

Reconstructing Agro-Biotechnologies in Tanzania

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IN SHORT

- Tanzania has recently jumped on the GM bandwagon. Genetically modified (GM) cotton Controlled Field Trials (CFTs), have started in the southern part of the country, as an initial stage before embarking on GM food crops.
- At the same time there is great concern whether Tanzania should promote GM crops and start their commercialization.
- The overall goal of this paper is to conceptualize ways to develop feasible agro-biotechnologies which address the real problems of the smallholder farmers in Tanzania.
- Based on a Tanzanian cotton sub-sector case study and literature review, the paper concludes that unless reconstructed, in their present form, agro-biotechnologies are likely to have only minor impact on improving the livelihood of resource poor farmers in Tanzania.

Background (1-2)

- In April 2005, Tanzania became the seventh African country to launch field trials of BT cotton.
- The Confined Field Trials (CFT) started in the southern part of the country where cotton farming was stopped in 1968 in a government move then aimed at halting the spread of red-ball worm disease that affected cotton yield.
- Thus depending on the outcome of these GM cotton CFTs and the anticipated positive reception by the cotton farming community, GM food crops will be the next target.
- In 2006 the Agricultural Biotechnology Center (ABC) was established at SUA
- The government views agricultural biotechnology as a tool to help Tanzania improve the nation's food security, raise agricultural productivity, increase farmer's income, foster sustainable development, and improve its competitive position in international agricultural markets.

Background (2-2)

- However, there is growing concern among development economists and policy makers regarding the impact of agro-biotechnology on Tanzania's agriculture and especially on smallholder farmer's livelihood.
- This led to the halting of the passing of the biotechnology policy by the parliament
- The big question is thus
 - should Tanzania promote agro-biotechnologies and start to commercialize GM crops?
 - what kind of technologies are currently needed by smallholder farmers and
 - under what context will they work best for the smallholders;
 - what will be the impact of alternative biotechnology policies on Tanzania's agricultural economy and trade?
- This is important because the agricultural sector plays an important role in the Tanzanian economy and possesses the potential to advance the country's objectives of growth and poverty reduction

Outline of the presentation

- The rest of the presentation is organized as follows:
 1. A brief profile of R&D and introduction of GM technologies
 2. The cotton sub-sector case
 3. A general review of the main problems facing smallholder farmers
 4. Conceptualization of the role to be played by agrobiotechnology in addressing smallholders' problem
 5. Concluding remarks

A Brief Profile of R & D and Introduction of GM Technologies (1-2)

- Tanzania was among the first early post-independence African states that recognized the importance of scientific and technological development in its quest for socio-economic transformation in the 1960s.
- The first national Science and Technology Policy for Tanzania was enacted in 1985. It was revised and published in 1996
- The policy objectives including: promoting science and technology as tools for economic development, improving human, physical and social well being and protecting national sovereignty.
- But, currently the policy under review identifies some research priority areas such as materials, biotechnology, telecommunications and information technology.
- The Government has actively supported the development of formal plant genetic resource management institutions.

A Brief Profile of R & D and Introduction of GM Technologies (2-2)

- This support was much broken in the 1990s structural adjustment programme (SAPs)
- The seed market was opened to multinational private seed companies
- Scaling down of support for the parastatal seed company TANSEED
- Additionally, reduce funding for Research activities (currently only 0.01% of GDP is allocated for R&D)
- From early 2000, with much effort from USAID biotechnology talks grew.
- Building of the Agricultural Biotechnology Center
- The preparation and presentation of the biotechnology policy to the parliament
- Start of the controlled field trials of BT cotton.

Is There a Role for GM Crops for Smallholders in Tanzania?

To try to answer this we look at the cotton sub-sector where BT cotton is on trials

Some facts about the cotton industry

- The cotton industry sustains, directly or indirectly, the livelihoods of nearly 48% of the Tanzanian population
- Most cotton is exported, contributing US\$100 million to export earnings (2005/06 season).
- Labor is the major input.
- Cotton is produced by smallholder farmers who cultivate between 0.2 and 2.0 hectares per year.
- Use of other inputs is limited.
- Cotton is cultivated in two areas, namely West Cotton Growing Area (WCGA) and East Cotton Growing Area (ECGA).

Some facts about the cotton industry cont...

- The main insect pests are cotton bollworm (*Helicoverpa armigera*) (HBW) and spiny bollworm (*Earias spp.*) (SBW).
- The main pest control recommendation is for six insecticide sprays, applied at 2-week intervals from first flower.
- However, research work at Ukiriguru Research Institute has shown that in some seasons, when bollworm pressure is low, there is no significant difference in yield between sprayed and unsprayed cotton (Baffes, 2002).
- In practice though, few cotton farmers in Tanzania apply more than one, two or at most, three sprays in a season.
- The current (from 2003/04 season) commercial cotton varieties grown in WCGA and ECGA are UK91 and ALAI 90 varieties respectively

INCREASE IN PRODUCTION

- BT cotton is being introduced as the 'liberator' of Tanzania's cotton smallholder farmers by agro-biotechnology promoters.
- Looking at the economic realities of cotton farming in Tanzania, bring up the question how farmers could derive any benefit at all from the GM seed.
- Tanzania is suffering from miserably low global cotton prices and its own increased domestic production
- In 2004/05 season after full introduction of UK91 and ALAI 90 varieties, the government introduced the region's first ever set of direct subsidies to cotton farmers.
- In the same 2005/2006 season farmers were in hard times with an estimated 7.8 million tones of cotton, out of the 28 million tones produced, being surplus production.
- Now, if cotton production is increasing without the use of GM technologies, are they really needed?

