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Economic Research Service

Mycotoxin Regulations

Implications for International Agricultural Trade

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Issue: Among grains and other field crops, an important food safety concern is the risk of contamination by mycotoxins, a toxic byproduct of mold infestations affecting as much as one-quarter of global food and feed crop output. Food contaminated with mycotoxins can cause sometimes-fatal acute illness and is associated with increased cancer risk from longer term exposure. To protect consumers from these health risks, many countries, including the United States, have adopted regulations to limit exposure to mycotoxins, often taking the form of product standards. However, diverging perceptions of tolerable health risks have led to widely varying standards among different national or multilateral agencies. The appropriate balance between addressing food safety concerns and limiting disruptions of trade is a contentious issue, with important economic consequences. How much do mycotoxin regulations vary internationally? To what extent do mycotoxin hazards and regulations affect international trade and what are the economic costs? What steps can be taken to mitigate trade disruptions?

Background: Concerns about human health arise when grains and other field crops are found to contain unsafe chemicals, additives, or other contaminants. Many countries have established sanitary and phytosanitary (SPS) regulations to protect consumers from these health risks, while seeking to balance health benefits with the potential trade disruptions, economic losses, and market uncertainties that regulations can cause. Among grains and other field crops, perhaps the most prevalent—if publicly unrecognized—source of food-related health risks are naturally occurring poisonous substances called mycotoxins. Consuming grains or other foods contaminated with certain mycotoxins can increase cancer risk and suppress the immune system, among other health problems.

As with many public food safety regulations, domestic and trade regimes governing mycotoxins in most countries take the form of product, rather than process, standards. That is, tolerance levels for the amount of mycotoxin in a product are established, rather than regulating the production or treatment of the commodity along the marketing chain.

The United States began regulating the concentration of mycotoxins in food and feed in 1968. At least 77 countries now have regulations for mycotoxins, and the number grew significantly from the mid-1980s to mid-1990s. The range of tolerance levels in these countries varies widely. In 1996, for example, 48 countries had established tolerance levels for total aflatoxins (a type of mycotoxin) in food—up from 30 in 1987—with standards ranging from 0 parts per billion (ppb) to 50 ppb. For the 21 countries with standards on animal feeds, the tolerance levels ranged from 0 ppb to 1,000 ppb (see table).

Enforcing these limitations naturally imposes costs on domestic producers and consumers (e.g., of monitoring, testing, destroying the crop or diverting it to a lower valued use). At the same time, when the cost and benefit analyses—or risk assessments—underlying domestic regulations lead countries to set different tolerance standards, these divergent standards can also affect producers in other countries, disrupt trade, and result in trade disputes.

The idea that there can be a uniform assessment of how to balance human safety concerns with “proportionate” impacts on trade can be both problematic and controversial. Some argue that exceptionally strict food safety regulations impose unfair economic, and even safety, burdens on lower income food-exporting countries. The argument is that such standards limit export opportunities because compliance is either too costly or unachievable given the lack of technical capacity, infrastructure, and experience with food hazards management.

Findings: The economic losses associated with mycotoxin contamination are difficult to assess, and no comprehensive analysis of the costs to U.S. and foreign crop/livestock producers is available. However, with an estimated 25 to 50 percent of the world’s food crops affected by

Medians and ranges of maximum aflatoxin tolerance levels and number of countries with regulations (1987, 1996)

	1987			1996		
Category	Median	Range	No. of countries	Median	Range	No. of countries
	— Parts per billion —		*Number*	*— Parts per billion —*		*Number*
B1 in foodstuffs	4	0-50	29	4	0-30	33
B1+B2+G1+G2 in foodstuffs	7	0-50	30	8	0-50	48
B1 in foodstuffs for children	0.2	0-5.0	4	0.3	0-5.0	5
M1 in milk	0.05	0-1.0	13	0.05	0-1.0	17
B1 in feedstuffs	30	5-1,000	16	20	5-1,000	19
B1+B2+G1+G2 in feedstuffs	50	10-1,000	8	50	0-1,000	21

Note: B1, B2, G1, G2, and M1 are subcategories of aflatoxins.
Source: Adapted from Van Egmond, Hans, "Worldwide Regulations for Mycotoxins." Third Joint FAO/WHO/UNEP International Conference on Mycotoxins. MYC-CONF/99/8a, March 1999.

mycotoxins, the economic costs are likely to be considerable. Numerous reports focusing on different countries/regions, commodities, toxins, and cost categories (e.g., costs of regulations, testing, production loss, trade losses) offer some indication of these losses. For example, the Council for Agricultural Science and Technology (2003) estimated that crop losses (to corn, wheat, and peanuts) from mycotoxin contamination in the United States amount to $932 million annually, in addition to losses averaging $466 million annually from regulatory enforcement, testing, and other quality control measures.

Wilson and Otsuki (2001) estimated that, for a group of 46 countries—including the United States—the adoption of a uniform aflatoxin standard based on international (Codex Alimentarius) guidelines would increase trade of cereals (grains) and nuts by more than $6 billion, or more than 50 percent, compared with the divergent standards in effect during 1998. Potential export gains to the United States amounted to $700 million. Also, since less developed countries generally have less stringent mycotoxin standards, those that conduct trade with one another will lose more export opportunities than will developed countries.

Trade disputes over regulatory standards on mycotoxins could persist. First, mycotoxin contamination is recognized as an unavoidable risk. Many factors that influence the level of contamination in cereals and grains are environmentally related—such as weather and insect infestation—and are therefore difficult to control. Second, perceptions of tolerable health risks are not likely to narrow significantly in the near future since they appear to hinge largely on the level of economic development and the susceptibility of a nation's crops to contamination. Finally, under the precautionary principle, some countries may set new standards on certain mycotoxins for which scientific evidence of a health risk is unclear.

One strategy to lower both the health risks and the economic costs associated with mycotoxins is to instruct food producers and handlers on strategies to minimize mycotoxin contamination, and to encourage the adoption of process-based guidelines such as Good Agricultural Practices (GAPs) before harvest and good manufacturing practices (GMPs) after harvest. These strategies would minimize risk throughout the production, handling, and processing chain, and can complement product standards.

An effective long-term strategy for controlling and monitoring mycotoxin risks in countries most susceptible to the problem (due to climate or poor storage facilities) will likely require technical assistance from public agencies and private actors abiding by quality control measures and GAP/GMP principles.

Information Sources:

For full text, see Dohlman, E. "Mycotoxin Hazards and Regulations: Impacts on Food and Animal Feed Crop Trade," chapter 6 in *International Trade and Food Safety: Economic Theory and Case Studies*. J. Buzby (ed.). USDA, Econ. Res. Serv., AER-828, Nov. 2003. www.ers.usda.gov/publications/aer828/