



AGRICULTURE FOR DEVELOPMENT POLICY BRIEF

Capturing the Benefits of Genetically Modified Organisms for the Poor

Transgenics, or genetically modified organisms (GMOs), are the result of transferring one or more genes, usually from a wild species or a bacterium, to a crop plant. Although transgenics have been widely adopted to date only in commercial agriculture, they have considerable potential for improving the productivity of smallholder farming systems and for providing more nutritious foods to poor consumers in developing countries. However, the environmental, food safety, and social risks of transgenics are controversial. Transparent and cost-effective regulatory systems that inspire public confidence are needed to evaluate risks and benefits case by case.

Adoption of transgenics has been rapid but narrowly based.

In 2006, farmers in 22 countries planted transgenic seeds on about 100 million hectares, which is about 8 percent of the global crop area (figure 1). Farmers in developing countries have been adopting transgenics since 1996, largely because of spillovers from private research and development (R&D) in the industrial countries. But their use has been limited to certain crops (soybean and maize used for animal feed, as well as cotton) and traits (insect resistance and herbicide tolerance). Moreover, their use has been limited to countries with commercial farming (Argentina and Brazil). The only transgenic widely adopted by smallholders has been Bt cotton, a transgenic crop used for insect resistance. An estimated 9.2 million farmers, mostly in China and India, planted Bt cotton on 7.3 million hectares in 2006.

The rapid adoption of Bt cotton in China and India attests to its profitability for most farmers. Farm-level studies point to higher profits from the adoption of Bt cotton and document substantial environmental and health benefits through lower pesticide use. In some studies, farmers in China recorded a US\$470 per hectare increase in net income (340 percent). This increase is largely attributable to a two-thirds reduction in pesticide applications. Likewise, most Indian farmers growing Bt cotton used less insecticide and gained significant yield increases, with the additional advantage of more stable yields. But the effects vary across years, institutional settings, and agroecological zones.

Progress in food crops is slow.

Transgenic food crops have not been widely adopted by smallholders in the developing world. There are five main reasons for this slow progress:

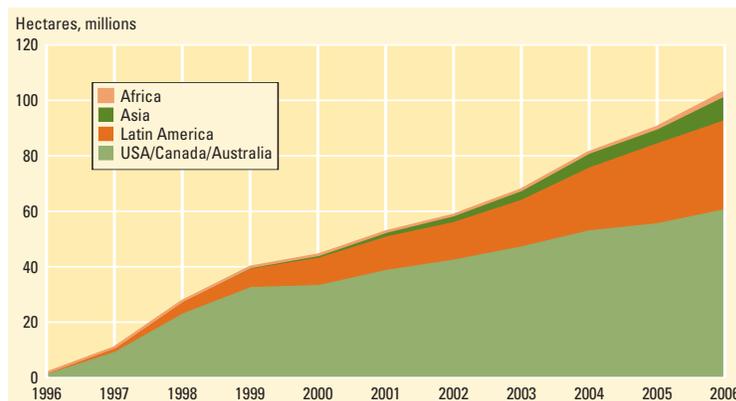
Neglect of pro-poor traits and orphan

crops. Investments in R&D on transgenics are concentrated largely in the private sector, driven by commercial interests in industrial countries. The public sector has underinvested in R&D generally for smallholder crops and in biotechnology specifically. Public spending on R&D on transgenics is only a fraction of the US\$1.5 billion spent each year by the four largest private companies.

Limited access to proprietary technologies.

The share of genetic tools and technologies covered by intellectual property rights is increasing. These tools and technologies are controlled mainly by a small group of multinational companies, and the cost of obtaining material transfer agreements and licenses can slow public research and the release of transgenics to the market.

Figure 1. The Adoption of Transgenics, 1996–2006



Source: James, Clive. 2006. *Global Status of Commercialized Biotech/GM Crops: 2006*. Ithaca, NY: International Service for the Acquisition of Agri-biotech Applications (ISAAA).

Note: The area planted with transgenics in Europe is about 200,000 hectares, mostly in Romania and Spain.



Risks. Continuing concerns about possible food safety and environmental risks have slowed release in many countries. Those concerns persist even though available scientific evidence to date on food safety indicates that the transgenics now in the market are as safe as conventional varieties. Likewise, after 10 years of commercial use of transgenics, scientific evidence and experience do not support the development of resistance in the targeted pests. Moreover, environmental harm from commercial cultivation of transgenic crops, such as gene flow to wild relatives, has not occurred when proper safeguards are applied. But despite the good track record of transgenics, public perception of risks is as important as assessments based on scientific evidence in ensuring acceptance.

