GM cotton push in Swaziland: Next target for failed Bt cotton

Research · July 2017

DOI: 10.13140/RG.2.2.11856.35845

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On 7 April 2015 the African Centre for Biosafety officially changed its name to the African Centre for Biodiversity (ACB). This name change was agreed by consultation within the ACB to reflect the expanded scope of our work over the past few years. All ACB publications prior to this date will remain under our old name of African Centre for Biosafety and should continue to be referenced as such.

We remain committed to dismantling inequalities in the food and agriculture systems in Africa and our belief in peoples' right to healthy and culturally appropriate food, produced through ecologically sound and sustainable methods, as well as their right to define their own food and agriculture systems.

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Acknowledgements

The Africa Centre for Biodiversity acknowledges the contributions of Linzi Lewis and Sabrina Masinjila of ACB and Dr Eva Sirinathsinghji. The ACB further acknowledges the support of PELUM Swaziland and the generous support of Bread for the World and the Swift Foundation.

Acronyms

ACB	African Centre for Biodiversity
ACTESA	Alliance for Commodity Trade in Eastern and Southern Africa
AFSA	Alliance for Food Sovereignty in Africa
AGOA	African Growth Opportunity Act
AICB	Inter-Professional Cotton Association of Burkina Faso
CFT	Confined field trials
CPB	Cartagena Protocol on Biosafety
CCSA	Competition Commission of South Africa
CEO	Chief Executive Officer
COMESA	Common Market for Eastern and Southern Africa
CSO	Civil society organisation
EPA	Economic Partnership Agreement
GDP	Gross Domestic Product
GM	Genetically modified
GMO	Genetically modified organisms
IPM	integrated pest management
ISAAA	International Service for the Acquisition of Agri-biotech Applications
PELUM	Participatory Ecological Land Use Management
RA	Risk assessment
SADC	Southern African Development Community
SEA	Swaziland Environmental Authority
TWN	Third World Network

About this paper

This paper is based on the research and work produced by the ACB and Dr Eva Sirinathsinghji, pursuant to a civil society organisation (CSO) biosafety capacity building workshop hosted by PELUM Swaziland and held in Swaziland on 30 March 2017. The aim of the paper is to provide a brief overview of the cotton sector in Swaziland and a critical analysis of the biosafety framework in relation to public participaton and access to information. An independent assessment of the application for GM cotton field trials, which sets out numerous biosafety and socio-economic concerns, is also discussed.

Summary

1. The push for genetically modified (GM) cotton is evident across the African continent. Bt cotton is a first entry transgenic crop, with the greatest likelihood of commercial approval – as has been the case in South Africa, Burkina Faso and Sudan.
2. Cotton is a major source of income for smallholder farmers in Swaziland, particularly in drought prone areas. Cotton is grown in all four regions of Swaziland, but primarily in the Lubombo and Shiselweni regions. There are approximately 2 500–3 000 small-scale farmers involved in cotton production across the country. Cotton producers are organised under the Cotton Growers Association.
3. In Swaziland, the cotton sector is vertically integrated and state controlled, which is an attractive environment for large multinational seed companies to enter, as was the case in Burkina Faso. The Swaziland Cotton Board provides a secured market for cotton producers, internationally supported research and development, and production and marketing of the cotton sector, and administers a credit scheme which finances seed, chemicals for cotton management, tractor hire and other activities related to the cotton sector. In this context, large multinational companies are provided a monopoly on cottonseed production. For example, Mahyco (Maharashtra Hybrid Seeds Co.; partly owned by Monsanto) has acquired the cottonseed company, Quton from Seed Co (previously Africa's largest cottonseed company).
4. Bt cotton is being offered as a saviour to declining cotton production, particularly with changes in market access following Swaziland being suspended from African Growth Opportunity Act (AGOA), and because of the potential of developing an integrated cotton-textile-clothing value chain in Swaziland.
5. In November 2016, The Swaziland Environment Authority approved open field trials of Bt cotton – also known as JK Event 1 cotton, owned by JK Agri Genetics, an India-based seed company. This Bt cotton makes use of a throwaway and outdated GM technology previously patented by Monsanto, the cry1Ac gene encoding for a Bt insecticidal toxin that targets pests from the Lepidoptera order of insects, like the African bollworm. The trait has come off patent and has been discontinued in South Africa, owing to widespread pest infestation.
6. JK Agri Genetics Ltd, which is linked to Mahyco Monsanto (India) Company, entered into a non-exclusive, non-transferable sub-licensing agreement with Mahyco Monsanto Biotech (India) Ltd in 2009. Previous field trials were conducted in 2014, and were halted due to the lack of an import permit being forthcoming for the import of GM cottonseed. The current Bt cotton trials commenced on 28 November 2016, for three GM hybrid cotton varieties deriving from JK Event 1 and imported from India, called JKCH1947 Bt, JKCH 1050 Bt and JKC 724, alongside the local non-GM variety, ALBA OM 301.
7. Revisions are being made to Swaziland's National Biosafety Act (2012) to expedite the commercial cultivation of GM crops. The proposed amendments are awaiting approval at parliamentary level.
8. The push for GM cotton in Swaziland is a well-coordinated strategy, including public relations work and biosafety capacity building. This is illustrated by the tour to India by an African delegation, including

Swaziland, in November 2016. The tour highlighted the benefits of Bt cotton in India and biosafety capacity building provided by the Common Market for East and Southern Africa (COMESA) with funds provided by USAID.

