Addressing the Impact of Biosafety Systems

Towards a Regional Approach to Biotechnology and Biosafety for Southern African Countries (RABSAC)

Three country synthesis report

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Please note:

This report draws on the following RABSAC project reports:

Phase I

- Stakeholders’ views and Situation Analysis – Mauritius by Harris Neeliah, Balraj Rajkomar, Asha Dookun-Saumtally and Jairaj Ramkissoon, August 2005
- Stakeholders’ views and Situation Analysis - Malawi by Charles Mataya, September 2005
- Stakeholders’ views and Situation Analysis – South Africa by Rosemary Wolson and Marnus Gouse, October 2005

Phase II

- National policy regarding food aid and commercial trade in GM crops and potential farm-level impacts of adopting GM crops – Mauritius by Harris Neeliah, Balraj Rajkomar, Asha Dookun-Saumtally and Jairaj Ramkissoon, September 2006
- National policy regarding food aid and commercial trade in GM crops and potential farm-level impacts of adopting GM crops - Malawi by Charles Mataya, September 2006
- National policy regarding food aid and commercial trade in GM crops and potential farm-level impacts of adopting GM crops - South Africa by Marnus Gouse, September 2006

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1. Introduction

Many developing countries, and particularly African countries, are at crossroads on making a decision regarding biotechnology and more specifically agricultural biotechnology and related products like genetically modified (GM) crops. The pace at which SADC countries are engaging in modern agricultural biotechnology is a cautious and precautionary one. This is partly caused by a lag in their own biosafety internal policy and regulatory capacities as well as a fear of losing international export markets if GM crops are adopted or accepted. Conversely, the opportunity cost of not adopting GM crops might be high for the SADC countries. Very impressive GM crop adoption rates in South Africa (in the 2005/06 season more than 90% of the total cotton area was under GM cotton and about 29% of the total maize area) suggest that African farmers can benefit from GM crops. The potential income gains associated with the first wave of technologies are significant and countries with a moratorium on GM crop imports also stand to lose out on much needed emergency food aid from organisations like the World Food Programme. Even and maybe especially countries who would like to remain GM free, for the time being, due to precaution or to enable them to produce for possible niche markets, needs to develop a biosafety policy. Failure by the SADC countries to engage in the development of a biosafety policy and regulatory framework is likely to increase biotechnology and trade divide in the region.

From March 2004 the Food, Agriculture and Natural Resource, Policy Analysis Network (FANRPAN) has been facilitating a project called “Regional Approach to Biotechnology and Biosafety for Southern African Countries” (RABSAC). This project is supported by the United States Agency for International Development (USAID) through the International Food Policy Research Institute’s Programme for Biosafety Systems (PBS). The RABSAC project followed a methodology similar to that of the “Regional Approach to Biotechnology and Biosafety Policy in Eastern and Southern Africa” (RABESA) project that was conducted for selected eastern African countries. The overall objective of these studies was and is to document a balanced review of the technical information needed to inform regional biosafety policy choices responsibly.

From early March 2004 RABSAC’s focus fell on three SADC countries, namely Malawi, South Africa and Mauritius. These countries were chosen because each presented a unique situation and thus case study:
South Africa has been producing GM crops since the 1997 production season and is the only country in Africa where GM crops are commercially produced. SA currently produces insect resistant cotton and maize and herbicide tolerant cotton, maize and soya-beans. Information on the South African experience with GM crops, especially the experience of small-holders, is of great interest to the rest of Africa, especially the SSA countries.

With Mauritius being an island, biosafety is of great concern, especially with Mauritius importing almost all its agricultural products. Mauritius is almost a mono-crop country with soil and climatic conditions suiting nearly only sugar-cane. Mauritius imports soya-beans and maize from GM producing countries. Mauritius is currently in a process of developing a biosafety policy and regulatory system and has significant capacity in biotechnology R&D.

Malawi is in an advanced stage of developing a biosafety policy and regulatory framework (one of very few in SADC). Transgenic crops like insect resistant cotton and maize is of great interest and Malawi is also part of a USAID funded project on transgenic cassava. ICRISAT has also identified Malawi as one of the countries that can benefit immensely from GM groundnuts that is currently still in a process of development. The Malawi policy regarding food aid is also of interest.

In Phase I of the research project, that stretched from May to September 2005, “current situation” and stakeholder analysis where undertaken in the three focal countries, highlighting where the countries currently are with relation to a biosafety policy and regulatory framework, what the major challenges are and what the knowledge level, perceptions and positions of stakeholders are regarding GMOs.

Phase II, that roughly stretched from November 2005 to May 2006, focused on the focal countries’ national policies regarding food aid and commercial imports of GM commodities as well as the potential and real farm-level impacts of allowing GM crop production.

This report aims to summarise and compare the findings of the study in the three countries. This report is a work in progress and will be updated with additional findings and insights that will follow out of the continuance of the RABSAC project for the period October 2006 to September 2007. This report draws on and frequently directly quotes out of the documents that were produced as research outputs during the run of the RABSAC project up to September 2006.
2. Policies and policy development

2.1. South Africa

Even though both Malawi and Mauritius have developed Acts that pertain to the regulation of Genetically Modified (GM) crops, these Acts are not currently fully functional or complete yet. South Africa is the only country with a functioning GMO Act. The South African Committee for Genetic Experimentation (SAGENE), a scientific advisory committee, was set up to monitor and advise on the development of GMOs in the country in 1979. Until the implementation of the GMO Act in 1999, regulation of transgenic crops was carried out by the National Department of Agriculture, utilising the services of SAGENE, which issued regulatory guidelines, informed largely by British guidelines in place at the time. The first application for a GM field trial was made in 1989 for Bt cotton. The commercial release of Bt cotton and Bt maize were approved under the SAGENE guidelines before the GMO Act came into effect.

