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Synopsis

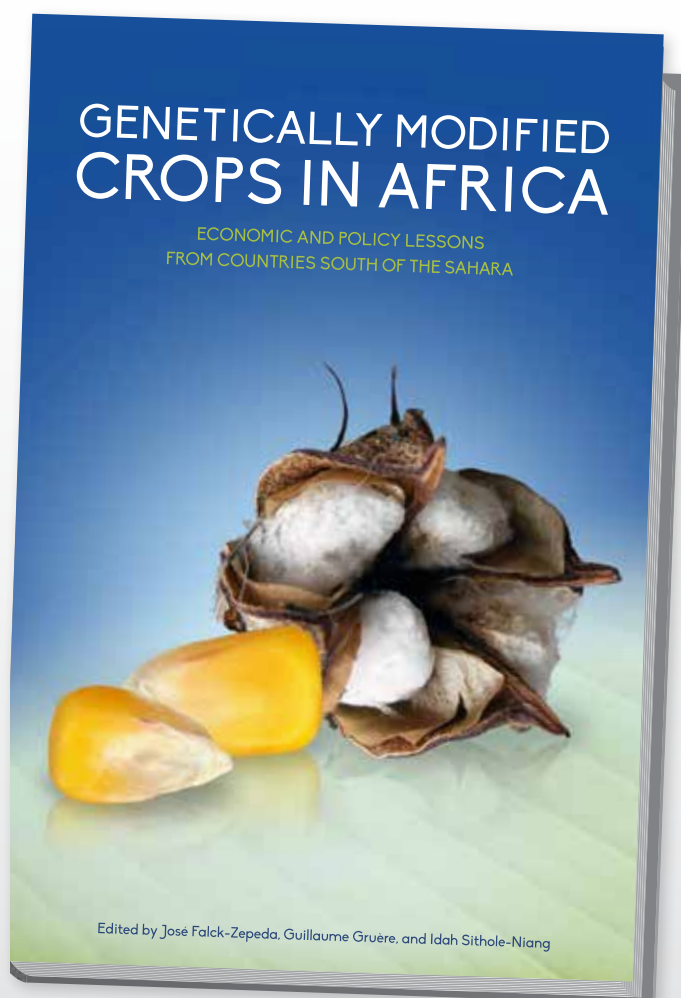
GENETICALLY MODIFIED CROPS IN AFRICA

Economic and Policy Lessons from Countries South of the Sahara

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Agriculture has a crucial role to play in ending hunger and poverty in Africa, as it contributes approximately 35 percent of the continent's gross domestic product while accounting for 70 percent of its labor force. Raising agricultural productivity is one of the best ways to increase rural income, and one promising but controversial means of increasing agricultural productivity is biotechnology, including genetically modified (GM) crops and other organisms.



Despite their promise, GM crops have been little used in African agriculture: as of 2011, Africa accounted for less than 1.6 percent of the 160 million hectares worldwide planted with GM crops. Some GM crops have been approved for commercial release in Burkina Faso, Egypt, and South Africa and are being tested in other African countries, but many policymakers and farmers in Africa south of the Sahara remain hesitant about using GM crops. They could benefit from more information about GM crops' potential, benefits, costs, and safety.

Genetically Modified Crops in Africa: Economic and Policy Lessons from Countries South of the Sahara aims to provide such information about these crops. Drawing on recently completed policy and economic analyses of GM products' current or potential effects in the region, the study addresses policy questions on biotechnology's role in Africa. GM crops can have a positive impact on African agriculture but this impact is highly dependent on conditions that include national and regional institutions. Various investments and reforms are necessary to improve the institutional context in African countries.

