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ASSESSING THE POTENTIAL ECONOMIC IMPACT OF GENETICALLY MODIFIED CROPS IN GHANA

VIRUS-RESISTANT CASSAVA

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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 GM cassava in Ghana. The evaluation is based on analysis of secondary information at two levels: (1) the pertinent industry or sector of the national economy (consumers and producers, linked by markets), and (2) international trade.

Cassava and the Cassava Mosaic Virus (CMV) Disease

Cassava is perhaps the most important food crop in Ghana. The cassava tuber is produced in all but two regions in the northernmost part of the country. Average area cropped per year between 1999 and 2004 was about 750,000 hectares, with the primary producers being the Eastern, Brong Ahafo, and Ashanti regions. Total annual output of cassava during the same period was about 10 million metric tons. This crop is perceived to generate extensive farm and nonfarm linkages for rural development, since it is utilized in various forms. Apart from cooking the fresh root, it can be processed into *gari* (fermented cassava dough), tapioca (toasted starch), and cassava flour (crude and refined). All these products are used for human consumption. The cassava leaves are also consumed as a vegetable by some ethnic groups. Although dried cassava chips and cassava pellets are ingredients in livestock feed in Europe, this is not yet a common practice in Ghana.

The main diseases affecting cassava are cassava mosaic virus (CMV), cassava bacterial blight, cassava anthracnose, and root rot. Pests and diseases, in combination with poor agronomic practices, combine to cause high yield losses in Africa. While biological and chemical control practices are available for other pests and diseases attacking cassava, CMV is difficult to control. In severe cases, plants become stunted. In fact, this disease can cause up to 60 percent yield loss, and no biological or chemical control is now available to farmers. Given the vegetative propagation method used for cassava, availability of clean planting material for propagation is a major constraint, since white flies and contaminated material transmit the disease. The disease occurs throughout the country. At present, tissue culture (in vitro) propagation is too costly to be considered as an alternative for addressing this productivity constraint in Ghana. The use of varieties genetically modified that can tolerate the disease shows then great potential.

Constraints to Cassava Production

While cassava production demands few external inputs, labor and planting material are main costs of production. As a root crop, cassava requires a lot of labor to harvest. The production of cassava is dependent on a supply of good quality stem cuttings. The multiplication rate of these vegetative planting materials is very low, compared to grain crops, which are propagated by true seeds. Postharvest deterioration of cassava is a major constraint. Cassava stem cuttings are bulky and highly perishable, drying up within a few days. Consequently, roots must be processed into a storable form soon after harvest. Ghanaian farmers recognize postharvest loss as a major risk factor in cassava production. Nevertheless, the rapid

postharvest perishability might lead to comparative advantages for small-scale producers linked to small-scale processing units. Furthermore, many cassava varieties contain cyanogenic glucosides, and inadequate processing can lead to high toxicity. Various processing methods, such as grating, sun drying, and fermenting, are used to reduce the cyanide content.

Industry level

Given that cassava is extensively produced and consumed in Ghana, both consumers and producers would benefit from higher productivity and reduced damage to the crop. Results of the industry-level analysis show that a cassava resistant to CMV (VR cassava) would yield high social benefits to the country. The social net benefits are positive for all the scenarios evaluated. In fact, statistical analysis of the distribution of benefits confirms that the probability of social losses is insignificant. Benefits are high even assuming irregular adoption of the technology. Hence, the analysis suggests that there is virtually no downside risk for the industry as a whole.

Clearly, however, any factor that depresses adoption of GM crops in general reduces the expected benefits. Finding an effective means of disseminating GM plant material is critical. A sustainable seed production system needs to be built around a steady flow of new varieties, a primary multiplication point, and a distributed set of secondary and tertiary multiplication points. The cost effectiveness of tissue culture has to be examined. Given successful provision of GM planting material to farmers, factors that would affect the level of net benefits of GM cassava are (1) the elasticity of the supply or how responsive prices are to higher or lower production, and (2) the degree of disease abatement due to the genetic modification.

Trade level

Available data on international trade (Comtrade) suggest that cassava exports are relatively small, but targeted mostly to European Union (EU) countries, which have stringent import approval of GM products. Over 70 percent of total exports of fresh cassava go directly to the EU each year. Fresh cassava exports ranged from \$6,000 to \$500,000 per year, with an average of \$150,000 (or 6 million metric tons) during the period 1996–2003 and \$20,000 (or 60,000 metric tons) during 1998–2003. Because total exports are a small share of total production, one would need to compare the economic benefits for farmers with the potential loss in exports. If the technology has a high likelihood of returning more than \$100,000 of benefits per year, it could be considered beneficial for the production sector overall.

At a cost for preserving and monitoring identity, it would be possible to set up a segregation system for exports of non-GM cassava in order to avoid being subject to regulatory approval of the technology in the EU. The international market for cassava, however, is competitive. Consequently, EU buyers will most likely obtain their supply from other providers, at least during the approval process. Thus there are few economic incentives for market chain actors to set up a segregation system.

Policy Implications

Although VR cassava has received the support of the President's Special Initiative as a future target product for export, more research on cassava is needed at the farm and market levels to complement the GM technology and address industry needs. Farmers do not perceive CMV as a problem but rather as a factor that is inevitably present. They will only adopt VR cassava if the varieties show a clear technological advantage in terms of yield, higher storage capacity, or even higher starch content as well as disease resistance.

The use of VR cassava varieties with resistance to CMV would bring economic benefits to the general economy. Despite the evidence of positive net benefits, future GM research and development in cassava most likely lies in public hands. Cassava is a crop that links the farmer to the market, but overall it is a food security crop that needs public research investment. In addition, the vegetative propagation system of cassava does not create incentive for private participation, since they cannot profit from seeds. While it may be profitable for some private companies to invest in GM crops, there appears to be little scope for private intervention in the case of cassava. Despite Ghana's interest in transforming cassava into a major industrial crop, cassava is still a food security crop with a vegetative multiplication system.

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FOR MORE INFORMATION

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