South Africa’s GMO Act (Act 15 of 1997) in conjunction with its implementing Regulations (Government Notice R1420 of 26 November 1999) came into effect on 1 December 1999. The Act is intended to promote the responsible development, production, use, and application of GMOs while limiting potential risks, and lays down the requirements for the importation, production, release and distribution of GMOs. The Act applies to (a) the genetic modification of organisms; (b) the development, production, release, use and application of GMOs (including viruses and bacteriophages); and (c) the use of gene therapy (although techniques involving human gene therapy are explicitly excluded from the ambit of the Act).

The GMO Act provides for the establishment of several bodies:

- An Executive Council, made up of officials from relevant government departments, to advise, to make decisions on applications and to monitor matters relating to GMOs, including their potential environmental and socio-economic impact.
- The Registrar, responsible for administering the Act (which includes issuing permits for applications approved by the Executive Council).
- An Advisory Council consisting of up to eight scientists with GMO-related expertise, and two members of the public sector (ie government officials) with knowledge of ecological matters and GMOs, acts as the national advisory body on matters relating to GMOs. It has authority to advise the Minister of Agriculture, the Executive Council, other ministries and other appropriate bodies on request or of its own accord on matters
concerning the genetic modification of organisms, and may call for expertise from other bodies or persons and appoint sub-committees to deal with specific matters, as required.

- An inspectorate of officials who has authority to examine, inspect and monitor registered facilities and activities, authorized under the GMO Act during office hours, without need for a warrant.

Although the South African GMO Act has only been in force for a few years, amendments have been anticipated for some time. In 2005 the “Genetically Modified Organisms Amendment Bill” was passed in order to amend the Genetically Modified Organisms Act, 1997, in order to, amongst others, incorporate international agreements pertaining to GMOs to which South Africa is a party to (Cartagene Protocol on Biosafety), to amend and add certain definitions and to address issues regarding powers and duties of the Council and the Committee, procedure relating to application and issuing of permits, risk assessment, liability determination and information requirements.

2.2. Mauritius

The United Nations Environment Programme, with funding from the Global Environment Fund, has overseen a capacity-building project to help developing countries assess the potential risks and rewards of genetically engineered crops. The $38.4m scheme aimed at helping up to 100 countries develop the scientific and legal skills to assess genetically modified imports. Under this programme, national biosafety guidelines for the safe development and introduction of GMOs into Mauritius were prepared by the Mauritius Sugar Industry Research Institute (MSIRI, 1999). These guidelines provide a framework for practices and procedures for the safe use of biotechnology in Mauritius so as to protect the country from any adverse effect on human and animal health or the environment. They cover trials, release, import, export and transport of GMOs.

MSIRI has been a key player in the development of a biosafety framework in Mauritius. In 1993, it initiated work on the development of transgenic sugar cane and, in 1996, it constituted an Institutional Biosafety Committee to review all projects regarding GM technology.

Mauritius ratified the Cartagena Protocol on Biosafety (CP) in April 2002 and the Protocol entered into force on 11 September 2003. The Protocol directly refers to the precautionary principle (in that parties should not refrain from taking measures to prevent adverse effects on
human health and the environment merely due to lack of scientific certainty or lack of information) and establishes a so-called ‘advance informed agreement’ procedure for the import of LMOs. This procedure permits signatories of the protocol to acquire and exchange information on LMOs through a biosafety clearing house. The Biosafety Clearing House was created to support the Protocol by facilitating the exchange of scientific, technical, environmental and legal information and experience relating to LMOs (CBD, 2000). Under Article 19 of the Cartagena Biosafety Protocol it is stated that each Party to the Protocol must designate one national focal point (NFP) to be responsible on its behalf for liaison with the CP Secretariat. All designated NFPs are registered with the Biosafety Clearing House. The Mauritius Ministry of AgroIndustry and Fisheries is the NFP for Mauritius.

The Genetically Modified Organisms Act of 2004 was introduced to fill a legal void. There had been an increase in the quantity of GM food products in the global food chain and Mauritius, being a net food importer, is a link in that chain. GM foods were already represented on the local market. A number of foods consumed daily are made from enzymes derived from GMOs, like bread, cheese, meat, processed foods, fruit juice, beer and wine. But the main issue is the importation of transgenic maize and soybeans for mainly animal feed. There were numerous concerns regarding GMOs and a legal framework was required to set appropriate controls to regulate the entry of GM foods and other products derived from GMOs. The country also lacked a regulatory framework for field-testing and producing GM crops. Therefore it was appropriate for Mauritius to set up legal and regulatory capacities to provide adequate protection and confidence to all stakeholders.

The GMO Act (2004) has 25 clauses providing for measures to regulate the responsible planning, development, production, use, marketing and application of permits pertaining to GMOs in Mauritius, and for the necessary precautionary steps to control, inter alia, entry into the country, marketing, disposal and all other dealings with GMOs and products derived therefrom. It also sees to it that GMOs are not harmful to human and animal health and to the environment; for instance, by providing for the labelling of foods. The Act is part of the process of implementing the provisions made under the CP on biosafety as a precautionary approach towards all dealings with GMOs. It has been framed in order to address the different articles of the protocol, for instance, risk assessment as per Article 15, rigorous handling, transport, packaging and identification of GMOs as per Article 18, public awareness and participation as per Article 23, review of decisions concerning a GMO permit as per Article 12. Furthermore, at the regional
level, SADC emphasised the need for legislation on GMOs. Member states were urged to enact the necessary legislation in order to harmonize biosafety legislation and regulations within SADC by 2004. A fully implementable GMO Act would also help in regulating trade of GM products within SADC. This regional pressure contributed to the setting up of the legislation.

