

## BIOTECHNOLOGY, TRADE, AND HUNGER

by Eugenio Díaz-Bonilla and Sherman Robinson

**IN THE PAST two hundred years, there has been much concern with the Malthusian race between population growth and food supply. So far, food has won: increases in agricultural productivity have exceeded population growth. The last century saw three revolutions in agricultural technology—one based on mechanization, one on chemistry (leading to effective fertilizers and pesticides), and one on biology (the “Green Revolution”). For much of this period, agricultural productivity and output have grown rapidly and the relative price of food has declined.**

**D**emographers predict that the world population will stabilize some time in the second half of the 21<sup>st</sup> century. And projections by IFPRI and others indicate that agricultural productivity can grow fast enough to sustain the world’s population, if new technologies are pursued. But there is more to feeding the world than making sure agricultural productivity stays ahead of population growth. International trade will also play a large role. Projections indicate that regions such as Africa will import a larger share of their food requirements in the future. At the same time, regions with a strong comparative advantage in agriculture will produce the additional food needed by the world.

But the new genetic modification (GM) technologies that many expect will help the world meet its food needs—not only through quantity, but nutritional quality as well—raise critical issues for international trade, including this key question: What will happen if pressure from consumers and environmentalists in the developed world leads to a new generation of trade restrictions, or to the segmentation of GM-food product markets, as appears to be happening in Europe and Japan?

An answer to this question requires a brief look at agricultural trade and involves both legal and economic analysis.

### AGRICULTURE AND INTERNATIONAL TRADE

Currently, a large share of agricultural produce is consumed in the producing countries. This is true despite major grain and oilseed exports from countries such as the United States, Argentina, Canada, and Australia, and even after accounting for major export crops such as coffee, tea, cocoa, and sugar. However, IFPRI and others forecast a growing role for international agricultural trade in the 21<sup>st</sup> century.

There is likely to be increasing specialization in agricultural production, with more exports from countries that specialize in particular types of agriculture. Many developing countries may well hold a comparative advantage in producing high-value, labor-intensive specialty crops and horticulture, while land-abundant countries may be better at producing bulk goods such as wheat, maize, and soybeans. Research indicates that it is neither efficient nor environmentally sound for developing countries to seek food security by becoming self-sufficient in the production of food crops, particularly when such production involves inefficient, unsustainable methods on fragile lands.

GM technologies may facilitate increased specialization, while also boosting local food production and improving food security through the development of plant varieties specifically tailored to particular agro-ecological environments. Although the technologies have the potential to affect both traded and nontraded products, most applications to date have involved highly traded agricultural commodities.



To benefit from increases in agricultural productivity, developing countries have an enormous interest in being able to market their goods in developed countries. The world agricultural trading system is still dominated by developed countries with protected markets and domestic subsidy programs that ultimately distort international markets and potentially increase price volatility, to the detriment of developing countries.

Major goals of developing countries in the new round of World Trade Organization (WTO) trade talks should include opening markets in developed countries for their agricultural exports, including high-value, labor-intensive commodities, and reducing or, preferably, eliminating trade-distorting domestic policies in developed countries—especially export subsidies and price supports.

While these goals appear desirable, the picture is complicated by the possible impact of consumer and environmental concerns, particularly within developed countries, on the development of biotechnology. To consumers in high-income countries, the price-reduction benefits from biotechnology seem minor, while the unknown dangers are magnified by lack of information and mistrust in the ability of their governments to regulate the safety of the food supply.

A ban on GM products in developed countries, based on domestic consumer and environmental concerns, would not only affect market access but could also make it more difficult for developing countries to gain financial support from industrialized nations to conduct research and build human capital for biotechnology activities. Another possibility is that consumer and environmental concerns could spill over into developing countries and block or slow the development of biotechnology in those countries.

## INTERNATIONAL LEGAL ISSUES

Any attempt to limit trade in GM products must be compatible with existing international legal agreements. There are only a few agreements (including environmental treaties) setting out the World Trade Organization legal framework regarding trade in GM products. These include the Sanitary and Phytosanitary (SPS) Agreement and the Agreement on Technical Barriers to Trade (TBT) of the WTO; and a multi-lateral environmental agreement, the Convention on Biological Diversity, particularly its Cartagena Protocol on Biosafety.

The question is what role these legal agreements may play in either keeping open or closing the opportunities offered by GM products. The international system is clearly under stress in this area, with growing tensions between the need for fairness in international trade and the need to respond to domestic concerns about food and environmental safety.

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The Sanitary and Phytosanitary Agreement, which concerns food safety and animal and plant health, says that WTO members have “the right to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health.” But those measures must be applied “only to the extent necessary to protect human, animal or plant life or health,” and must be “based on scientific principles.” The agreement also states that WTO members must “ensure that their SPS measures do not arbitrarily or unjustifiably discriminate between Members where identical or similar conditions prevail, including between their own territory and that of other Members,” and, furthermore, that those measures “shall not be applied in a manner which would constitute a disguised restriction on international trade.” In addition, the agreement suggests the use of international standards when possible.