DISINCENTIVE

- Being labor intensive cotton is often an unpopular crop with smallholders.
- They grow it if it gives them a reliable source of income and when there is no alternative.
- Until 1992 the government-backed Cotton Authorities used to provide incentives to grow cotton by providing access to subsidized fertilizer, seed, and transportation of harvested seed cotton.
- The Tanzania Coffee Board together with private ginning companies still provided seeds for free.
- Selling the cotton seed would introduce a further disincentive to cotton growing.
- Under these circumstances, smallholder farmers will be burdened with more costs for GM seed with the possible addition of a 'technology fee'
- The enforcement of Technology Use Agreement (TUA), containing tight condition that forces farmers to purchase seeds annually, and thus enhance corporate profits, would also act as a disincentive to cotton production.

AVAILABILITY OF VARIETIES

- With two cotton growing areas (WCGA and ECGA), smallholders require seed for the varied physical environments.
- It is difficult for formal sector seed breeders (often biotechnology corporations) to provide the kind of seeds needed by the majority of farmers. This is because the formal sector seed system is geared to generating a limited number of varieties, each of which is distinct, uniform and stable, displays a wide environmental adaptability, and has a potential in terms of high yield if grown with application of external inputs.
- Where variation is dealt with by releasing a stream of new varieties over time, each to replace the previous, rather than by generating a large range of varieties at any one time, among which farmers can choose
- Thus replacing UK 91 and ALAI 90 (varieties now in use), by BT cotton would not necessarily address the needs of varied physical environments and many attributes already included in these varieties would be lost.
- On top of this, smallholder farmers, particularly those who do not use insecticides at present or who only use one or two sprays per season (Baffes, 2002), will find it more expensive to invest in GM cotton seed if they still continue to suffer significant yield loss from non-lepidopterous pests.

The major problem

- Thus it is apparent that seed technology is not what a cotton smallholder farmer in Tanzania needs or wants.
- With new non-GM varieties smallholder farmers have increased production dramatically but this is yet to translate to increased income and improved livelihoods.
- The problem in the cotton sub-sector is added value in the cotton value chain rather than simple increase in production as argued for the case of BT cotton.
- Cotton consumption within the country is low thus forcing most of the crop to be exported. This is partly because of lack of enough textiles and spinning industry to process cotton.
- Due to this Tanzania has failed to export a value added product contributing to a lower producer price.
- Thus the introduction of GM cotton alone in the country would only if at all solve one problem i.e. opening up part of the country that was not suitable for cotton production (this, in itself as shown above, would be counter productive).
- The positive impact on income and poverty reduction is thus exaggerated.

Re-appropriation of Agro-Biotechnologies in Tanzania

- To make an impact, agro-biotechnologies must target crops that smallholder farmers traditionally know how to grow and address agronomic traits of significant importance to their needs. The currently available and widely commercialized GM crops (e.g. BT cotton currently on CFTs) are not good examples of technologies that will help smallholder farmers.
- Available GM crops are not designed for poor smallholder farmers and it is doubtful that large agricultural companies will ever design crops exclusively for the benefit of smallholders.
- Therefore, scientists, international agricultural research centers (IARCs) and other players need to join forces to re-appropriate agro-biotechnologies to tackle the specific problems that smallholder farmers face.

Appropriate Technologies Needed By Resource-Poor Farmers (1-2)

- It is now evident from the work of Aaron deGrassi (2003); Hisano, (2005); Eicher et al (2006) and the case of cotton described above that, most GM crops are presently not tailored for smallholders and that they will take at least 10 to 15 years or longer to reach smallholder farmers in Africa.
- GM crops bring a different dimension, one that gives transnational corporations more control over farmer's seeds. With the patents they have on GM crops, corporations can prohibit farmers from saving seed from year to year.
- It should be remembered that, the vast majority of land in Tanzania is planted with seed of local species, developed and maintained by farmers themselves.
- For example in 2004/05 season it is estimated less than 15% of the maize crop in Tanzania was planted with purchased certified seed of modern varieties.

Appropriate Technologies Needed By Resource-Poor Farmers (2-2)

- Hence by introducing GM crops, potential benefits of improving food supply, would be accompanied by overwhelming new risks to traditional farming systems and to ecological systems.
- Therefore, for the time being, special attention should be given to strengthening conventional plant breeding programs in National Agricultural Research Systems (NARS).
- However, agro-biotechnology approaches must be nested and integrated into these plant breeding programs.
- On top of that smallholders need the support of rural development strategies that give farming communities control over their own resources and build on local knowledge and technology systems.

