importers							Total exports
		EU	Japan	Other E. Asia	Mexico	China	Brazil	Rest of world	
Top exporters		<i>Million tons</i>							
U.S.	1998	6.8	3.4	2.5	3.1	1.3		3.2	20.3
	1997	9.0	3.7	3.5	2.9	1.7	0.8	4.5	26.1
Brazil	1998	6.6	0.6	1.2	0.1	0.9			9.3
	1997	6.6	1.1					0.6	8.3
Argentina	1998	1.1			0.1	0.4		1.1	2.8
	1997	0.4						0.1	0.5
Paraguay	1998	1.1	0.3	0.6			0.3		2.1
	1997	0.6	0.2				0.8	0.1	1.7
European Union	1998	1.6		0.2				0.1	1.8
	1997	1.0						0.2	1.2
Canada	1998	0.3	0.1					0.4	0.9
	1997	0.3						0.1	0.5
Rest of world	1998		0.2	0.1		0.1	0.1		0.8
	1997		0.3	0.1				0.5	1.0
Total imports	1998	17.5	4.6	4.6	3.4	2.7	0.4	4.9	38.0
	1997	17.9	5.3	3.6	2.9	1.8	1.6	6.1	39.3

Totals may not add due to rounding

Sources: For the U.S., *Foreign Agricultural Trade of the U.S. (FATUS)*, Economic Research Service; for other countries, United Nations FAOSTAT and COMTRADE databases.

Economic Research Service, USDA

East Asian countries, the U.S. experienced an across-the-board drop in soybean exports. The U.S. faces direct competition from top soybean exporting countries in nearly all markets, since competitors have established bilateral trade ties in those same markets. The Mexican market, an exception because it has few alternative suppliers, increased its imports of U.S. soybeans.

Traditional competitive forces (primarily prices) appear to be the main driving factors behind the changes in observed bilateral trade patterns for soybeans, and the price-competitive nature of the market has implications for producer decisions to plant bioengineered seed. In order to remain in business, all producers, including those in the U.S., need to remain globally competitive and strive to adopt cost-reducing technologies. Bioengineered seed is such a technology. A possible strategy for some producers is to sell in niche markets willing to pay higher prices for differentiated products, including products not derived from bioengineered crops.

### **Potential Profit & Cost In Differentiated Products**

Among buyers in some countries, demand may co-exist for both biotech crops (grown from bioengineered seed) and nonbiotech crops (grown from seeds developed with traditional plant breeding techniques). The extent to which demand for one or the other will eventually dominate may vary significantly from country to country. Some exporting countries are likely to produce and export both types of crops, and to develop marketing systems that offer consumers products that are differentiated according to their biotech status.

Such product differentiation is merely an extension of a trend already established for high-value products in grain and oilseed markets. Other differentiated products such as high-oil corn, hard endosperm corn, white corn, waxy corn, nutritionally dense corn, high oleic soybeans, and improved food-quality soybeans are already fixtures in the marketplace.

The Japanese soybean market is one example of how U.S. agriculture may tap into opportunities presented by potential demand for nonbiotech commodities, and how new marketing channels emerge to accommodate shifts in demand. In contrast to the EU, a significant amount of soybeans in Japan is consumed by humans. Although Japan continues to import biotech soybeans for use in animal feed, the U.S. has also been successfully exporting both organic and nonbiotech soybeans to the Japanese food-use market at a considerable price premium.

U.S. exports of organic and nonbiotech soybeans suggest that some U.S. producers and companies have pursued profits from potential foreign demand for nonbiotech foods. If there are premiums to be earned for nonbiotech commodities (or for any varieties with other specific traits of value to users), then suppliers of marketing services that help producers meet these specific demands are likely to emerge.

## World Agriculture & Trade

For example, in 1999, Clarkson Grain and Nisshin Shokai announced a program, called Fresh Pure Green, to assure buyers (principally Japanese soy food manufacturers) that their soybeans are nonbiotech varieties and 99.5-percent free of bioengineered material. The company contracts directly with farmers for specific varieties that are identity-preserved, from planting through harvest, storage, delivery, cleaning, and conditioning. The company relies on an independent certifying agency, the Illinois Crop Improvement Association, to sample and test the soybeans to assure they meet the 99.5-percent standard.

In the long run, consumers around the world will decide what premiums they will pay for nonbiotech products, and producers in different countries will consider the relative prices for biotech and nonbiotech crops in relation to their local farming conditions when deciding what to plant. Both the magnitude of preferences (demand) and the costs of providing different products (supply) will determine the market outcome.

Regulatory actions of governments around the world will also influence the impact of biotech issues on trade. The EU recently adopted labeling regulations for foods containing a biotech ingredient or containing any ingredient with a biotech content of 1 percent or more. Further, to avoid labeling, if the food contains less than 1 percent biotech material, processors must prove that introduction of the biotech content occurred accidentally. However, it is unclear whether enforcing a 1-percent threshold for food is technically feasible, especially where commingling can occur at many locations in the marketing chain. The EU is currently drafting feed labeling regulations.

Japan is also developing food labeling regulations. In August 1999, the Japanese government announced it would institute mandatory labeling of over 20 foods and food ingredients produced from biotech corn and soybeans, to be effective in April 2001. Last fall, well ahead of scheduled government implementation of labeling requirements, a few tofu manufacturers, brewers, and soy sauce and soy protein food manufacturers announced that they will cease using biotech corn or soybeans in their operations. These companies are apparently seeking to cultivate niche markets for nonbiotech foods.

A number of other Asian export markets—South Korea, Thailand, Indonesia, and Hong Kong—as well as Australia and New Zealand, also have decided to follow suit, drafting labeling regulations they expect to implement soon. Canada recently announced that it intends to encourage voluntary labeling.

Full implementation of labeling regulations, while responding to some consumer concerns, could hinder market adjustment by increasing the costs of market segregation and voluntary labeling that may be naturally occurring in response to differentiating demands. Government labeling policies may specify the set of products requiring labeling and determine the tolerance levels for products. If the tolerance level is unduly low or if the standard exceeds the capabilities of currently available technologies—such as diagnostic tests—to reliably differentiate products, mandatory labeling could lead to increased costs.

Potential changes in consumer preferences and the likely evolution of technologies to segregate and verify biotech-free products mean that standards need to

change over time. Adapting government regulations to these dynamic market conditions requires widespread public and industry discussion.

### *Prices Capture Biotech Tradeoffs*

Not surprisingly, prices summarize all the impacts of biotechnology on both demand and supply for corn and soybeans. On the demand side, consumers must be willing to pay higher prices for nonbiotech crops in order to cover higher costs of production and marketing. Consumer preferences may create two potential markets and a choice for producers in the future. Producers may face a trade-off between potentially higher prices for nonbiotech crops and lower costs of producing biotech commodities.

Prices play a central role in all types of global market adjustments. In any year, a large number of corn and soybean importing countries switch suppliers readily to obtain the lowest market price, and producers face constant pressures to cut costs in order to remain competitive. The global market impact of a country's preferences regarding biotech products depends on the size of the affected trade flow. EU corn imports represent a small share of global corn trade, but the EU is the world's largest soybean importer. On top of shifts in global markets for biotech crops, consumer willingness to pay for nonbiotech foods also creates a new market that U.S. producers and traders have started to supply. To date, evidence shows that the higher price, nonbiotech market remains small. **AO**

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#### For further information on crop biotechnology issues

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#### For more on agricultural implications of the Biosafety Protocol

[www.fas.usda.gov/info/factsheets/biosafety.html](http://www.fas.usda.gov/info/factsheets/biosafety.html)