9. Although Swaziland is a Party to the Cartagena Protocol on Biosafety (CPB), which, under Article 21 (6) (c) requires that the government provide the public with access to a summary of risk assessment, no such summary was made publicly available. This rendered any comprehensive independent risk assessment of the field trial application documents impossible. Nevertheless, with the little information that was provided, we found that the data available on the characterisation of JK Event 1 is too inadequate to ensure safety of the introduced trait, thus falling short of Swaziland's Biosafety Act requirements. Further, information on the known risks of Bt toxins to human health and the environment that was provided in the application was outdated and excluded independent data exposing such risks.
10. Bt cotton only protects the crop against the infestation of certain pests, and does not address the multiple priority risks for farmers, especially agro-climatic variability. Due to the persistent drought, there was a sharp decline in the number of farmers engaged in cotton farming during the 2014/15 growing season (from the usual 3 000 to 1 997 farmers). This illustrates the need for more holistic measures to reduce risk and vulnerability.
11. With the introduction of more costly inputs associated with GM technology, farmers endure greater risk, betting on higher yields to recover higher debt. Therefore, agricultural climatic variability will also have an effect on cotton production, whether Bt or conventional. Low yields and higher-than-normal debts can have widespread implications for livelihood and food security. The ultimate beneficiaries are those who are able to take financial risks, such as wealthier farmers, who often have other forms of income.
12. In light of the potentially severe, adverse effects of the introduction of Bt cotton, especially for small-scale farmers (who are the initial targets of these technologies), the Swaziland government is urged to take a more cautious approach. Burkina Faso phased out Bt cotton in 2015, due to loss of quality characteristics that affected farmers, the country's market and profits of cotton companies, while receiving no compensation from Monsanto. In Ghana, the field trials involving GM cotton have also been abandoned. South Africa's Bt cotton farmers experienced crippling debt, which led to the plummeting of cotton production and closure of the Makhatini gin in 2007. It is vital that the Swaziland government learn from these experiences on the continent, before making any decisions regarding further field trials and revisions of its Biosafety Act to allow for GM based agriculture systems. The Swaziland government should seriously consider investing in research on alternative pest management strategies, which have shown to be effective.

Introduction

There is a concerted push for the adoption of GM cotton, particularly Bt cotton on the African continent as the GM industry is constantly looking to expand its influence and control into new territories. The promotion of Bt cotton is based on claims that crop cultivation will require markedly less insecticide, and this will result in increased yields due to reduced bollworm damage, which in turn will enhance profitability (Fok et al., n.d.). Cotton is a lucrative cash crop on the African continent; an essential income source for smallholder farmers in 28 African countries and contributing about 5% to global production (ACB, 2015).

In recent years, cotton production on the African continent has been declining – standing at half the world average – while global production is increasing. This is often cited by African governments to justify the need for quick fixes, such as GM technology to boost cotton productivity (ACB, 2015). In Swaziland, between 1993 and 2008, cotton production was reduced by almost half, and in the growing season of 2014/15, there was a further decline in the number of cotton farmers, which resulted in the cotton ginnery

receiving only 864 metric tonnes, a quarter of the usual throughput (Nkambule, 2015). There is hope that the introduction of Bt cotton will enable Swaziland to revive its textile and clothing industry, as part of establishing an integrated cotton-textile-apparel value chain within the country.

The only countries that have cultivated GM cotton on the continent are South Africa, Burkina Faso and Sudan, and in these countries exaggerated success has been attributed to its performance. Despite the claims of the benefits of Bt cotton on the continent, the situation on the ground reveals a tragic tale of crippling debt, appalling market prices and a technology prone to failure in the absence of very specific and onerous management techniques, which are not suited for smallholder production (ACB, 2015). Burkina Faso, Africa's largest producer of GM cotton in 2015, with over 700 000 MT of seed cotton produced (Dowd-Uribe and Schnurr, 2016) began to phase out Bt cotton in 2015. In South Africa, the collapse of the credit system led to a decline in cotton production, leaving farmers destitute. Burkina Faso is now planting conventional cotton, while in South Africa, cotton production is largely in the hands of large commercial farmers. Production of GM cotton in South Africa has declined over the years. In the 2015/16 production season, the GM cotton area planted decreased by almost half to 8 350 hectares, from 15 230 hectares in the 2014/15 production season(GAIN report, 2016).

Agroecology is evidenced as being a viable and necessary option for the future of agriculture. The current approach of using chemical inputs, facilitated by agricultural policy and practice on the continent, should be replaced by a biological approach. In West Africa, for example, there is a shift to organic cotton production, which has had significant economic benefits. The Swaziland government should also consider investing in alternatives to GM, such as agroceology. Furthermore, research has shown that alternative pest management strategies, such as integrated pest management (IPM), are also effective.

Background to the cotton sector

Overview of the cotton sector in Swaziland

Swaziland covers an area of 17 363 square kilometres and has a population of 1.287 million people, according to World Bank figures of 2015. About 80% of the Swazi population lives in rural areas and relies on subsistence farming (WTO, 2015).

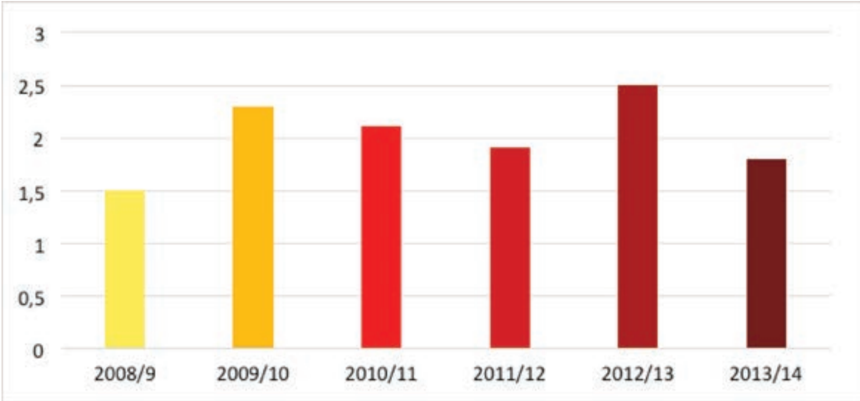
The cotton sector in Swaziland is a small yet significant contributor to Swaziland's economy. Since cotton is a dryland crop, it serves as a vital livelihood economic activity for many small-scale farmers who have little access to irrigation in drought-prone areas.

Cotton is grown in all the regions of Swaziland, but primarily in the Lubombo and Shiselweni regions. There are approximately 2 500–3 000 small-scale farmers involved in cotton production across the country, with the largest having approximately 40 hectares under cultivation (Kipling, 2010). Cotton producers are organised under the Cotton Growers Association.

