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The Economics of Biotechnology (Gmos) and the Need for A Regional Policy: The Case for COMESA Countries

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Abstract

Many countries in the world have adopted genetically modified organisms as products that can have great beneficial impact on agriculture, industry and trade. However, to date for the whole of Africa, only South Africa has commercialized genetically modified organisms (GMOs). Realizing the high transactions costs—particularly in trade that may underlie different countries having varying policy stances on biotechnology, COMESA (COMESA—Common Market for Eastern and Southern Africa, is a regional grouping of 20 countries. In the context of this study, Tanzania is also included although it is not a COMESA member. This is because it belongs to the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) of which nine countries are in COMESA. ASARECA was an active partner in this process together with ACTS—African Centre for Technology Studies and PBS—Program on Biosafety) in collaboration with a number of partners embarked on a process of shaping a regional consensus on biotechnology policy for their 20 countries between 2004 and 2006 and adopted it in principle by the end of May 2006. Based on case studies of six countries—Egypt, Kenya, Ethiopia, Tanzania, Uganda and Zambia, this paper, summarizes the analysis of projected farm income gains in the region from commercialization of Bt maize and Bt cotton; provides an analysis of commercial export risks from approval of GMOs and states the position of COMESA countries on GMOs to date. Using quite conservative methods, projected net income gains from GMOs remain significant with over US $ 25 net benefit per hectare. As regards commercial export risks to Europe from GMOs, the analysis suggests that except for Egypt, countries need not fear significant export losses if they make a decision to plant any of the GM commodities currently on the market.

Keywords: Biosafety, Biotechnology, Africa, Policy

Introduction

The term “GMO” stands for “genetically modified organism.” It is a term used to identify organisms such as agricultural plants that have had their DNA modified using a process called “genetic engineering.”

The production of GM crops globally has increased 50-fold, from 1.7 million hectares in 1996 to 90 million in 2005 (Paarlberg 2006). GM crops were grown by approximately 8.5 million farmers in 21 countries in 2005, up from 8.25 million farmers in 17 countries in 2004 (Clive, 2004).

Although currently there are eight crops (maize, cotton, canola, soybean, tomato, Irish potatoes, papaya and rape) that are now commercialized around the world, In Africa, only South Africa is growing GM crops commercially, To date, Egypt, Kenya and Burkina Faso are testing GM crops.

Objectives of this Paper

The three key objectives are: (1) to estimate the impacts of GMO crops on farm incomes for maize and cotton (2) to estimate the possible commercial exports risks associated with planting of GMO crops in the COMESA region (3) to summarize the developments to date in developing a regional policy on GMOs for COMESA countries.

Methodology and Assumptions in Estimating Potential Farm Income Gains from Bt maize and Bt cotton

The method used here begins with an examination of the actual harvested area of maize/cotton in each study country. Data on harvested maize/cotton areas are available from the Food and Agriculture Organization (FAO) of the United Nations. We then estimate the share of this maize/cotton area that is currently planted to improved varieties of maize/cotton, including hybrids and improved openly pollinated varieties (OPVs) for the sake of maize. We assume it will be this area currently planted to improved varieties that will first switch to Bt. The percentage of this improved seed area likely to switch to Bt will then depend largely on the income constraints that seed-buying farmers currently face from stalk borer pests, the pests the Bt maize/cotton is intended to resist. We assume here that where stalk borers/boll worms are a primary farm production and farm income constraint for these farmers, roughly 40 percent of the maize/cotton area currently planted to improved varieties will switch to Bt varieties within 5-10 years. If the stalk borer /boll worm constraint is only secondary, we assume only a 20 percent switch to Bt. If the stalk borer/boll worm constraint is small compared to the many other farm income constraints faced by these farmers, we assume only a 10 percent adoption rate on this acreage currently planted to improved varieties. Once we have used this method to project the total area on which Bt maize/cotton is likely to be grown, we then bring in evidence of income gains per hectare that have been recorded in other countries from switching to Bt. This will allow at least a crude estimate of total income gains to be expected in the six study countries from commercializing Bt maize/cotton.