The goal of all these regulations phrased in legal language is to allow countries to maintain standards of food safety but to prevent them from doing so in a way that unfairly discriminates against foreign suppliers.

The difficulty with GM products is that there are as yet no international food safety standards that really apply to them. The Codex Alimentarius defines international standards of food safety, but it does not yet specifically address GM products. Although the countries participating in the Codex are currently discussing adequate standards for GM products, a possible agreement is still some years away.

In the absence of agreed-upon international standards, some countries invoke the “precautionary principle” that allows them to set standards provisionally where relevant scientific evidence is lacking, although they are supposed to do the necessary research within a reasonable period of time. Other countries argue that the precautionary principle is being abused in order to protect less efficient domestic producers from foreign competition. Again, the challenge lies in adequately addressing both safety concerns and fairness in trade. Currently, a review of available scientific evidence indicates that GM foods have not been found to be unsafe—a double negative that highlights the difficulties of balancing consumer concerns, science, and international law. Proponents of GM products correctly argue that research has shown no health risks, while opponents argue that such research is not enough to prove that there are no such risks.

The basic issue continues to be market uncertainty about how consumers, mostly in developed countries, will react to GM foods. Regardless of the science, if consumers decide that they do not want to consume GM goods, markets will adjust to satisfy their demands. If these negative reactions persist, markets will adjust to different scenarios of prohibition, market segmentation, and product differentiation. These market adjustments in developed countries will have an impact on developing countries.

## THE ECONOMICS OF GM TRADE

What will happen if consumers in developed countries refuse to consume GM commodities? Can world markets adjust to a complete segmentation of the markets for GM and non-GM commodities? Will developing countries still benefit from these new technologies if world markets are completely segmented and if, in addition, some developed countries refuse to adopt the new technologies at all?

To provide tentative answers to these questions, IFPRI has undertaken research jointly with the Danish Institute of Agriculture, Forestry, and Fisheries Economics. Using multi-country models of world trade focused on agriculture, the research analyzes the price, production, and trade consequences of changing consumer preferences regarding the use of genetically modified organisms in food production.

In the world model, the two primary GM crops, soybeans and maize, are specified as either GM or non-GM. This GM and non-GM split is maintained throughout the entire processing chain: GM livestock and GM food processing industries use only GM intermediate inputs; likewise, non-GM livestock and non-GM food processing industries use only non-GM intermediate inputs. The underlying assumptions in the model are that developing countries will adopt the new



technologies, to varying degrees, and that countries such as the United States will continue to use them, while Europe and Japan will not adopt them and will restrict their demand for such goods. The issue is which countries, if any, would benefit from the new technologies, to varying degrees, given the growing segmentation of the markets.

The empirical results indicate that global markets are able to adjust to this segregation in the sense that non-GM exports are diverted to the GM-intolerant regions, while GM-exports are diverted to the indifferent regions. Price differentials are significant but tempered by commodity arbitrage. In particular, in certain GM-favorable regions, the prices of the non-GM varieties also decline because of the high degree of substitutability between the GM and non-GM varieties in domestic use and increased production of non-GM varieties to supply GM-intolerant consumers. The market results are analogous to what one would expect from increased consumer preferences in developed countries for organic foods. Such foods are more expensive to produce and command higher prices in the market. There is a gap between prices for organic and other foods, which ultimately reflects cost differences in their production and distribution. Similarly, price differentials between GM and non-GM commodities will reflect their different costs of production and distribution, with consumers who are indifferent benefiting from access to cheaper goods they find to be equivalent to non-GM goods, and producers benefiting from the higher productivity of GM crops.

An important finding of this empirical analysis is that the developing countries are also responsive to GM preference changes and redirect their trade flows among partners accordingly. Furthermore, given the existing bilateral trade patterns for these particular crops, the price wedges that arise in the developing countries mainly reflect productivity differences, not preference changes in the developed world. Overall, the regions most receptive to the productivity-enhancing technology gain most, including developing countries that adopt the new technologies.

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## Can world markets adjust to a complete segmentation of the markets for GM and non-GM commodities?

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### APPROPRIATE TECHNOLOGY IS A FIRST STEP IN FEEDING THE HUNGRY

The development of GM technology appears to hold great promise, with the potential to complement other, more traditional research methods as the new driving force for sustained agricultural productivity growth in the 21st century. Such agricultural productivity growth is crucial if the world is to produce enough food to provide for what is likely to be a stable but large world population in this century. At this point, the many problems and concerns surrounding the new GM technologies do not seem insurmountable, just very difficult.

A world with an adequate supply of food is clearly more desirable than a Malthusian world in which food is scarce, food prices are high and rising, and people are in conflict over scarcity. However, providing an adequate aggregate food supply will not eliminate malnutrition and hunger, now or in the future. To do that requires much more. To achieve food security for the entire world population, countries must work to reduce poverty and achieve a more equitable distribution of income—tasks that technology alone can only support, not achieve.

*Eugenio Díaz-Bonilla is a research fellow in and Sherman Robinson is division director of the Trade and Macroeconomics Division of IFPRI.*