Figure 1: Regions of Swaziland[1]

1. Obtained from: http://www.swazilandhappenings.co.za/swaziland_maps.htm

Figure 2: Cotton exports from Swaziland ('000 tons)



(Source: World Trade Organisation)[3]

The main players in the cotton sector in Swaziland include: the Swaziland Cotton Board,[2] the Swaziland Environmental Authority, the Cotton Growers Association, research centres and the African Cotton and Textile Industries Foundation; as well as the seed and agrochemical companies, farmer associations, ginners, spinners and government.

In Swaziland, the cotton sector is vertically integrated and state-controlled, which is an attractive environment for large multinational seed companies to enter because of the lack of competition and closed value chain. The Swaziland Cotton Board, which is the main institutional body co-ordinating the cotton sector, oversees research, production and marketing of the cotton sector and provides a secured market for cotton producers. In such a context, large multinationals are provided with a monopoly on cottonseed production. The Board also administers the Credit Scheme, which finances seed, chemicals for cotton management, tractor hire and other cotton activities. Unfortunately the Credit Revolving Fund has been underperforming and was operating at a deficit of E1.9 million (approximately US$140 351) in 2014/15 season, as 97% of the farmers who received financial support could not pay back loans (Swaziland Cotton Board, 2016). Furthermore, by June 2016, E2.4 million (about US$177 285,5) loan repayments were outstanding (Makhubu, 2017).

Table 1: Area and production of different crops in Swaziland, 2006–2008

Crop	Harvest area ('000 ha)	Metric ton production
Sugar cane	53	5000000
Maize	47	60765
Cotton	15	1115
Fruit	12	88809
Legumes	12	9426
Tubers	11	59821

(Source: Thom, et al., 2014)

The cotton value chain in Swaziland

All cotton growers sell their cotton to the Cotton Board, as part of the agreement through the Credit Scheme. The only ginnery in Swaziland, Sikhulile Ginner in Big Bend, spins all the cotton, separating the cottonseed and lint (Kipling, 2010). The ginnery has a capacity of 25 000T, but is currently operating at around 10% of its capacity, whereas it was ginning 1 556 T in 2009, and 2 450 T in 2010 (Kipling, 2010). The lint is sold to the only spinner in Swaziland, Spintex, based in Matsapha, which produces 400 T of cotton, poly cotton yarns, core yarns and sewing thread per month, principally for the South African market. In 1999, Spintex was bought by HGH Threads, a South African Company. The seed is currently sold to South Africa for livestock feed (Kipling, 2010).

2. The Swaziland Cotton Board consists of regional cotton farmer associations, ginners, spinners, the Department of Agriculture, and the Department of Finance.
3. https://www.wto.org/english/tratop_e/tpr_e/s324-04_e.pdf

In the early 2000's the Swazi textile industry was stimulated by AGOA (African Growth Opportunity Act), which creates liberal trade agreements between countries in sub-Saharan Africa and the United States of America. In 2015, however, Swaziland was suspended from AGOA[4] and has had to find alternative export markets for local textiles and clothing, primarily South Africa. Since June 2016, with the Economic Partnership Agreement (EPA) established between the European Commission and the Southern African Development Community (SADC), including Swaziland, the government sees new market opportunities for Swaziland textile and apparel industries.

The Swaziland GM cotton push in the broader African context

Status of Bt cotton in Africa

Until 2016, three countries in Africa grew GM cotton on a commercial scale: South Africa (since 1997), Burkina Faso (since 2008) and Sudan (since 2012) (ACB, 2015). Only South Africa and Sudan currently cultivate Bt cotton. There is also a proliferation of GM trials on the continent, accompanied by amendments to national biosafety legislation to facilitate fields trials and commercial cultivation.

Smallholder farmers bear the consequences of failed Bt cotton in South Africa and Burkina Faso

South Africa

South Africa was one of the first countries on the continent to plant GM crops, with the commercialisation of Monsanto's insect-resistant Bt cotton starting in 1997 (Dowd-Uribe and Schnurr, 2016). For large-scale commercial farmers, the adoption rate was high, as they realised the financial benefit of reduced pesticide applications and increased yields (Dowd-Uribe and Schnurr, 2016). After a year of the release of Bt cotton in the country, Monsanto launched a targeted campaign to increase adoption among smallholder cotton farmers in the Makhatini flats, a poverty stricken, remote rural district just south of the borders with Mozambique and Swaziland (Dowd-Uribe and Schnurr, 2016).

Historically, the smallholder farmers of Makhatini were growing cotton due to a range of economic, political and social forces that resulted in chronic indebtedness (Mayet, 2007). These farmers also operated in a closed value chain, where one parastatal cotton company managed all aspects of production, including credit supply, seed production and distribution, extension support, transport, ginning, etc. (ACB, 2015). As noted by Mayet (2007), despite cotton growing declining in South Africa, the government and a range of agribusiness actors, particularly Monsanto, lured the Makhatini farmers into adopting Bt cotton. They provided *inter alia* free production packages, including Bt cottonseed that was subsidised with public funds. Initial accounts of Bt cotton's performance were very positive, with reported gains in average yields and profits, and a reduction in the use of pesticides (Dowd-Uribe and Schnurr, 2016). The GM industry, together with the South African government, touted the experiences of these smallholder farmers as a 'success story' to be replicated in the rest of the continent (Mayet, 2007).

However, this success for the farmers in the Makhatini flats did not last. In 2003, the local credit institution collapsed under the weight of unpaid debt of approximately R22 million (approximately $2 million dollars at that time) (ACB, 2015). This was due to farmers deciding to sell their cotton to a new company, in a bid to avoid paying back their loans. Without the certainty of using cotton as collateral for loans, credit became unavailable and cotton production declined. Farmers were destitute, with social relations in tatters due to unpaid debts (ACB, 2015). Within 10 years of its introduction, most growers had abandoned Bt cotton altogether. Reduced cotton production led to the closure of the Makhatini gin in 2007. To date, there is minimal cotton

4. https://agoa.info/

production in South Africa, and even this is predominantly within the domain of large-scale producers. In the 2014/2015 growing season, 747 smallholder farmers contributed to only 2.8% of South Africa's total cotton production (ACB, 2015) while the total number of adopters during the same period was below 5%.