Data and Analysis

We have refrained from over promising farm income benefits. With these conservative methods, projected farm income gains remain significant. Moreover, these are only estimates of short term duration—5 to 10 years. But certainly, beyond 10 years the adoption rates and yield gains are likely to be phenomenal.

Table 1. Projected annual net farm income from commercialization of Bt maize

	Total harvested maize area, 20041	Share of maize planted to improved seed	Salience of Stalk Borer Constraint	Estimated maize area that would switch to Bt maize in 5-10 years	Estimate of net income gain per ha from swit-ching to Bt maize	Total annual net farm income gain estimated 5-10 years after commercialization of Bt maize
Egypt	830,000 ha.	90% of maize area hybrid seeds.	Primary	36 % of total (298,800 ha.)	$25/ha.	$7.5 million
	1,409,515 ha.	15% of maize area improved seeds	Secondary	3% of total (42,285 ha.)	$25/ha.	$1.1 million
Kenya	1,664,746 ha.	70% of maize area improved seeds	Secondary	14% of total (233,064 ha.)	$25/ha.	$5.8 million
	1,580,000 ha.	24% of maize area improved seeds	Primary	10% of total (158,000 ha.)	$25/ha.	$4.0 million
	750,000 ha.	20% of maize area improved seeds.	Secondary	4% of total (30,000 ha.)	$25/ha.	$0.8 million
	750,000 ha.	77% of maize area improved seeds.	Secondary	15% of total (112,500 ha.)	$25/ha.	$2.8 million

Source: Paarlberg, R. et al, RABESA Report No.1 ACTS 2006

Table 2. Projected net annual farm income gains from commercialization of Bt cotton

Country	Total harvested cotton area 2004 Ha	Share of cotton area planted by farmers with reliable and affordable access to quality seeds %	Salience of bollworm constraint	Estimated cotton area that would switch to Bt cotton in 5-10 years	Estimate of net income, gain per ha from switching to Bt cotton (USD per ha)	Total annual net farm income gain estimated 5-10 years after commercialization of Bt cotton (million USD)
Egypt	315,000	100	Primary	60% of total (189,000 ha)	50	9.45
Ethiopia	64,000	72	Primary	43% of total (27,500 ha)	50	1.37
Kanya	20,000	17	Secondary	5% of total (1,000ha)	50	.05
Tanzania	420,000	25	Primary	15% of total (63,000 ha)	50	3.15
Uganda	250,000	25	Primary	36% of total (19,800 ha)	50	1.88
Zambia	55,000	60	Primary			.99

Source: Paarlberg, R. et al, RABESA Report No.2 ACTS 2006

In Kenya for example, De Groote at al (2002) reports a loss of 13.5% due to stem borers valued at between US$25million and US$59.8million.

Export Risks

Export values of these commodities to various destinations were used to calculate potential risks under different scenarios. Because of erratic nature of some of the exports such as maize, average export values over a period of three years were calculated whenever large variations were detected. The export values are expressed as a percentage of total agricultural exports to the same destination in order to compute the magnitude of risk. A >2% proportion has been used in all cases as a measure of risk exposure

The analysis assessed four scenarios of potential export risks namely; Scenario I: Probable Scenario – Exports to EU; Scenario II: Unlikely scenario – Exports to EU of all possibly GMO tainted commodities; Scenario III: Unlikely Scenario-exports in the context of intra-regional trade for all commodities that could be GMO tainted; Scenario IV: Worst case/Unlikely Scenario – Global exports.