As one of the provisos of the CP, Clause 4 of the GMO Act proposes the setting up of a National Biosafety Committee (NBC). Clauses 5 to 6 of the act deal with the NBC, its composition and functions. The NBC is responsible for coordinating and monitoring the overall implementation of the act. Committee members will be experts in the field of biotechnology and relevant representatives of various authorities concerned with research and development, as well as with the trade, health and environment sectors. Should the need arise, external expertise can be sought to assist the NBC in deliberation. The consumers’ association has also been included to promote public consultation and involvement in decision-making. This will ensure that the ethical and social implications of developments in biotechnology, including issues of food safety, public health and environmental protection, are taken into consideration. The main function of the NBC is to examine, on the basis of scientific principles, all permit applications received by the Ministry concerning activities dealing with GMOs, including application, development, exportation, importation, marketing, production, release, research, sale, transit and use.

The legislation demands the maintenance of an up-to-date register of all facilities where activities with GMOs are carried out, along with other relevant records for regular inspection purposes to ensure strict compliance with conditions attached to the GMO permit. Clause 20 of the legislation also establishes clear-cut procedures in case of unanticipated accidents involving GMOs. This comprises emergency notification of an accident and its causes and other relevant information that would assist in assessing the impact of the accident, with a view to finding the right strategy to minimise damage, through the advice of a special committee comprising relevant experts.

It is clear that Mauritius potentially has a strong GMO legislation (based on the Cartagena Protocol) in place but not all the sections of the enacted GMO Act have been proclaimed, with the effect that the power and level of control of the legislation is still minimal. A NBC has been set up, but the role of the committee is still limited to investigating the implications of proclaiming the remaining sections of the Act. There is no independent technical arm of the NBC to examine risk assessment documentation on permit applications and advise the Permanent Secretary accordingly. This is a major weakness and could be one of the reasons why some
sections of the Act have not yet been proclaimed, even though the Act makes provision to co-opt if the need arises. There are no independent laboratories to carry out GM food tests locally. The situation could change with the coming of a new Food Laboratory, but its mandate with respect to screening of GM products has not yet been defined. National standards for GM foods and/or feeds have yet to be set and harmonised with regional and international standards.

2.3. Malawi
Malawi accepted genetically modified maize from the USA as food aid during the famine that hit the country in the year 2001. The Government was taken unawares that the food aid would contain GM in nature and had to come up with a position on GMOs there and then. The choice at that time was between starvation and eating GMOs to survive. The Government opted for survival. However, the question that lingered on the minds of policy makers was “for how long will Malawi continue to be a passive recipient of technologies, which she does not even understand very well?” Considering that the thrust of the new Government Policy was to reorient the country’s development paradigm from a consumption based economy to a production based one, science and technology, especially biotechnology were perceived as critical elements towards the attainment of this goal.

In the wake of this development, the Biosafety Bill was enacted into law by Parliament in October 2002 when the debate on genetically modified maize was at its highest peak. The Biosafety Bill was intended to ensure wise use and management of biotechnology and products thereof.

During the GM Maize food crisis, the Act could have assisted the Malawi Government and other stakeholders to decide on whether or not to import the GM maize. It could also have firmly guided on safe importation, distribution, public awareness, monitoring of possible contamination and health hazards; as well as liability and redress régime.

In spite of passing the MBA, no single application for testing, use and application of GMOs has been authorized in Malawi at the pretext that there is insufficient human and technical capacity to monitor the trials and applications. Maize, cassava and cotton are potential candidates for GM trials in the country.
Considering that the enactment of the Act was rushed due to the emergence of the GM food aid, the National Research Council of Malawi (NRCM) organized a consultative workshop that brought together various stakeholders in biotechnology whose purpose was to brainstorm, discuss, and make recommendations for harmonizing the policy, legal, and institutional framework for managing the use of modern biotechnology in Malawi. During the ensuing discussions it was apparent that there was no clear policy on biotechnology/ GMO related issues in Malawi to the extent that there were no guidelines and regulations on how biotechnology could be introduced and managed in the country. The meeting further observed a number of weaknesses with the Malawi Biosafety Act. Some of these included lack of specific focus, unclear clarification of definitions and terms and missing some important issues.

In the light of these concerns, the meeting agreed on the following key issues to be considered for taking the process forward:

- That the development of the biotechnology law in Malawi should begin with the development of the policy which should guide the process. The policy should be all encompassing including all aspects of biotechnology, GMO and Biosafety and all other concerns in areas of environmental, human health, ecology, social, ethical, livestock and other plant and animal welfare;

- The policy should be backed by a well thought legislation and regulatory framework that comprehensively address the demands of the legislation. Further, the policy should provide guidance on the naming of the Act;

- There is need to build capacity at sectoral and national level to ensure that the various responsibilities that emerge as a result of taking forward this work is easily met within the country;

- There is need to ensure that proper mechanisms for sourcing funds are instituted for this purpose, otherwise, failure to do so would frustrate and jeopardize the whole exercise. Mobilization of both public and private resources for this purpose should be expedited and special consideration should be given to those activities already in the pipeline;

- There is need to foster public/private partnership and encourage public awareness programs and that the success of this work would depend on the degree of consultation and participation during policy formulation stage and implementation; and that
• There is need for policy harmonization at national, regional and international levels so that there is complementarity between national and global initiatives.

In order to facilitate implementation of the above resolutions, the International Fertilizer Development Centre (IFDC) in collaboration with the Program for Biosafety Systems (PBS), the International Food Security and the Ministry of Agriculture and Food Security provided technical and financial support to the country through the National Research Council of Malawi (NRCM) to develop a comprehensive policy on biotechnology.