The Makhatini case showcases the inappropriateness of a development regime that seeks to introduce technological solutions to deeply rooted, systemic socio-economic problems (Mayet, 2007). Efforts to replicate this in Swaziland and elsewhere on the African continent will likely have similar results. According to Dowd-Uribe and Schnurr (2016), it is important that aggregate data is contexualised and analysed over a long period of time, to determine the implications of GM technologies for resource-poor and maginalised farmers, as well as for different actors along the commodity chain.

Burkina Faso

Burkina Faso is one of Africa's most consistent and largest cotton producers, where smallholder farmers account for the vast majority of total cotton production. The country was the top cotton producer in Africa in 2015, with over 700 000 MT of seed and cotton produced (Dowd-Uribe and Schnurr 2016). With a highly organised and regulated cotton industry, it appealed to multinational companies, such as Monsanto, for the introduction of Bt cotton. In 2003 Burkina Faso became one of the first African countries, other than South Africa, to begin experimental field trials on Bt cotton, in partnership with Monsanto. However, Burkina Faso refused the importation of germplasm from the United States, as it boasts a high quality cotton, exhibited through high ginning ratio and long fibre length (Dowd-Uribe and Schnurr, 2016), the result of a breeding programme spanning over 70 years in the country. Monsanto agreed to backcross its Bt cotton Bollgard II into local Burkinabe's varieties, which were subsequently released to farmers in 2008.

Burkina Faso made big news once it introduced Bt cotton and was celebrated widely by the biotech industry on the progress it had made in adopting and growing GM crops. By 2013, almost 70% of total cotton hectares were planted with Bt cultivars (Dowd-Uribe and Schurr, 2016). Like the Makhatini Flats farmers, this was used as a huge GM success story in helping poor African farmers out of poverty. Since the introduction of Bt cotton in 2008, the country has received delegations from at least 17 diferent African nations, with many of these countries represented on multiple occasions (Dowd-Uribe and Schurr, 2016). With farmers adopting the Bt cotton, yields and profit reportedly increased, with an average household gaining 50% more profit from conventional cotton, despite the high cost associated with the Bt cottonseed.

However, Burkinabe officials noticed declines in both fibre length and ginning ratios during the first years of commercial release, which persisted over time. This undermined the reputation of Burkina Faso's cotton and cut its value on the international market. Monsanto was unable to correct the declines in quality and Burkina Faso's cotton industry set a timeline to abandon Bt cotton and return to conventional Burkinabe cultivars. In 2015, Burkina Faso's cotton industry announced that it will phase out Monsanto's Bt cotton by 2017, citing inferior lint quality of the GM cultivars. The government managed to reduce availability of Bt cottonseed from the peak rate adoption of 73% in 2014/15 to 53% in 2015/16. They further planned on reducing this amount to 30% in the 2016/17 growing season, with the goal of a complete return to conventional cotton in time for the 2017/18 season (Dowd-Uribe and Schurr, 2016).

The Association interprofessionnelle du coton du Burkina Faso (AICB), which represents and manages the cotton sector, sought to claim compensation from Monsanto; around US$84 million in damages on the loss incurred over the years (TWN and ACB, 2017). However, Monsanto's contract with Burkina Faso for the commercialisation of Bt cotton expired in 2016, and, due to confidentiality of these agreements, it is difficult to determine what Monsanto is accountable for with respect to the damage incurred (TWN and ACB, 2017). In the end, Burkina Faso had to agree to a bad settlement deal, with no compensation and the dividing up of royalties withheld by Monsanto's partners (Reuters, 2017).

In 2016, Nigeria approved the commercial release of Monsanto's Bt cotton (Bollgard II). In Malawi, Bt cotton trials have progressed for three years, with an application for (commercial) environmental release being granted in April 2016. Since December 2016, the Ministry of Agriculture has been conducting variety registration trials in open fields.

Kenya is at advanced stages of field trials of Bt cotton, and in September 2016, approved national performance trials of Bollgard II to run for two to three years before approving commercial cultivation (FoEA and ACB, 2017).

While Bt cotton trials were, similarly, at an advanced stage in Ghana, according to recent news reports in Ghana, the Council for Scientific and Industrial Research (CSIR) suspended trials after Monsanto withdrew its funding (Ibrahim, 2017).

Cameroon, where field trials have been underway for some time, has amended its biosafety regulations to expedite the commercial release of Bt cotton (FoEA and ACB, 2017).

Field trials have begun in Ethiopia while Zambia is in the process of relaxing their biosafety laws in preparation for Bt cotton experimentation (FoEA and ACB, 2017).

Swaziland, another target for GM cotton, approved an application for confined field trials involving Bt cotton in November 2016. This application was submitted by the Swaziland Cotton Board and the GM seeds was sourced from JK Agri Genetics Ltd, an Indian Company with links to Mahyco Monsanto (India) Company. However, Swaziland is not new to these field trials, as previous trials involving Bt cotton had already been done in 2014. The 2014 trials were discontinued, due to the lack of an import permit required for the importation of GM cottonseed to continue the trials.[5]

In order to ensure the easy transition from field trials to commercialisation, Swaziland is weakening its Biosafety Act No. 7 of 2012, which is viewed by the Chief Executive Office of the Swaziland Cotton Board, Mr. Khumalo as a hindrance to the introduction of GM in the country (Nkambule, 2015). Currently, the amendments are at parliamentary level and it is only at a proposed validation meeting that civil society organisations will be included.