The results of the analysis under the four scenarios are presented in Tables 3-5. From the above analyses, under scenario 1 there is no risk exposure to any country of the region. Under scenario II Egypt faces a risk of 5.42%. Under scenario III, only Kenya and Egypt do not have significant risk exposures while Tanzania has the highest at 11.3% followed by Uganda at 5.5%. Under scenario IV, all countries except Kenya and Egypt face a risk of >2%--but this is considered the most unlikely scenario. Therefore, the magnitude of risk associated with exports to the EU appears to be relatively low

Toward a Regional Biotechnology (GM) Policy

COMESA, the largest economic trading bloc in Africa is confronted with a formidable challenge of reconciling trade and biotechnology/bio-safety developments. Regardless of individual nations positions, when some countries go forward with commercializing GMOs and others no, the region will become a patchwork of variable laws and regulations on GMOs. Even countries approving GMOs may have differing regulations and actual approved GM varieties. Trade problems may arise when countries have different regulations regarding the testing and approval procedures necessary to place GMOs and their products on the market or when they disagree about labelling and identification requirements. These conditions will pose critical challenges for the

Table 3. Scenario I: Probable Scenario – Exports to EU

Country	Value of total agriculture exports to Europe (US$ million)	Value of maize exports to Europe (US$)	Proportion of maize exports to total agricultural exports Europe (%)
Egypt	938	58,750	0.01
Ethiopia	450	0	0
Kenya	1291	2,059	0
Tanzania	408	19,052	0.005
Uganda	116	1,023	0.001
Zambia	119	0	0
Other	2753	33,359	0.001

Source: Paarlberg R. et al, RABESA Report No. 3, 2006

Table 4. Scenario II: Unlikely scenario – Exports to EU of all possibly GMO tainted commodities

Country	Value of total agriculture exports to Europe (US$ million)	Value of exports to EU that may be shunned as GMO tainted (US$ million)	Proportion of exports that may shunned to total agricultural exports (%)
Egypt	938	50.8	5.42
Ethiopia	450	0.045	0.01
Kenya	1291	0.456	0.04
Tanzania	408	1.4	0.34
Uganda	116	0.067	0.06
Zambia*	119	0.728	0.61
Other	2753	4.517	0.16

Source: Source: Paarlberg R. et al, RABESA Report No. 3, 2006.

Table 5. Scenario III: Exports in the context of intra-regional trade of all commodities that could be tainted as GMO

Country	Total Exports to COMESA (US$ m)	Of which can be shunned (US$ m)	Proportion of total exports to region (%)
Kenya	850	6	0.7
Uganda	147.8	9	5.5
Tanzania	186.4	21	11.3
Zambia	350.8	18	5.2
Egypt	372	1	0.3
Ethiopia	58.4	1	2.1
Other COMESA countries	396.9	21	5.2

Source: Paarlberg R. et al, RABESA Report No.3 2006

COMESA countries in terms of trade in specific commodities within the region, let alone outside the continent.

The divergence of national policies in the region inspired efforts to consider closer regional policy coordination. When considering issues of GM trade and biosafety, the potential benefit of greater policy harmonization among the countries in region is obvious.

If one country in the region approved the commercial planting of a GMO crop before a neighboring country had done so, the chance arose that routine formal or informal cross-border would begin to bring viable GM-seeds from the approving country into the neighboring country that had not yet given planting approval. Taking cognizance of the current and anticipated challenges, efforts directed towards establishing a common policy on biotechnology and bio-safety in the COMESA region were set in motion in 2004 and in May 2006, a representation of member states from COMESA meeting in Nairobi, Kenya agreed that the movement of GMOs in the region is an inescapable fact and hence agreed on a regional protocol on how GMOs will be managed and administered.

Conclusions

Net farm income gains by smallholder farmers from the use of GM seed maize and cotton are evident. Conservative estimates have shown net farm income gains per country of up to US $ 58 million for maize and US $ 9 million for cotton. Commercial export risks to Europe emanating from production and exports of GM crops that are now commercially available are negligible. In fact, countries of the region should be more concerned with having a harmonized regional policy on GMOs because intra-regional exports on the available GM crops are by far larger compared with exports to Europe. Individual nation's positions on GMOs--with some countries going forward with commercializing GMOs and others not, will seriously stifle intra-regional trade for these commodities.

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