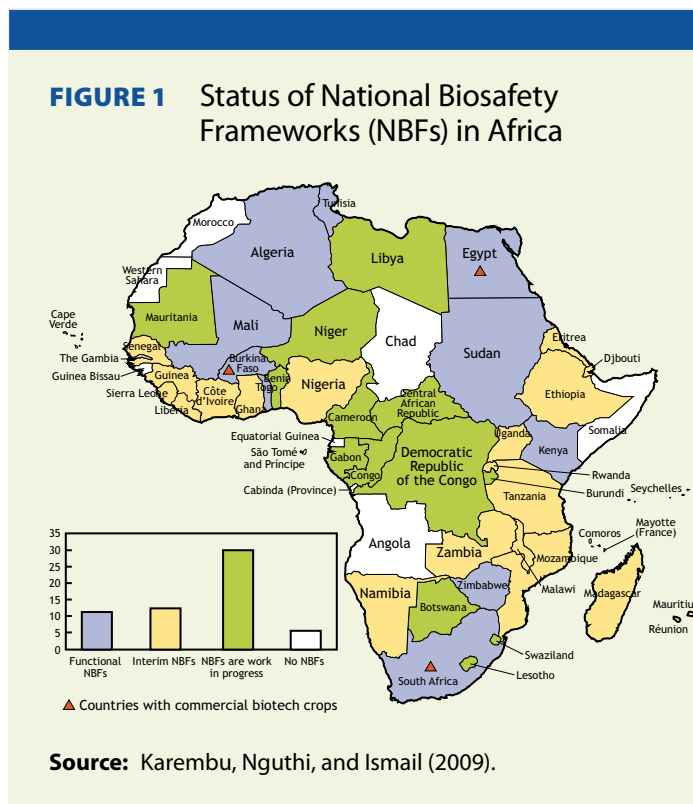
The current low level of GM crop adoption observed in Africa results partly from the state of biosafety regulatory frameworks: unlike traditional and organic crops, GM crops have to comply with biosafety regulations, which include policies, laws, and implementation regulations. In Africa, most countries lack functional biosafety regulatory systems (Figure 1), and even those with such systems have not necessarily approved a GM crop for release.

The low level of GM crop deployment is also because of an insufficient level of research and development (R&D) investment. The low availability of human and financial resources in the region limits the overall innovative capacity to conduct R&D and to develop indigenous GM crops. African GM crop adoption could affect trade because some countries might not want to import GM crops. The potential impact on intra-African trade is a reason for establishing regional biosafety procedures and a regional regulatory decisionmaking process.

FINDINGS

Five main lessons about both the opportunities offered by GM crops and the multiple challenges in effectively using them emerge from the contributions to this study.

Lesson 1: *Given available data and published studies, current GM crops have had, on average, a positive economic effect in African countries south of the Sahara. The magnitude*



and distribution of their potential economic benefits for farmers are highly dependent on the crop and trait involved and, above all, on the institutional setting in which the technology is introduced.

GM cotton and maize have had positive effects in South Africa. Over 90 percent of South African cotton and roughly 70 percent of maize is genetically modified. Peer-reviewed research on Bt cotton use in South Africa suggests that such cotton produces higher yields than conventional cotton while reducing farmers' insecticide costs. Another study found that the improved pest control fostered by GM maize use led to average yield increases of 10–11 percent for commercial farmers. Bt cotton has contributed an estimated additional US\$21 million to farm income over a 10-year period, while Bt maize increased adopters' farm income by a total of US\$476 million over a similar period. Analyses of what might happen if GM cotton and bananas are adopted in Uganda point toward other GM crop benefits: cotton and bananas that are resistant to insects or fungus or are herbicide tolerant (HT) could yield higher returns than alternative crop varieties.

These positive findings have important qualifications attached, however. For some South African smallholder farmers, GM cotton cultivation is made possible by a ginning company providing inputs and credit in return

for the right to purchase the resulting cotton crop. When poor weather and low cotton prices have prevented small farmers from paying back ginners' loans, the credit system has collapsed and cotton production has fallen. Further, no institution provides a comparable service for small maize farmers: South African farmers must pay for their own maize inputs, which might explain the low adoption rate of GM maize among small farmers. In Uganda, translating increased GM cotton yields into benefits for farmers depends on various conditions: the government needs to negotiate with the biotechnology's developer so the GM cotton fee does not offset the crop's benefits; GM and organic cotton production must be carefully separated so as not to damage opportunities to export organic cotton to genetically modified organism (GMO)-averse countries; and farmers must have access to herbicide and know how to use it for HT cotton to be beneficial. The welfare benefits of Ugandan GM bananas depend on overcoming negative perceptions of GMOs, especially among urban consumers. Local authorities and extension workers—who enjoy a high level of community trust—can do this by providing biotechnology-safety information. For all these reasons, technology-induced advances might be limited in the absence of institutional structures, regulations, and other conditions.

Lesson 2: *There are insufficient public and private efforts to develop biotechnology in Africa, and one of the main constraints is related to the policy environment.*

Most African countries faced stagnating or declining rates of growth in public agricultural R&D investment from the 1970s to the 1990s, although this trend has improved modestly between 2001 and 2008. Meanwhile, only a tiny fraction of private investment in agricultural biotechnology is relevant to Africa's needs. Low levels of agricultural R&D investment are partly because of the poor state of the institutions that disseminate agricultural biotechnology to farmers. This is a major disincentive to increasing regional investment in GM crops and biotechnology research.