USAID and COMESA'S influence

A number of players are involved in the promotion of GM crops in Africa. In particular, USAID has funded capacity building, technology transfer and infrastructural development through an intricate network of institutions and programmes, and has, in many cases, assisted with the founding of new African bodies to oversee biosafety policy development, technical guidelines and GM public relations (FoEA and ACB, 2017). Key programmes funded by USAID include the Agricultural Biosafety Support Project and Programme for Biosafety Systems, the International Service for the Acquisition of Agri-biotech Applications, African Biosafety Network of Experts, Open Forum on Agricultural Biotechnology in Africa and African Agricultural Technology Foundation, to name a few (FoEA and ACB, 2017). USAID has also supported the development of harmonised biosafety policies within Regional Economic Communities to promote expedited and seamless regional trade in GM seeds and grains as is already the case with COMESA (FoEA and ACB 2017). Financial support of African expert legal scientific bodies working in collaboration with American experts craft harmonization regulation policies where priority of investor profits are high with little regards of safeguards for environmental and socio-economic wellbeing (ACB,2015).

USAID also funds the implementation of the COMESA Policy on Biotechnology and Biosafety, which was adopted in February 2014. Member states of COMESA validated the implementation plan in March 2015 (ACB, 2015). In March 2017, while ACB was attending the CSO biosafety capacity building workshop in Swaziland, COMESA was

5. Information from the Swaziland Environmental Authority registrar Bongani Nkabindze during the Swaziland Biosafety Workshop on the 30th of March hosted by PELUM Swaziland

holding a workshop as part of their biosafety harmonising process. This workshop focused on risk analysis and regulatory compliance monitoring and inspection for GMOs in Ezulwini. Media reporting of GM has also shifted on the continent, owing to the strategy COMESA has adopted in 'creating more awareness' of GM technologies for more favourable media reporting. The skewed propaganda campaign also included a tour by African delegates, including Kenya, Malawi, Zambia and Swaziland, to Bt cotton fields in Maharashtra State in India in November 2016, which was supported by ISAAA AfriCenter, Alliance for Commodity Trade in Eastern and Southern Africa (ACTESA) – a specialised agency under COMESA, United States Department of Agriculture and the South Asia Biotechnology Centre (ISAAA, 2016). This tour was part of the strategic objectives of COMESA Biotechnology and Biosafety implementation plan, designed to support experience-sharing through peer-learning platforms within COMESA member states and beyond. It is through this study tour that that the Swaziland delegation solidified its relationship with Mr Sanjay Kumar Gupta, President and Director of JK seeds (JK Agri Genetics Ltd), who encouraged Swaziland to take up GM cotton production (ISAAA, 2017).

Mergers and GM cottonseed industry expansion

Despite its relatively small size (less than 2% of the global total in monetary terms) the seed industry in sub-Saharan Africa already appears to be following the same trends of corporate expansion and consolidation apparent at the global level. African agriculture is becoming increasingly corporate controlled and concentrated, as is evident by the recent spate of mergers; giants Bayer-Monsanto, Dow-DuPont, and ChemChina-Sygenta (ACB, 2017). The merger most recently approved on the continent was Bayer-Monsanto in May 2017, by the Competition Commission of South Africa (CCSA) . However, the CCSA noted in its ruling that the merger would produce a monopoly in the supply of GM cottonseed in South Africa, where over 90% of the seed used is

genetically modified, and therefore required the disposal of Bayer's GM cotton assets and sales to another entity that will produce the seed and chemicals commercially in South Africa. Unfortunately, this still locks South Africa in the GM technological paradigm (ACB, 2017).

To date, Swaziland has been sourcing its main cotton variety (non-GM) ALBA QM 301 from Quton Seed company based in Zimbabwe, as there is no cottonseed production in Swaziland. Quton, Africa's largest cottonseed producer, based in Harare, Zimbabwe, was acquired by India's leading agri-biotech company, Maharashtra Hybrid Seeds Company (Mahyco), from Seed Co, Africa's largest seed company.[6] Mahyco is 26% owned by Monsanto and has 50:50 joint venture with the gene giant to sub-license its Bt cotton traits throughout India. The acquisition of Quton by Mahyco was criticised by the Alliance for Food Sovereignty in Africa (AFSA) in 2014, which warned against a neo-colonial occupation of Africa's seed systems.[7] Interestingly in the Swaziland case, JK Agri Genetics Ltd (jkseeds.net) is the company supplying GM seeds for Bt cotton field trials, which will ultimately lead to the application for commercial release. JK Agri Genetics Ltd entered into a non-exclusive non-transferable sub-licensing agreement with Mahyco Monsanto Biotech (India) Limited (MMBL) in 2009.

6. www.business-standard.com., 2014
7. See AFSA's press release: Acquisition of Africa's SeedCo by Monsanto, Groupe Limagrain: Neo-colonial occupation. https://goo.gl/XHRuW6 .

Table 2: Status of GM cotton in African countries by December 2016

Country	Trait	Institutions/companies involved	Status as of December 2016
Burkina Faso	Insect resistance	Monsanto; Institute of Environment and Agricultural Research; Inter-Professional Cotton Association of Burkina Faso (AICB)	Commercial release since 2008. Discontinued in 2015, due to short cotton fibres and losses suffered by farmers and seed traders.
Sudan	Insect resistance	Biotechnology and Biosafety Research Centre; China-aid Agricultural Technology Demonstration Center, Elfaw	Multi-location trials completed for three additional Bt hybrid varieties. Approved for commercial planting in 2012.
Nigeria	Insect resistance	Monsanto Agriculture Nigeria Ltd	Approved for commercial release: Bt cotton on four multi-location national performance trials. No commercial cultivation has commenced due to civil society push back.
Ethiopia	Insect resistance	Ethiopia Institute of Agricultural Research; JK Agri Genetics-India	Multi-location trials in six sites. Trials commenced in 2012.
Cameroon	Insect resistance and herbicide tolerance	Bayer Crop Science	Application for environmental release in process, with field trials having commenced in 2015.
Kenya	Insect resistance	Kenya Agricultural and Livestock Research Organisation; Monsanto	Conditional approval for environmental release to conduct national performance trials.
Malawi	Insect resistance	Lilongwe University of Agriculture and Natural Resources; Department of Agricultural Research Services; Monsanto; Quton	General release approved, however no commercial cultivation has yet taken place. Variety registration trials underway in nine sites.
Swaziland	Insect resistance	Swaziland Cotton Board; JK Agri-Genetics	Approved confined field trials (CFTs) underway.
South Africa	Insect resistance and herbicide tolerance	Bayer Crop Science	Trial permit granted for commercial growing.