Weak regulatory capacity. The capacity of regulatory bodies to assess environmental and food safety risks and to approve the release of transgenics is limited in most developing countries. Weak regulatory systems fuel public distrust and ignite opposition to transgenics. Weak capacity also results in widespread use of unauthorized transgenic seeds in many settings (cotton in China and India, as well as soybeans in Brazil in past years), which further reduces public confidence in the regulatory system.

Complexity of trade in transgenics. Some countries worry about health effects of imports of transgenic foods, including food aid. Exporters fear the loss of overseas markets and of a “GMO-free” brand. They have to consider the cost of separating transgenics from conventional varieties during storage and shipment, as well as the cost of obtaining clearance for transgenics for consumption in the importing country. But countries and farmers who are slow to adopt transgenics may lose their competitiveness in global markets if cost-reducing transgenics are widely adopted in large exporting countries, as in the case of Bt cotton.

Transgenic food crops in the pipeline have considerable potential.

Despite limited adoption of transgenic food crops, interest in them remains high, and a wave of second-generation products, largely developed in the public sector, is making its way to the market. Transgenic rice, eggplant, mustard, cassava, banana, potato, sweet potato, lentil, and lupin have been approved for field testing in one or more countries.

Many of those technologies promise substantial benefits to poor producers and consumers. Most notable are traits for the world’s major food staple, rice, including pest and disease resistance, enhanced vitamin A content (Golden Rice), and salt and flood tolerance. But despite the promise, the 1990s projections that transgenic varieties of rice would be available to farmers by 2000 were too optimistic.

Africa has benefited the least from transgenic crops, in part because locally important food crops such as sorghum and cassava have

attracted little attention from commercial biotechnology firms. Transgenics could reduce the impact of several of Africa’s intractable problems, such as plant and animal diseases, drought, and Striga (a devastating parasitic weed), much faster if they were integrated into breeding programs.

Policy priorities to move forward.

An important opportunity to contribute to the pro-poor agricultural development agenda will be missed if the potential risks and benefits of transgenics cannot be objectively evaluated on the basis of the best available scientific evidence and taking into account public risk perceptions.

Introducing transgenics requires a cost-effective and transparent regulatory system with expertise and competence to manage their release and use. Open information disclosure, labeling (where feasible), and a consultative process are critical for harnessing public support for transgenics. Strong regulatory capacity does not necessarily mean stringent standards on risks. On the contrary, competent regulators can keep information requirements for approval at an appropriate level to ensure safety through a case-by-case assessment of the knowledge of the trait and the ecosystem into which it will be introduced. High regulatory barriers may impose high costs on society by restricting or slowing access to beneficial technologies. High barriers may also restrict competition in seed markets and reduce options for farmers, because public research organizations and national seed companies may not be able to pay the high cost of regulatory clearance (estimated at more than US\$1 million for the first Bt cotton varieties in India).

In setting the regulatory standards, decision makers must weigh public risk perceptions and degrees of risk tolerance, which differ among societies. Despite the absence of proven risks, the precautionary approach calls for a broad assessment of the technology’s potential risks and benefits in the wider food and ecological system. Risk assessment must also consider the consequences and risks of *not* using transgenics. For example, transgenics offer a powerful tool for nutritional enhancement that may save lives (Golden Rice) or help poor farmers adapt to climate change through faster integration of genes for drought and flood tolerance.

Countries and societies ultimately must assess the benefits and risks for themselves and make their own decisions. The international development community should stand ready to respond to countries calling for safe access to these technologies. Specifically, it should be prepared to meet requests to fund the development of safe transgenics with pro-poor traits and to underwrite the high initial costs for their testing and release. If a new wave of safe and pro-poor technologies is developed and accepted, the regulatory costs should fall sharply.

This policy brief has been extracted from the World Bank’s 2008 World Development Report, *Agriculture for Development*. Further information and detailed sources are available in the Report. The Report uses a simple typology of countries based on the contribution of agriculture to overall growth, 1990–2005 and the share of rural poor in the total number of poor (2002 US\$2-a-day level). In agriculture-based countries (mostly Africa), agriculture contributes a significant (>20%) share of overall growth. In transforming countries (mostly in Asia), nonagricultural sectors dominate growth but a great majority of the poor are in rural areas. In urbanized countries (mostly in Latin America and Europe and Central Asia), the largest number of poor people are in urban areas, although poverty rates are often highest in rural areas.