Steps that can increase investment, particularly private-sector investment, in biotechnology R&D include greater private tax incentives for such research, the use of non-profit organizations as intermediaries that can protect private business' proprietary knowledge and technology, and efforts by the public sector to get biotechnologies to farmers. Also, exchanges of GM crop information between the public and private sector should be encouraged to foster biotechnology R&D. Greater public-private collaboration on agricultural biotechnology can foster a more entrepreneurial culture of innovation in African countries and make

public research institutions and private companies more responsive to emerging needs and opportunities.

Lesson 3: *Evolving biosafety regulations in countries south of the Sahara, which tend to determine the degree of deployment of GM crops in the region, appear to be based on a costly, European precautionary approach, despite clearly diverging agricultural and development priorities.*

Regulatory models in Africa tend to be influenced by European models, which are generally averse to GMOs. Causes of this European influence include extensive European bilateral aid to Africa; multilateral technical assistance to African nations from the United Nations Environment Programme, to which European countries are significant donors; and Europe's status as a major market for African agricultural exports. Because of these influences, African regulations are strict and biotechnology needs to go through a complicated approval process before being authorized first for confined field trials and then for commercial release to farmers. Widespread use of GM crops in farming can therefore take years to realize.

This European model does not correspond to African needs and realities, however. GM crops can aid farmers by reducing both losses from pests and the costs of weeding. For European countries, in which only a tiny percentage of the population grows crops such as maize, cotton, and soybeans, these advantages are negligible. In Africa, though, where 60 percent or more of the population depends directly on agriculture for income and subsistence, far more people could benefit directly from biotechnology that includes agricultural GMOs.

Delayed GM crop release under the European regulatory model defers benefits to farmers and returns to investors. Moreover, delayed returns and other high costs of compliance with extensive biosafety regulations can reduce investments in the regulated products and thus reduce the flow of potentially valuable products to farmers. Rather than imitate other regions' regulatory systems, African countries south of the Sahara need to consider and develop their own regulations for biotechnology development that balance risk avoidance (and the accompanying regulation costs) against such technology's net benefits for farmers.

Lesson 4: *Alleged short-term export risks due to potential market losses in Europe and other GMO-averse areas may have been exaggerated and need to be assessed on a case-by-case basis. Also, the upcoming challenges of market access and import regulations call for regional integration of GMO trade regulations.*

A literature review indicates that the risk of exports to European nations falling is relatively small in the short

and medium terms. Most African agricultural exports to other regions are products such as tea, coffee, vegetables, and flowers rather than the staples that are likely to be genetically modified. Most staples are currently traded with other African nations. Because trade patterns may change, however, the long-term consequences for exports of allowing and expanding GM crops may differ across countries. The risk of lost export earnings would need to be assessed for each trade partner, on a case-by-case basis.

Given the opportunities for exporting GM crops presented by intra-African trade, African nations should pursue regional trade agreements. Bilateral and multilateral mechanisms to manage intraregional trade in products that may contain GMOs are necessary to ensure that the goal of regional economic integration is not jeopardized. Biosafety considerations should therefore be incorporated into regional integration instruments.

Lesson 5: *The level of awareness of GM crops appears to be low among surveyed consumers. To the extent consumers are aware of such crops, they are generally accepting of them, but urban (especially high-income) consumers appear to have a lower acceptance of GM food than do rural consumers.*

Past literature shows minimal biotechnology awareness in Kenya and South Africa, while both the literature and original research shows GM products to be more acceptable to rural than urban populations in Benin, Kenya, Niger, Nigeria, and Uganda. Although low awareness and other limitations make it possible to draw only tentative conclusions about public attitudes' impact, the minimal

acceptance of GM crops among urban consumers might create significant challenges to commercializing potentially promising crops, especially foodcrops.

Developers and national policymakers need to pursue explicit and robust outreach and communication efforts to address urban consumers' concerns and raise awareness of the potential positive impact of GM crop technologies. Also, these communication efforts might need to go beyond consumers: in some cases, decisionmakers in the African food industry may be more skeptical of GM products than consumers are, perhaps because they are influenced by attitudes in European and other developed countries.

CONCLUSION

GM crops have a significant role to play in agricultural development in African countries south of the Sahara. This role will be defined largely by national and regional policy choices, as well as the institutional setting in which these technologies are deployed to farmers. Robust and consistent investments in technology and support of the institutional setting in which these technologies will be released to farmers are necessary to realize GM crops' potential. Although external institutions, such as international donors and regional organizations, will continue to play major roles, the driving force for biotechnology advancement lies in the hands of national policymakers and their willingness to pursue opportunities.

Reference: Karembu, M., F. Nguthi, and H. Ismail. 2009. "Biotech Crops in Africa: The Final Frontier." Accessed September 23, 2013. www.isaaa.org/resources/publications/biotech_crops_in_africa/download/Biotech_Crops_in_Africa-The_Final_Frontier.pdf.

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