Source: Adapted from ISAAA, 2016; ACB, 2017

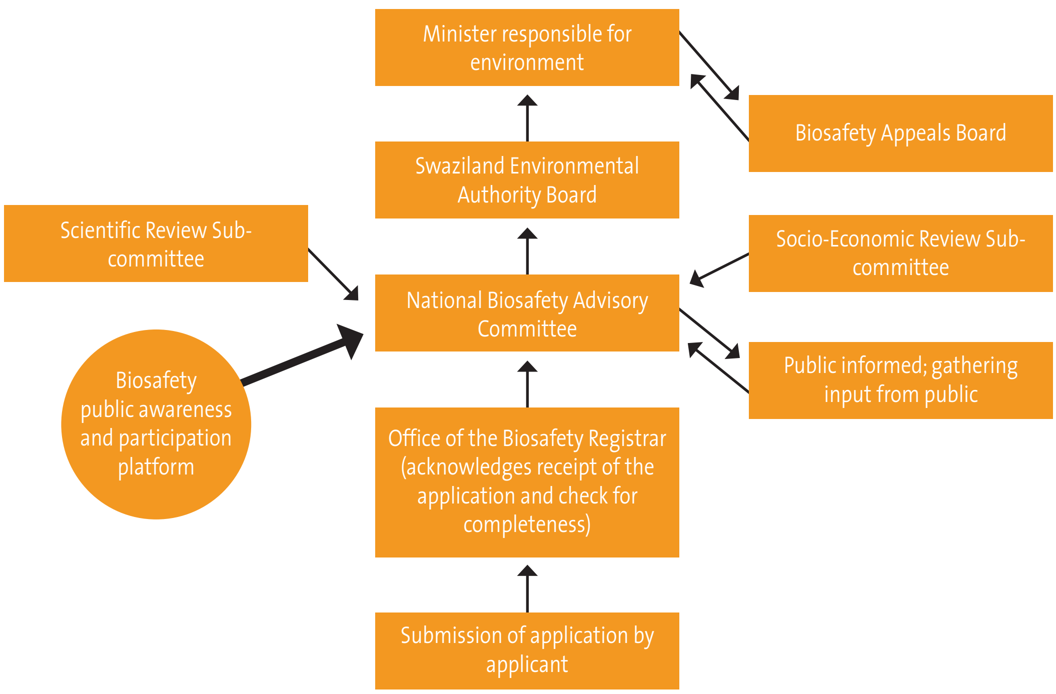
GM cotton in Swaziland

Swaziland's Biosafety Act

Swaziland ratified to the Cartagena Protocol on Biosafety (CPB) in 2006 and has domesticated it through the Biosafety Act of 2012. All applications for permission to conduct expriments in contained use, field trials, commercial releases and imports of GMOs, either as seed or grain, are handled by the Swaziland Environmental Authority, which is also the Biosafety Focal Point. An application must be made for a permit, which should be accompanied by risk assessment reports, among other documents as required. This also includes any potential adverse effects[8] as required under Schedules 1 and 2 of Swaziland's Biosafety Act. The National Biosafety Advisory Committee, consisting of government agencies and independent institutions, is responsible for conducting a review of the risk assessment reports.

Under Section 25(3) of the Swaziland Biosafety Act, the Biosafety Focal Point is responsible for promoting public awareness and making available the portions of GMO-related applications received that do not qualify as confidential information. With regards to the current application for confined field trials, four documents were made available to civil society upon request. However, there was limited access to the risk assessment information of the application, as this was withheld by the Biosafety Authority who claimed that it contained confidential information and was only available for viewing in their office. However, the CPB, under Article 21(6)(c), specifies that a summary of risk assessment of the effects on the conservation and sustainable use of biological diversity, taking into account risks to human health, should be made available to the Swaziland public, to ensure that they take part in the decision-making process.

Figure 3: Institutional framework of the Swaziland Biosafety Act



Source: Swaziland National Biosafety Framework (draft), 2006

8. Potential harmful effects include those that: may give rise to disease (e.g. toxicity/allergenicity of novel trait introduced); render prophylaxis or treatment ineffective; and promote establishment and/or dissemination of the GMO in the environment, giving rise to harmful effects on organisms or natural populations present; or harmful effects arising from gene transfer to other organisms.

Revision of Swaziland's Biosafety Act

With only four years of existence of Swaziland's Biosafety Act, there is already a process underway for the revision and weakening of the law, in order to facilitate the introduction of GMOs in the country. The biotech industry and its supporters of GM technology claim that the continent's current approach to GMO regulation is an obstacle to 'unlocking GM's potential' (Schnurr and Gore, 2015). However, this undermines the basis on which the biosafety regimes in Africa have been developed in the first place and stands in sharp contrast to the precautionary approach taken by African governments when they negotiated the CPB and the African Union's Model Law on Biosafety.

Current Bt cotton field trials in Swaziland

A permit to conduct Bt cotton trials in Swaziland was approved on 15 November 2016 for one cotton growing season (2016/17) in two sites: Big-Bend, Lowveld experimental station, and Malkerns research station.Trials commenced on 28 November 2016 for three GM hybrid cotton varieties imported from India, deriving from JK Event 1 (JKCH1947 Bt, JKCH 1050 Bt and JKC 724), alongside a Zimbabwean non-GM variety (ALBA OM 301), which is also local to Swaziland. According to the Swaziland application, the trial is testing for agronomic performance and bio-efficacy of the crop and is at the stage prior to applying for the general release of the GM cotton variety for commercial planting. JK Agri Genetics use a modified version of Cry1Ac technology, developed in India and patented by Monsanto, which came off patent. JK Agri Genetics have their own technologies to produce Bt cottonseed (Koshy, 2010). The Bt cotton variety of the JK Event 1 cotton contains the cry1Ac gene encoding for a Bt insecticidal toxin that targets lepidopteran pests, like the African bollworm (*Helicoverpa armigera*). Cry1Ac is however, ineffective against other important local cotton pests such as mealybugs, aphids and jassids.[10]

9. Swaziland Cotton Board Application MESA
10. These pests were mentioned by the researchers at the Malkerns research station as local cotton pests in the country.