Currently, the draft Biotechnology Policy is being circulated in preparation for presentation to parliament and cabinet for adoption. The policy stance on food aid and GMO tolerance is that before any GM food is released, it should be assessed with respect to food, human health and the environmental effects and, wider input should be sought before a final decision on commercialisation of common foods is made. Further the policy states that proper labelling and regulation through a bureau of standards, and regulation of food additives in dairy products, shellfish, nutrition mixes, and dietary supplements, processed foods like meat, poultry and eggs should be observed.

In principle, the policy is geared towards promoting commercialisation of biotechnology and international trade in biotechnology products. The policy also aims at promoting free enterprise and international collaboration in biotechnology industry so that public agencies and private enterprises can become involved in research and development and commercialisation of new biotechnology products and services. Strategies to promote these aims and objectives as stated in the draft Biotechnology Policy are as follows:

a. Initiating a national biotechnology development programme and acquiring the necessary items of equipment and expertise with the view to building capacity and achieving self-reliance;

b. Establishing appropriate linkages between the biotechnology programme and Science and Technology coordinating institution to facilitate a strong, locally based bio-informatics system;

c. Establishing small and medium-scale biotechnology industries to engage in domestic bio-resource and biotechnological entrepreneurship development through:
• Purchase of patent or trademark
• Open market purchase of technology
• Technical assistance and collaboration

d. Setting up standards, specifications, guidelines and codes of practice according to international practice for biotechnology production and processing, including the handling of food aid.

Malawi became a signatory to the Convention on Biological Diversity on 10 June 1992 and ratified it two years later on 2 February 1994. In the same spirit, Malawi signed the Cartagena Biosafety Protocol in May 2000, but the Protocol is yet to be ratified.

3. Stakeholders

3.1. South Africa

An analysis of a stakeholder survey carried out in South Africa in 2000, classified stakeholders based on their attitudes towards agricultural biotechnology. 48 respondents from 33 organizations could be grouped into three perception clusters. The first group was made up of 15 respondents, mainly representing environmental NGOs, with a negative attitude. The second group consisted of 25 respondents with affiliations to government, industry, academia and producer organizations, who displayed a moderately positive view towards agricultural biotechnology, believing in its potential to solve certain South African agricultural problems. The third group of 8 respondents, representing a range of organizations and affiliations (with the exception of environmental NGOs), was very positive, holding strong belief in the power of agricultural biotechnology to alleviate current problems. Overall, representatives of environmental NGOs were found to be most strongly opposed to GMOs, while scientists (from both the public and private sectors) emerged as the most supportive stakeholder group (Aerni, 2001).

The South African government’s stance towards GMOs has been described as ‘guardedly positive’. This is borne out, for example, by a 2004 public statement from the Director General of the Department of Agriculture, which is responsible for administering the GMO Act and Regulations, in which the belief was reiterated that the use and application of GMOs can play an important role in poverty eradication, while at the same time the risks associated with application of the technology were acknowledged. However, despite this caveat, many would argue that
government’s approach is in fact highly supportive of the technology. It has been suggested that the long title of the GMO Act, which states its first objective as the ‘promotion’ of the responsible development, production, use and application of GMOs, encourages the regulatory authorities to promote GMO activities, which impedes their ability to assess the risks impartially and mitigate against them (Mayet, 2001). While DEAT has occasionally made statements which are more critical than those emanating from NDA (and which have resulted in the government being accused of sending ‘mixed messages’), DEAT defers to NDA as the lead agency on GM issues.

Despite the fact that stakeholders representing a wide range of constituencies have at some point weighed in on the South African GM debate, the main protagonists are respectively Biowatch, campaigning against the technology, and Africabio in support. The debate remains highly polarized and adversarial, with activists on both sides, each indignantly rejecting the validity of their opponents’ arguments and claiming the moral high ground, and government playing a somewhat passive role. Efforts have to be made to build trust, without which meaningful engagement will not be forthcoming. However, with stakeholders seen as occupying one camp (‘government, industry and specialists’) or the other (a small group of “concerned public’), it becomes difficult to identify an appropriate facilitator who is considered independent and can develop and facilitate a biosafety system for the benefit of the predominantly oblivious South African public.

3.2. Mauritius and Malawi

The same divide between scientists and NGOs is apparent in Mauritius. Survey respondents with a science background generally thought that GM crops would have a positive impact, whereas those from consumer organisations had a negative opinion of genetic modification. The results tend to show that those who had an optimistic view of the impact of GM crops had a background in the biological sciences, whereas those who considered themselves to be part of civil society and consumer organisations were more pessimistic. Stakeholders tended to rate their own knowledge of the technology as good, but 90% of them claimed that consumers have poor awareness. Further questioning regarding GMOs, legislation and international agreements however showed that even amongst stakeholders knowledge levels were low. The results show that there is a general lack of awareness associated with issues surrounding genetic modification. This gives rise to concerns (sometimes unfounded ones) on all issues surrounding genetic modification.
In Malawi there is still significant concern amongst government officials, parliamentarians and farmers regarding human and animal health effects of commercially available GM crops. This suggests that either there has been some extensive misinformation or there is a serious lack of information or maybe a lack of deliberate demand for information. It can also be that advisory scientists are delivering mixed messages.

