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BRIEF NO. 3 OF 5

ASSESSING THE POTENTIAL ECONOMIC IMPACT OF GENETICALLY MODIFIED CROPS IN GHANA

INSECT-RESISTANT CABBAGE

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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 cabbage 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.

Cabbage and the Diamondback Moth (DBM)

Cabbage is a popular vegetable to grow and to eat in the urban and peri-urban areas of Ghana (particularly around Accra), where urban agriculture has boomed to meet a rising demand for fresh vegetables in the absence of appropriate refrigerating facilities. Growing cabbage is also an important source of income for migrant farmers. While convenient for farmers and consumers, cabbage production is associated with health and environmental risks due to contamination from pesticides and polluted water. Cabbage is often beset by insects. The primary pest is the diamondback moth (DBM, *Plutella xylostella*). The probability of farmers losing their entire crop to DBM could be as high as 75 percent if not properly controlled. DBM damage can be so profuse that farmers apply increasingly large amounts of insecticides to control it. (Pesticide application to control DBM represents the main cost to cabbage producers.) There is evidence that the indiscriminate and widespread use of pesticides has resulted in the development of pesticide resistance within DBM populations. This pest is especially serious in the Ashanti Region where some farmers have shifted to the production of less susceptible vegetable crops.

Constraints to Cabbage Production

There is almost no statistical information about cabbage production in the country. Average cabbage plot sizes are below half a hectare and represent almost 80 percent of the farmer's total cultivated area. Cabbage production can be a very profitable activity, with a quick return on investment. The total period that the crop is in the field varies from three to four months, but some varieties can be harvested in as few as 70 days. There is no seed recycling, but total seed cost for this crop represents only 5 percent of the farmers' total costs. Meanwhile, fertilizers and insecticides together account for 17 percent of total expenses, and labor costs a whopping 60 percent, with a high proportion being family labor. The main activities are land preparation, transplanting, weeding, watering, and harvesting.

Cabbage production tends to be very intense, with high levels of pesticides and fertilizers applied, which can run off into drinking water sources. This is a concern in the metropolitan area, as water is already scarce in Accra. Vegetable producers usually use low-quality water from drains, shallow wells, and streams to irrigate their fields. Many smallholder farmers have taken over so-called "open access" areas (or areas of restricted access, according to Ghanaian law), which are close to water

channels or water wells. As these areas should not be utilized, potential for conflict has increased over access to land. It has also been argued that water dugouts, wells, and channels used for vegetable irrigation represent potential breeding sites for the malaria vector.

Farm level

The perceived yield lost to DBM is quite high (27 percent). While it is most likely that a GM solution would involve a combination of Bt seed with Integrated Pest Management (IPM) practices, developing a prototype budget for the combination is difficult without additional information. For the Bt scenario, the reduction in the level of pesticides applied is assumed to be 25 percent, although it could be much greater since DBM is the single most important pest for cabbage. By the same reasoning, the reduction in the use of labor for spraying chemical could be higher. The marginal rate of return shows that for each dollar invested in Bt cabbage, the average farmer surveyed would recover not only that dollar but an additional 30 cents, if the GM technology is 100 percent efficient. Use of IPM also provides a high marginal rate of return, suggesting that a combination could be very profitable for farmers.

Market level

Cabbage marketing and prices are determined by the seasonality of demand. Cabbage demand peaks around Christmas and continues throughout the dry season. Both cabbage demand and supply are elastic. The compact head of Oxyllus, the most preferred variety, transports and stores well. Lack of variety diversity, however, is a problem that needs to be addressed.

Industry level

Under the assumptions used in the estimations, investment in GM cabbage would generate benefits for society. Returns to investment however are rather low. The net benefit value is especially low considering that expected maximum adoption is 100 percent. Results also show that there are relatively high chances of negative net benefits. These occur mainly in scenarios where R&D and technology transfer costs are taken into account. High R&D and biosafety compliance costs can reduce the profitability of this investment. However, high percentage yield loss due to DBM might justify the investment in Bt cabbage. Net benefits increase significantly for each percentage unit increase in yield and consequently in total cabbage supply.

Trade level

Reports collected from the Ministry of Trade and Industry in Ghana and the United Nations COMTRADE show that, in recent years, Ghana has not been a large importer or exporter of cabbage. Exports of cabbage from Ghana do not go to Europe or other OECD countries with strict importing regulations for GM crops, but to other countries in the region like Burkina Faso. Given the low value of trade and the apparent disconnection with sensitive markets, we expect that the introduction of GM cabbage will not significantly disrupt trade. If cabbage were to become a main export, the commercial risk for exporters would depend on the evolution of regulations governing the approval of GM crops in the region.

Policy Implications

A GM cabbage resistant to DBM is a technology that represents an attractive alternative to farmers, particularly those in the urban areas. The relatively small areas cultivated could limit the economic impact of a GM variety. The environmental and health hazards of cabbage production with current practices appear to be large, which suggests that a GM cabbage could generate substantial economic benefits to society. In spite of the high visibility of cabbage in urban and peri-urban areas, there is almost no information available on cabbage production. Additional information would allow the public sector not only to quantify the real impact of cabbage production, but also to propose policy solutions and control the negative externalities associated with this activity.

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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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