Spelling: Critically

Biosafety concerns with the current field trial application

In order to analyse the field trial application that was approved, Pelum Swaziland and the ACB managed to get hold of four main documents related to the application. These contained information filled in Schedules One, Five and Eight, and a permit for approval granted by the Swaziland Environmental [redacted] assessed and analysed by us as is discussed further below.

We found that critially important information was omitted with regards to general characterisation, the safety assessment and the environmental risk assessment, as required under Schedule One of the Swaziland Biosafety Act.

First, no summary of the risk assessment was made publicly available, rendering any independent risk assessment impossible. This flouts the international obligation that Swaziland has, in terms of the CPB to promote public awareness and participation in the decision-making process.

Second, information of the GMO at the molecular level can inform on potential biosafety risks caused by disturbances of the GMO at the genomic level, such as disruption of the cotton plant's own genes. This could potentially lead to altered levels of important constituents that may affect GMO characteristics, or levels of nutrients or toxins. Such disturbances have been previously documented in other GMOs, and are attributed to the process of genetic modification itself. This is exemplified by the recently published study on the GM Golden Rice, showing the crop to have abnormally low levels of growth hormones and problems with photosynthesis, rendering the rice stunted and dwarfed (Bollinedi et al., 2017). The researchers who discovered the problem found that this was caused by the genetic material introduced into the plant, integrating itself into, and therefore disrupting, genes involved in the production of proteins that are part of growth hormone production and photosynthesis. Analyses of other GM crops also finds severely altered levels of potentially toxic metabolites (Mesnage et al., 2016). Indeed, (as summarised below) the introgression of the Bt trait into local cotton varieties in Burkina Faso resulted in shortened cotton fibres. Though the underlying mechanism for these trait disturbances have not been investigated, these observations suggest that a similar disruption of the endogenous local cotton varieties was the cause.

Information omitted with regards to molecular characterisation of JK Event 1 cotton includes inadequate information on the genetic material introduced. Since this was synthesised in the laboratory, it has no history of safe use and, therefore, a full description of the introduced sequence is necessary to analyse risk. However, no such information was made publicly available to confirm what was introduced, or to confirm its original integrity. As specified by the CPB, sequence information on the genetic elements introduced is important for considering how the 'genetic information may be expressed in the modified organism', i.e. its genetic activity and, therefore, subsequent effects it may have on the overall characteristics of the GMO. A description of where the genetic material integrated into the cotton genome is also lacking. This information is necessary to assess if any of the cotton genes have been disrupted.

Third, safety assessment data under Schedule One of Swaziland's Biosafety Act asks for 'a description of any risks associated with GMOs and activities undertaken', including 'health considerations: toxic or allergenic effects of the viable of non-viable genetically modified organisms(s) or product thereof or their metabolic products'.

However, the application states that a summary report on the biosafety has been enclosed, but is not available for public scrutiny. The application also states 'N/A' when asked for information on pathogenicity to humans. Only descriptive, irrelevant information purporting to lack of effects on general feed consumption, weight gain and health is provided when asked for information on allergenicity.

The applicant failed to incorporate the latest independent studies showing toxicity of the

Cry1Ac toxin to mammalian health, including the presence of Bt toxins in the blood of pregnant mothers and their fetal blood supply (Aris and Leblanc, 2011) showing its ability to survive digestion; elicitation of an immune response in mice (Moreno-Fierros et al. 2003, Rojas-Hernandez et al. 2004); toxicity to both kidneys and livers in rats following a 90-day feeding trial (De Vendômois et al., 2009), as well as shared homology with known pollen allergens. Information publicly available on risk assessment, submitted to the Indian authorities also fails to provide any empirical data to support claims of safety of JK Event 1 cotton, making any claim on safety publicly unverifiable.

Fourth, environmental risk assessment data was similarly lacking in the application. It is critical that potential risks to the environment, including effects to non-target organisms, as well as Bt pest resistance management is assessed.The application states that JK Event 1 Cotton 'is toxic only to lepidopteran pests', without providing any empirical data to support the claim. The summary of the risk assessment resubmitted to the Indian authorities provides a vague description of assessment of effects on non-target organisms, without empirical data available or information on the conduct of the studies including their duration, number of animal studies, or route of exposure, e.g. via soil or pollen. Exposure pathways need to be understood in order to determine whether or not, and to what degree, non-target organisms are exposed. Whether the insects and environment studied are in any way relevant to the receiving environment of Swaziland is a vital question that remains unassessed. In the event of an application for general release, it would be pertinent to ask for information on laboratory tests performed on species relevant to Swaziland. Independent studies challenge the claim made by the applicant that Cry1Ac is toxic only to lepidopteran pests. Previous studies have shown that Bt toxins are toxic to beneficial organisms, including pest predators, such as lacewings and ladybirds (Hilbeck et al., 1998; 2012), plant pollinators (Ramirez-Romero et al., 2005), and beneficial soil organisms (Castaldini et al., 2005; Chen et al., 2016). None of this information was incorporated into the applications.

The evolution of insect resistance to Bt toxins is also a major concern. It is a phenomenon that is being seen across multiple regions of the world, including South Africa (Van Rensburg, 2007; Zhang et al., 2012) , and is natural and expected, even by GMO producers. Resistance has even been documented againt crops with multiple Bt transgenes (Fabrick et al., 2015). Such agronomic and socio-economic risks make a pest management system vital, and should be implemented at the time of introduction of any general release of a GMO. Such information on management systems will need to include strategies, such as: structured refuges of non-GM crops, to delay resistance; provision of data on baseline susceptibility for the species targeted in Swaziland; monitoring of pest resistance; and compensation to farmers for crop losses due to resistant pests. Furthermore, with the lack of capacitation and training support in the current field trials,[11] risks are easily overlooked, and create a very vulnerable situation as the trials expand across the country.