This report would not like to suggest that any genetically modified organism is safe for human and animal consumption. However today it is common and accepted scientific knowledge that the GM crops that can be found on the commercial market have passed extremely stringent testing by not only the companies that produced it but also and especially by independent scientific bodies and review panels in order to ensure that it is safe for human and animal use. According to a report by the Council for Agricultural Science and Technology (CAST) the potential hazards associated with transgenic crop technology have been studied by the U.S. National Academy of Sciences (NAS). The NAS has repeatedly concluded that biotechnology is no more likely to produce unintended effects than conventional technology—indeed the greater precision and more defined nature of the changes introduced may actually be safer. European Union scientists addressed this same issue and concluded that conventional plant breeding produces more unintended changes than are introduced in the construction of a transgenic plant (Cellini et al. 2004). These studies found that there are no new risks associated with the transfer of genes across species barriers. They concluded that transgenic crops on the market today are as safe to eat as their conventional counterparts, and likely more so, given the greater regulatory scrutiny to which they are exposed. After 10 years of safe use, it is fair to conclude that the inherent safety of the technology and the premarket case-by-case safety assessments conducted by regulatory agencies around the world have ensured that foods from transgenic crops are as safe to eat as any food (CAST, 2005).

In all three focal countries there exist a need for more information regarding GM crops and the bodies, policies and legislation that governs them. Consumer confidence in regulatory systems is vital to enable outcomes to be credible and acceptable. Insufficient participation and a lack of transparency, breeds distrust, exposes the system to challenge, and in the long run, could limit the uptake of the technology and prevent it from reaching its potential to contribute to solving African problems for African farmers and consumers. This demands dissemination of a wide range of information pertaining to agricultural biotechnology and creation of opportunities for meaningful public participation.
Another issue for the Malawian government, exporters and farmers is that of possible export risk if GM crops are accepted or adopted. This is a very legitimate concern and one of the objectives of the RABSAC project is to study and supply more information regarding the possible loss of export markets.

4. Trade policies and trade impacts

4.1. Mauritius

Mauritius follows a food security strategy that involves securing adequate food at the national level and then ensuring that this food is accessible to the population. This approach has involved the interplay of food aid, trade and price policies. But here it needs to be highlighted that the weight of these policies has changed over time as a result of the economic development of the country. The food security policy of Mauritius was very dependent on food aid under the World Food Program in the seventies and eighties but has decreased drastically to reach zero in 1997, corresponding with the rapid economic development of the country, mirrored by the upward trend in GDP per capita. Mauritius is however classified as a net food importer by the World Trade Organisation (sugar does not qualify as a food item) and it has established procedures in the form of certificates and permits to regulate commercial food imports. These procedures do not cover imports of GM foods and the GMO Act was introduced to fill this legal void. One of its main objects is to regulate all aspects concerning the importation of GMOs locally, but the relevant section of the Act has not yet been proclaimed. This therefore minimises the powers of the legislation as far as the imports of GMOs into the country are concerned. Consequently the import of GMOs into the country is without a GMO permit and follows the same marketing chains as conventional imports.

4.2. Malawi

During the past two decades Malawi has increasingly relied on imports and food aid to compensate for recurring food production deficits. The country requires 2,173,600 - 2,654,080 metric tons of food in maize equivalents to feed an estimated 12 million people; but over the past two decades, food deficits have ranged between 400,000mt to 798,085 mt, the worst deficit being that of 1991/92 with a food deficit of approximately one million mt in maize equivalents. Since 1994, maize imports have risen above 200,000 mt except in 1999/00 and 2000/01, the period in which the country produced more than its requirements largely as a result of free input
distribution by Government. Since 2001 food aid in form of cereals has trebled from around 50,000 mt to 150,000mt.

Despite various initiatives, interventions and macroeconomic frameworks during the past 20-30 years, the overall performance of the food sector has been unsatisfactory. These initiatives included maize self sufficiency through government input subsidies from the time of independence in 1964 to 1994, Maize Productivity Task Force, and Maize Agronomy Research Programme (Manda 2001), donor-supported agricultural productivity investment program (APIP) and the starter pack and targeted inputs programme (TIP) which expanded access to credit and provided limited quantities of free inputs to smallholder farmers, respectively. Most recently in 2005/06, the Government re-introduced the input subsidy scheme targeting the poorest of the poor growing maize and tobacco. This programme is likely to continue for the next three to five years.

Import of commercial and food aid requirements have ranged from five per cent in good harvest season such as 1999/00 to as high as 27 per cent in a bad harvest year such as 2001. Although the national food balance sheet is based on nine crops which account for 85 per cent of the energy supply in the national diet, maize constitutes the major commodity in food imports due to the fact that it contributes approximately 72 per cent of the daily calorie. Increasing levels of imports of commercial and food aid demonstrate policy failure to reverse the deteriorating trend in the food security status in the country.

South Africa and the United States of America (USA) have been the major sources of commercial imports and food aid since the 1990s. The great drought of 1992 in Southern Africa, necessitated a large influx of foreign produce, especially yellow maize from the USA and South America. It is well documented that by the late 1990s, a significant and growing proportion of U.S. food aid included GM maize (either as whole grain or flour) or GM soy extract (which is used to make “blended foods” that Congress mandates be given). It is also known that the World Food Programme (WFP) has been distributing GM food aid in southern Africa since the mid-1990s. The United States provides more than half of the food aid, much of which is distributed by WFP, and approximately 35 per cent of U.S. food aid may contain GMOs. It is therefore interesting to note that that concerns of SADC member-states about the risk to consuming GM only surfaced a decade later.
In 2002 Malawi experienced severe food shortages in rural and urban areas in excess of 600,000 mt of maize. The maize shortage was worsened by the fact that a number of other countries in the SADC region, including Zimbabwe, Zambia, Mozambique, Namibia, and Angola, also experienced similar food shortages, which resulted in a high demand for maize in the region. To protect the Malawi population from the adverse effects of hunger, the Government of Malawi instituted a number of measures that included the purchase of maize from countries in Africa and abroad. The government imported relief maize, and in addition, the donor community offered to support Malawi with 210,000 mt of maize for free distribution. Of the donation, 73,000 mt was from the United States comprising bulked GM and non-GM grain. Considerable debate was held in the country on the advisability of accepting this maize. Eventually the Government of Malawi accepted the maize on condition that it would be milled prior to distribution. To date this remains the policy for importation of GM maize. Malawi also annually imports significant quantities of soya beans and has been importing from the main soya bean production countries (US and Brazil - that also happen to be the biggest GM soya adopters) for decades.