Conditions under Which Agro-Biotechnologies Should Be Developed (1-4)

- Although smallholders have long been ignored by the formal plant genetic resource management system, smallholders' knowledge and management skills are alive and well at the local level.
- In many parts of the country, farmers continue to play a key role in the selection and maintenance of varieties for food resources.
- Their skills in selecting for different characteristics to meet environmental, household and consumer needs are evident and well-developed.
- While some benefits can be foreseen to farmers from the introduction of agro-biotechnologies, particularly in better-off, market-led economies, care should be taken to avoid a high price to be paid for the gene pool.

Conditions under Which Agro-Biotechnologies Should Be Developed (2-4)

- New agro-biotechnologies should be developed in a manner that reduces dramatic impact on genetic erosion where the spread of a single variety can reach a point where community food security is under threat.
- In that context the links and interactions between local plant genetic resource management systems and formal plant genetic resource institutions need to be fostered.
- The demand driven technologies will give farmers more sense of ownership and thus act as an incentive towards adoption.

Conditions under Which Agro-Biotechnologies Should Be Developed (3-4)

- As observed in many previous works agro-biotechnologies are currently largely pursued by private multi-national companies which are profit oriented.
- For agro-biotechnologies to be “for the poor” the public sector must play a greater role.
- Given that GM crop development in the country is in its infancy and capacity building is basically a step by step process that unfolds slowly, donors and foundations can play a strategic role in supporting long term public sector investment in capacity building (human capital and infrastructure).
- This is a call for more collaboration between the public and the private sector in responding to smallholders technological and institutional needs.

Conditions under Which Agro-Biotechnologies Should Be Developed (4-4)

- Although it is evident that GM crops are still a long way from being a norm for smallholders in Tanzania, special attention should be given to raising public awareness of biotechnology, mobilizing political support and commitment to strengthening the country’s capacity in biotechnology, biosafety, food safety and IPR (Intellectual Property Rights) and mounting long-term training programs to train the next generation of plant breeders and GM crop specialists.
- On top of that, farmers should be made to understand that GM crops alone cannot deliver yield increases if basic crop management is poor.
- Thus pursuit of GM crops in the country should take the form of being only one part of the larger solution to problems facing smallholders.

Planning For the Impact of Agro-Biotechnologies (1-2)

- Like all agricultural technologies, the socio-economic impact of agro-biotechnology outputs must be taken into account.
- Understanding their benefits, compared with those of alternatives, is crucial in deciding when and where it is most appropriate to invest in biotechnology.
- The failure to anticipate and plan for differential response of farmers to varying opportunities and threats of agro-biotechnologies could lead to problems, as observed during the green revolution in Asia, where in spite of a significant increase in yields as a result of high use of chemical inputs, the major problem of worsening income distribution is still felt today.
- At this time, the government has not undertaken enough research to determine the impact of introducing agro-biotechnologies in the country.

Planning For the Impact of Agro-Biotechnologies (2-2)

- This raises the question of whether this whole rush to GM crops has been thoroughly analyzed and planned or is it just another response for donor support.
- What smallholders do not need is another technological innovation that will see others (multi-nationals) benefit at their expense.
- Planning for the impact of agro-biotechnology is crucial and should definitely be embedded in the whole idea of introducing the technology in the country.

Challenges to Overcome For Agro-Biotechnologies to Benefit Smallholders

- Even with proper planning, the reconstruction of agro-biotechnologies in the country faces two fundamental challenges.
- Firstly, most of the smallholder households and small and medium enterprises (SMEs) have few assets and are largely unorganized.
- As a result they do not reach the economy of scale to access the proposed agro-biotechnologies, markets, and capital required for rapid growth.
- The second challenge is the presence of policy and institutional weaknesses related to poorly defined property rights, and inadequate research and extension,

CONCLUSION (1-2)

- Tanzania should not give up the dream to acquire, develop and commercialize GM crops. The future of the country's agricultural development is to a great extent dependent on how well the agro-biotechnology industry would grow.
- However, there is a need to reconstruct agro-biotechnologies in Tanzania so that they can have an impact in solving the smallholders' problems.
- First, appropriate technologies which address smallholders' problem must be identified. We have seen that the present package of agro-biotechnologies is not tailored for this goal.
- Resource poor farmers are expected to be the major stakeholder in the development of these appropriate technologies. This would mean that technologies are developed by smallholders for smallholders.

CONCLUSION (2-2)

- Given that most agro-biotechnologies are pursued by the private sector, it will be for the interest of "the poor" if the public sector is assisted in developing capacity in agro-biotechnologies.
- Lessons from other countries which have introduced GM crops should be carefully assessed. This will help the government plan agro-biotechnologies which have a positive impact on the socio-economical situation of smallholders.
- More research is needed to give a comprehensive understanding of this subject in Tanzania.
- In their present form, agro-biotechnologies are likely to have very small impact (if any) on improving the livelihood of resource poor farmers in Tanzania, unless reconstructed.