Glover (2010) explains that transgenic cotton does not reduce risk, but rather spreads it across seasons, owing to varied pest pressure between growing seasons. Transgenic cotton only protects the crop against the infestation of one type of pest, and does not address the multiple risks, especially agro-climatic variability, farmers are confronted

11. Interview with Nzima Bheki and Nhlanhla Hlophe, researchers at Malkerns Research Centre, March 2017.

with. In such a case, farmers are having to endure greater risk, betting on higher yields to recover higher debt when purchasing transgenic cottonseed, for protection they might not even need. Such agro-climatic variability will also have an effect on cotton production, whether Bt or conventional; low yields and higher-than-normal debts can have widespread implications on livelihood and food security. With the decline of cotton in Swaziland as seen in 2014/15, this has implications for the survival of the entire cotton sector, as, if the ginnery closes, cotton producers will not have a secure market.

Therefore it is clear that the field trial was approved on the basis of inadequate information provided by JK AgriGenetics. The information does not meet the requirements of Swaziland's Biosafety Act to ensure biosafety protection of humans and environment, as a result of field trial release of JK Event 1.

Conclusion

With the GM push across the African continent establishing itself, there is no doubt that Bt cotton as an entry crop will continue to be advocated for commercial production in several countries. Together with revisions to national biosafety laws and regulations, this paves the way for cultivation of other GM crops, such as GM maize. In South Africa, GM cotton farmers in the Makhathni Flats in Nothern KwaZulu-Natal experienced crippling debt ,which led to the plummeting of cotton production and closure of the Makhatini gin in 2007, while national production of GM cotton has further declined over the years. Currently the Credit Revolving Fund, which provides credit and subsidises cotton growers in Swaziland, is already illustrating this risk: as a result of the drought, many farmers were unable to pay their loans after the previous growing season. This has resulted in a deficit of E1.9 million in 2014/15 season, as 97% of the farmers who received financial support could not pay back loans (Swaziland Cotton Board, 2016). By June 2016, E2.4 million loan repayments were outstanding (Makhubu, 2017). The implications of indebtedness has impacts on local economies, food security and social relations, as well as serious implications for the industry as a whole. This has been well documented in other countries and already discussed elsewhere in this report.

In Burkina Faso, Bt cotton presented technical failures in the backcrossing of Monsanto's Bollgard II cotton with the Burkinabe's cotton. This resulted in a decline in the country's cotton quality in both fibre and ginning ratios and reduced the value of their cotton on the international market. With Monsanto unable to correct the declines in quality, Burkina Faso phased out Bt cotton, having to settle for a bad deal that included no compensation.

Additionally, weakening of biosafety legislation will not be able to safeguard countries against the malpractices of biotech industry, or any other damages resulting from the use of GM technology. In the long run, the cotton industry, including the stakeholders along the value chain and vulnerable smallholder farmers will bear the cost of GM failures. The Swaziland government should carefully evaluate decisions concerning the introduction of Bt cotton for commercialisation. Farmers in Swaziland may well be better served if the government shifted its priorities towards more sustainable solutions than on agricultural quick-fix technologies that will eventually result in negative consequences. Such priorities might include support for research and development that favour ecologically sound agricultural practices that build on resilience and sustainability of agro-ecosystems and on the farmers themselves. Agroecology, and in particular organic cotton has proven to be effective as a solution to poverty alleviation for smallholder farmers in West Africa and thus a viable and necessary option for the future of agriculture. On the other hand, the Swaziland government should also consider investing in research on alternative pest management strategies, which have shown to be effective.

Glossary of terms

Bt cotton: cottonseed that has been genetically modified by inserting a bacterial gene that produces insecticidal toxins from the bacterial species *Bacillus thuringiensis* (or Bt). The bacteria produces two types of toxins, including Cry toxins, of which there are a known 50 different forms with distinct toxic effects that target various insect species. In the case of cotton, the protein is fatal to larvae from the genus Lepidoptera which are the most pernicious cotton pests.

Contained use: any operation or activity, undertaken within a facility, installation or other physical structure, which involves GMOs that are controlled by specific stringent measures that restrict their contact with and impact on the external environment and the general population.

Confined field trials (CFTs): small-scale field experiments to evaluate the performance of genetically modified (GM) plants. The biotech industry has created this definition as it is not in the Cartagena protocol and scientifically not part of the biosafety discourse. It is considered a situation where GM crops are under confined conditions where the exposure to the environment is restricted or it is in field trials. It is also considered as an environmental release of GMO, even if it is behind a fence of a wall.

Environmental release of GMO: This means an introduction of the GMO into the environment, without any precise confinement measure being taken to restrict the contact between this GMO and the population or the environment in general. There are two broad categories of release of GMOs: i)the experimental release of GMOs, through introduction for experimental purposes also commonly known as field trials of clinical trials and ii) release of GMOs into the environment by placing on the market for commercial purposes.

Genetically modified organism (GMO): any organism whose genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination. In agriculture, the majority of GMOs are seeds that have had genes added to them that enable an organism to tolerate certain chemicals, or added genes found in soil bacteria that enable the organism to produce certain proteins that are toxic to insect pests.

Integrated pest management (IPM): an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programmes use current, comprehensive information on the life-cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

Socio-economic considerations: 'The set of the intertwined social and economic consequences resulting from the changes arising from the introduction of GMOs into the environment, which need to be taken into account in the biosafety decision-making processes' (Cartacora-Vargas, 2013). They focus on the impact of changes, rather than the changes only. They may be tangible, such as effects on income generation, trading opportunities, livelihoods, employment, access to food, food quality, health and gender equity, or intangible, such as cultural and psychological changes and changes in values and perceptions, amongst others . They are highly contextual, and vary between and within communities. It is important to look at socio-economic impacts from a variety of dimensions, including economic, social, ecological, cultural and health impacts .

Transgenic: Transfer of a gene from one organism into another via genetic engineering techniques.

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