4.3. South Africa

South Africa is a net importer of cotton and soya. Cotton is sourced from surrounding countries like Zimbabwe, Zambia and Swaziland where GM cotton has not officially been released yet and soya, in all likelihood GM, are imported from the US, Argentina and Brazil. However, since the release of GM crops in South Africa trade concern has surrounded maize. With South Africa producing yellow maize mainly for animal feed and white maize for predominantly human consumption, the maize sector has for decades been geared to separate white and yellow maize and, because of the previous government’s emphasis on self-sufficiency, South Africa has ample silo storage facilities for grain. Infrastructure and a history of control on what goes where have made it possible to separate GM and non-GM maize if necessary and to an acceptable level. Maize that is produced for domestic use as maize meal (maize flour) or for animal feeds are not being segregated. South Africa is however a net exporter of maize to countries like Zimbabwe, Zambia, Malawi, Mauritius, Kenya, Mozambique and Japan where there is a demand for non-GM maize. Where non-GM maize is required, farmers have to declare whether they are delivering GM or non-GM maize to the elevators, the maize is tested using an inexpensive but, arguably rather inaccurate “dipstick” test, and the maize is delivered into specific silos. There thus is a real effort to segregate GM and non-GM but currently the system depends greatly on the honesty of
the farmer with the effect that sometimes stringent unintended GM tolerance levels can not be met out of certain silos or production areas, especially with increasingly severe EU tolerance levels. It can be expected that an increase in a non-GM premium will probably increase farmer dishonesty but it is also true that if premiums increase it might become economically viable to implement a more accurate and stringent segregation system. For South African food processors and trading companies who have identified a market opportunity to deliver non-GM maize and maize products to domestic consumers or export markets it has become common practice to contract farmers to produce non-GM maize. There are also a number of areas in South Africa were farmers have decided not to plant GM maize either as a marketing strategy or just because the technology is not needed in these areas. Currently South Africa’s GMO Act states that only GM events that have been approved for commercial production in South Africa are allowed to be imported. There currently thus exists a de facto moratorium on maize imports from the US as US maize is not segregated and contains Bt maize that was modified to control rootworm. South Africa does not have a rootworm problem and will in all likelihood (hopefully) never have need for rootworm resistant maize seed for production. A study by the Department for Trade and Industry is underway to assess the best plan of action.

In the following year the RABSAC project will focus on more in-depth research on trade effects of GM crop adoption in Malawi and Mauritius.

5. Real and potential farm-level impacts of GM crops

5.1. South Africa

In 1997 South Africa became the first country in Africa to commercially produce transgenic crops. To date the commercial release of insect-resistant (Bt) cotton and maize as well as herbicide-tolerant (RR) soya-beans, cotton and maize have been approved. Cotton with the “stacked gene” (Bt and RR) was approved in October 2005 after an extended review period of three years. Farmers started adopting insect resistant (Bt) cotton varieties in the 1997/1998 season and insect resistant (Bt) yellow maize in the 1998/1999 season. Herbicide tolerant cotton and soya beans were made available for commercial production in the 2001/2002 season and Bt white maize was also introduced. A limited quantity of herbicide tolerant maize seed was commercially released for the 2003/2004 season and in 2005 stacked gene cotton was released for commercial production.
According to Van Der Walt (2006) who conducts the official South African GM crop area estimations, supported by funding from the South African Maize Trust, GM cotton (Bt, RR and Stacked) currently covers approximately 92% of the total cotton area in South Africa. GM maize (Bt and RR) covers approximately 29% of the total maize area and herbicide tolerant soy beans cover 59% of the total soya area.

Socio-economics impact studies in South Africa have focussed mainly on insect resistant crops as they were first introduced. Some studies in herbicide tolerant crops are currently underway.

Adoption of insect resistant (Bt) crops can impact farm income in at least three different ways:
- Possible increase in yield due to better pest management
- Possible decrease in input cost through savings on insecticide chemicals and application costs
- Possible increase in input cost through a higher seed price and an additional technology fee.

If the particular pests are present but not in sufficient numbers to significantly affect yield, or if the pests affect yield but can be inexpensively controlled by other means, then the producer of the pest resistant crop may not experience a net benefit. If the pests are prevalent to an economically damaging extent in the area, however, then this complete control can result in significant yield increases (Marra, Pardey & Alston, 2002). In other words, if the use of insect resistant crops reduce the number of sprays and thus pesticide volumes needed to control problem insects and the reduced spraying need outweighs the additional cost of seed, then farmers gain.

In South Africa large and small scale farmers benefit from the use of insect resistant crops, but only in seasons when there is significant insect (boll worm on cotton and stalk borer in maize) pressure. Farmers can and do benefit significantly mainly by enjoying higher yields and saving on insecticide cost (purchase and application costs). Gouse et al (2003) found an 18.5% yield increase for large-scale irrigation cotton farmers for the 2000/2001 season, which compares well with a 16.8% increase measured on field trials at the Clark Cotton experimental farm in Mpumalanga. Large scale dryland farmers enjoyed a 14% yield increase while small-scale dry land farmers enjoyed an increase of between 16 to above 40 percent in 1998/1999 and 1999/2000 (Gouse et al, 2005). Commercial maize farmers estimate a yield advantage of approximately 10% with Bt maize (Gouse et al, 2005). Important to note however is that all of the above benefits
depend on the focus pest infestation level and the profitability of adopting Bt crops thus vary between seasons and areas. A number of farmers in South Africa have described the adoption of Bt crops as being like an insurance policy against boll worms and stalk borers.

