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BRIEF NO. 2 OF 5

ASSESSING THE POTENTIAL ECONOMIC IMPACT OF GENETICALLY MODIFIED CROPS IN GHANA

VIRUS RESISTANT TOMATO

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In many countries, economic considerations are an important factor in government decisionmaking on the introduction of genetically modified (GM) products. However, reliable information on their actual or likely economic impact is often lacking. This brief illustrates the use of a methodological framework to assess the potential economic impact of introducing genetically modified tomatoes in Ghana. The framework consists of four interrelated levels of analysis, corresponding to four sets of actors in the economy: (1) farm (smallholder producers); (2) market (processors, traders); (3) the pertinent industry or sector of the national economy (consumers and producers, linked by markets); and (4) international trade.

Tomatoes and Tomato Yellow Leaf Curl Virus

Tomatoes are a popular food item in Ghana. A main source of vitamins A and C, they are consumed on a daily basis in many households. Moreover, tomato production is an important source of income for smallholder farmers. While domestic tomato production has intensified across the country in recent years, it still does not meet the high demand, so tomatoes are imported from Burkina Faso five to six months of the year. This situation is attributed to a number of constraints in the production and marketing chain. One such constraint is a virus, transmitted by the white fly (*Bemisia tabaci*). If the fly is not controlled at the early stages of tomato cultivation, it can cause tomato yellow leaf curl virus (TYLCV), a disease that devastates crop yields and critically affects farmers' livelihoods. Farmers often use pesticides to control the white fly, but they may be ineffective if the plant is already infested. Also, the use of clean new seed is strongly recommended to help control the disease, but seed recycling is common practice. Unfortunately, this further reduces the genetic diversity among tomato varieties making crops more susceptible to pests and diseases and farmers more vulnerable to disastrous yield losses.

Constraints to Tomato Production

Several factors affect tomato production and ultimately the cost of tomato cultivation. For one, farmers obtain seed either from their own fields, from neighbors and friends, or from women's groups that maintain and distribute varieties that are in high demand in the marketplace. This recycling drives down seed price, but has a negative effect on seed quality. Also, most tomato varieties used in commercial production are introduced varieties, which are not well adapted to local conditions in Ghana. This, along with the seasonality of tomato production, creates periods of abundance and scarcity, which dramatically affect market prices. On average, labor (land preparation, transplanting and harvesting) represents more than 50 percent of total production costs, but farmers who use family labor are hardly aware of this. Services and equipment costs together account for only 6 percent of the total expenses incurred by a tomato producer. Manure is often used as fertilizer by producers across the region. During the rainy season, fungal diseases and pests are common. Because synthetic insecticides and fungicides are generally too expensive for the average farmer to use, such expenses represent on average only 2 percent

of the total costs. Access to irrigation facilities also conditions production. Still, despite these constraints, farmers consider tomato production to be a profitable activity.

Farm level

Seed for GM virus-resistant (VR) tomato is expected to cost as much as 50 percent more than the typical certified seed. A small part of the research costs might be transferred to the consumer as a technology fee. In the case of a private provider, the firm would be able to charge higher seed prices if it had a monopoly in seed provision. The main reduction in costs from the use of VR tomato seed is from inputs and labor. VR tomato seed would require lower doses of pesticide to control the vector. Since the resistance is built into the plant, the population levels of white fly could be high. Karate, a wide-spectrum insecticide, is the major pesticide used by tomato farmers in Ghana. A total halt to the use of pesticide is not a realistic scenario because several other pests that also attack tomato plants need to be controlled.

Market level

The seasonality of tomato production together with the distance of the production areas from the consumption centers has favored the development of a vertically integrated market chain. A highly organized network of itinerant and sedentary wholesale traders, called "market queens," controls the transportation and distribution of tomato from producing areas to just about every village, district and city in Ghana. Margins to farmers are lower than to the other actors in the chain. While prices are more affected by season than by quality, the variety of tomato produced in Burkina Faso is preferred to the local tomato. Tomato quality deteriorates as a result of inappropriate postharvest practices, such as lack of storage and cooling facilities and unsuitable commercial containers. Breeding efforts (conventional or GM) should pay attention to market demands.

Industry level

Under the assumptions made in our simulations, investments in a VR tomato would yield benefits to the society. Even considering an irregular adoption path and accounting for costs of technology development and adaptation, the average return to investment in VR tomatoes is 76 percent. The benefits would be higher with a higher adoption rate. We have assumed a conservative 35 percent rate of adoption, which is equivalent to the percentage of farmers using new seed from the formal system. Notably, these farmers do not necessarily buy seed every season, but may buy seed one season and recycle it for four or five years. Maintaining this practice will only be possible if the introduced GM varieties are open pollinated, not hybrids.

Trade level

As Ghana is currently a net importer of tomato products, and the volume of exports of fresh or chilled tomatoes represents a very small share of total production, the introduction of GM tomato, if associated with a rise in farm productivity, could help satisfy the large and increasing domestic demand. Also, since Ghana is a net importer of processed tomato products, there appears to be no risk of immediate export losses in tomato due to market restrictions and lack of consumer demand in Europe. So, if Ghana were to commercialize GM tomatoes in the near future, trade issues would depend on the existence and application of future regional agreements related to the approval for imports of GM commodities. At the same time, the local need for tomatoes might encourage neighboring countries to agree on regional biosafety standards.

Policy Implications

Given the importance of tomatoes to the Ghanaian economy, the introduction of GM tomato varieties resistant to TYLCV would create substantial economic benefits for farmers and society. However, since TYLCV is not the only disease that affects tomatoes in this system, and since it is transmitted by a vector that would still be present in the fields, it is possible that farmers would continue to require pesticides and maintain the same level of application. As such, this technology may not significantly reduce grower investment in pesticides. Notably, other crop attributes may have to be introduced to tomato varieties to increase their productivity and economic viability, and decrease imports from Burkina Faso. Heat resistance is the attribute most in demand by growers in the southern part of Ghana, while resistance to transportation damage or delayed ripening are crucial for the northern regions. A tomato variety that is not customized for each region does not appear to be a viable economic alternative for farmers.

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FOR MORE INFORMATION

Horna, D. et al. *Assessing the Potential Economic Impact of Genetically Modified Crops in Ghana: Tomato, Garden Egg, Cabbage and Cassava*. PBS report, October 2006. Available upon request (dhorna@cgiar.org).

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