Little independent research studies have up to now focussed on the farm level performance of herbicide tolerant soya beans, cotton and maize in South Africa, but the impressive adoption rate (Table 1) suggests that farmers are benefiting.

Table 1: Areas under GM crops in South Africa for the last couple of seasons

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bt Cotton %</td>
<td>70%</td>
<td>70%</td>
<td>81%</td>
<td>60%</td>
<td>39%</td>
</tr>
<tr>
<td>Area</td>
<td>25 000</td>
<td>18 000</td>
<td>30 000</td>
<td>12 719</td>
<td>8 420</td>
</tr>
<tr>
<td>RR Cotton %</td>
<td>&lt;10%</td>
<td>12%</td>
<td>7%</td>
<td>30%</td>
<td>13%</td>
</tr>
<tr>
<td>Area</td>
<td>1 500</td>
<td>3 500</td>
<td>2 500</td>
<td>6 360</td>
<td>2 805</td>
</tr>
<tr>
<td>Stacked gene %</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40%</td>
</tr>
<tr>
<td>Area</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8 630</td>
</tr>
<tr>
<td>Bt Yellow Maize %</td>
<td>14%</td>
<td>20%</td>
<td>27%</td>
<td>22.4%</td>
<td>18.7%</td>
</tr>
<tr>
<td>Area</td>
<td>160 000</td>
<td>197 000</td>
<td>250 000</td>
<td>249 000</td>
<td>106 967</td>
</tr>
<tr>
<td>Bt White Maize %</td>
<td>0.4%</td>
<td>2.8%</td>
<td>8%</td>
<td>8.3%</td>
<td>22.7%</td>
</tr>
<tr>
<td>Area</td>
<td>6 000</td>
<td>55 000</td>
<td>175 000</td>
<td>142 000</td>
<td>220 691</td>
</tr>
<tr>
<td>RR Yellow maize %</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.3%</td>
<td>11.8%</td>
</tr>
<tr>
<td>Area</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14 000</td>
<td>67 629</td>
</tr>
<tr>
<td>RR White maize %</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.3%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Area</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5 000</td>
<td>60 000</td>
</tr>
<tr>
<td>RR Soya-beans %</td>
<td>5%</td>
<td>10.9%</td>
<td>35%</td>
<td>60%</td>
<td>59%</td>
</tr>
<tr>
<td>Area</td>
<td>6 000</td>
<td>15 000</td>
<td>35 000</td>
<td>91 200</td>
<td>135 000</td>
</tr>
</tbody>
</table>

*According to Dr Wynand v d Walt of FoodNCropBio. Cotton areas 2005/06 in ha - own calculation

5.2. Mauritius

The adaptation or suitability of sugar cane (Saccharum) to the Mauritian climate coupled with preferential trade packages have made sugar cane of significant socio-economic value to the Mauritian economy. But reform of the European sugar regime has brought down guaranteed
sugar prices and consequently the Mauritian sugar industry is forced to increase its productivity and decrease its cost of production.

Weeds constitute a major constraint to production. They can affect yield up to 50%, depending on their type and the level of infestation, cane growth cycles, cultural practices adopted by producers and the agro-climatic zone. During the last decade or two a successful level of weed control has been achieved by making use of two or more herbicide treatments usually complemented by some manual weeding. But the importance of these different weeding methods has changed over the years due to increasing labour cost and the need to reduce the cost of production of sugar cane.

In 1996 research on the genetic transformation of sugar cane was initiated at the Mauritius Sugar Industry Research Institute with the aim of producing herbicide (Basta)-resistant varieties (BR). The first transgenic BR sugar cane varieties were produced in 1999 and have been evaluated under glasshouse conditions only.

One of the major benefits of adopting the GM technology is that it can potentially reduce the cost of production of sugar cane by decreasing the variable cost associated with weed management. For producers to adopt the Basta-resistant variety there should be palpable farm level benefits, but the economic assessment has shown that under present operational and market conditions weed control based on BR cane is not more cost-effective than alternative non-GM methods. However, the use and benefits of this new technology should not be overlooked as any reduction in price of Basta will open new avenues for an additional cost-effective management tool for controlling weeds in sugar cane.

Potato is the second most important food crop in Mauritius, with an annual production worth about 7 million US$. Mauritius imports around 10,000 T to satisfy domestic demand. But local production is reckoned to be competitive on the international market and consequently efforts to increase production must be sustained. Potato is a controlled product in Mauritius, that is, it is imported, stored and sold at the Agricultural Marketing Board. In 1998 the importation and prices of potato were liberalised, but the Marketing Board is still heavily involved in potato production, importation and marketing.

Potato virus Y (PVY) is a major constraint to local potato seed production. It is aphid transmitted and the disease is tuber-borne. It hampers seed potato production during the second season and
can result in yield losses of up to 20%. The Mauritius Sugar Industry Research Institute (MSIRI) initiated work on GM potato seeds. The transgenic (with high tolerance to PVY) and the non-transgenic lines of the Shepody variety (MT 15-15) were provided by Monsanto to assess their reaction to the local PVYN strain (MSIRI, 2002). Experiments carried out under glasshouse conditions showed that the transgenic lines were highly resistant as they did not show any symptoms, nor could any infection be detected. On the other hand the non-transgenic lines did show severe virus symptoms and were found to be infected. Further exploitation of the PVY gene construct from Monsanto did not materialise, but given that PVY is a major production constraint, other sources of the PVY construct have been sought and efforts will be put to produce a PVY-resistant potato.

The demand for grain maize is around 90,000 T and almost all of it is met by imports. Local production is around 300 T and consists basically of green cobs and sweet corn. The main reason behind the phasing out of maize production is attributable to Mauritius’ inability to achieve any degree of economies of scale in order to compete with imported maize. Two other reasons are the limited scope for improving yield and the limited scope to reduce the cost of production through mechanisation. Most of the constraints that have affected maize production locally do not have a “GM solution”. Today it is therefore economically more rational to import comparatively cheaper grain maize from the world market.

5.3. Malawi
A study by the IFDC in Malawi has shown that approximately 30% of annual maize crop harvest in Malawi is lost due to pests and disease infestation and it can be argued that up to 15% of the loss can be attributed to borers. It is estimated that a 15% reduction in yield loss as a result of using GM technology would double farmers’ gross margins in both Bt cotton and Bt maize (IFDC 2004).

The RABSAC project aims to collect more maize and cotton production information in the coming year in order to make more accurate or informed ex ante estimations regarding the possibilities of insect resistant cotton and maize in Malawi.
6. Conclusions

Contrary to the 6 countries in the RABESA project where the focal countries are at generally the same level of framework development and with roughly comparable agricultural conditions and systems, each of the three countries in the RABSAC project present significantly different contributions to the body of evidence needed to inform regional biosafety policy choices.

Mauritius has a strong R&D background and significant capacity and has been able to develop a comprehensive biosafety policy based on the Cartagena Biosafety Protocol. However the policy is still powerless as crucial sections have not been proclaimed by government. Even though Mauritius is in all likelihood currently importing GM maize and soya beans, there does not seem to be much concern out of a biosafety point of view. At the moment there also does not seem to be much need for a GM crop for commercial production in the sugar dominated Mauritian agricultural sector.

The influx of possibly genetically modified food aid in 2002 caused sudden great concern in a number of SADC countries. This is interesting as in 2002 these same countries had already been commercially importing soya beans and maize that contained GM soya and maize for a couple of seasons already. However in order to be able to make use of the much needed food aid the Malawian government felt that a biosafety policy had to be developed. Despite the fact that a policy was developed, no applications were submitted as it was felt that there was not enough capacity to evaluate applications. Four years after the food aid debacle, Malawi has overhauled its biosafety / GMO policy and the new policy is still under review. It is not clear if the human capacity problem is been remedied but there have been a number of efforts by amongst other PBS and UNEP-GEF to increase biosafety knowledge and skills of Malawian officials and scientist.

Maize and cotton are major crops in Malawi and Lepidoptera species are reported to cause significant damage. This means that Malawi stands to benefit from insect resistant crops – these will in all likelihood be the first crops for which commercial release applications will be brought before the new regulatory authority. As the South African experience has show us, the performance of these crops in the short term will depend on insect pressure, but ultimately the long term success of the decision to adopt or not will depend on the institutional management and development of supply chains. For example, farmers who do not use hybrid maize seed are very unlikely to adopt Bt hybrid seed and the technology will in all likelihood be available only in hybrids. Farmers will probably also not be willing to invest in expensive inputs if there does not
exist a trustworthy market offering a reasonable price. Cotton seed companies will also not enter
countries like Malawi if they cannot keep control over their cotton seed, prevent farmers from
replanting seed and protect their investment in R&D.

South African farmers have for almost a decade now been benefiting from the use of genetically
modified crops. The South African farmers have quickly realised that the technology will not
work for all farmers in all areas in every season. The technology is problem specific and if a
farmer does not have stalk borer problems, there is no reason why he/she should plant Bt seed.
The SA maize sector has also shown that it is possible to produce both GM and non-GM and
deliver to markets demanding GM free maize. Despite cotton farmers benefiting from the new
technology, there has been a steady decline in the cotton area produced over the last few seasons
due to a low world cotton price, a relatively strong Rand and comparatively better prices for
competing crops like maize and sunflower. This shows that GM technology is not a cure all and
that it is but an input like irrigation or fertiliser that can increase yield, decrease risk and increase
or replace managerial skills, but it cannot save a sector if the fundamental structures of market
and price are not in place and functioning.
7. References


IFDC (2004) in collaboration with the National Research Council of Malawi (NRCM), Lilongwe, Malawi. An Assessment of the Requirements for Establishing a Biosafety/Biotechnology Regulatory System in Malawi.


Van Der Walt (2006). GM Crop Area Estimations, FoodNCropBio
RABSAC papers:

Phase I

- Stakeholders’ views and Situation Analysis – Mauritius by Harris Neeliah, Balraj Rajkomar, Asha Dookun-Saumtally and Jairaj Ramkissoon, August 2005
- Stakeholders’ views and Situation Analysis - Malawi by Charles Mataya, September 2005
- Stakeholders’ views and Situation Analysis – South Africa by Rosemary Wolson and Marnus Gouse, October 2005

Phase II

- National policy regarding food aid and commercial trade in GM crops and potential farm-level impacts of adopting GM crops – Mauritius by Harris Neeliah, Balraj Rajkomar, Asha Dookun-Saumtally and Jairaj Ramkissoon, September 2006
- National policy regarding food aid and commercial trade in GM crops and potential farm-level impacts of adopting GM crops - Malawi by Charles Mataya, September 2006
- National policy regarding food aid and commercial trade in GM crops and potential farm-level impacts of adopting GM crops - South Africa by Marnus Gouse, September 2006