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BRIEFING: BURKINA FASO'S REVERSAL ON GENETICALLY MODIFIED COTTON AND THE IMPLICATIONS FOR AFRICA

BRIAN DOWD-URIBE* AND MATTHEW A. SCHNURR

CAN GENETICALLY MODIFIED (GM) CROPS help smallholder farmers in sub-Saharan Africa? To date, only two GM crops – insect-resistant forms of cotton and maize – have made it into the hands of African farmers. Of these, GM cotton has the longest empirical track record, having been the first GM crop ever introduced in Africa, and the only one that has been grown in multiple countries – first South Africa, then Burkina Faso.[1] The performance of this crop has received intense scrutiny, as it offers the best indication of how the suite of other GM crops slated for commercial approval may perform across the continent.

This briefing reviews the experiences of South African farmers with GM cotton, which has emerged as the crucial precedent highlighting the value of GM crops for poor farmers. It then turns to the case of Burkina Faso, which became the showcase for how GM crops can benefit smallholder African farmers. However, as shown here, Burkina Faso has begun a complete phase-out of GM cotton, citing the inferior lint quality of the GM cultivars as the reason for abandoning its cultivation. Burkina Faso's phase-out could stall or even end negotiations to adopt GM cotton in other Francophone African countries with similar concerns over cotton quality. More generally, Burkina Faso's reversal could undermine public trust in GM crops across the continent at a time when many African countries are grappling with the politicized and polarized debate over whether to adopt these new breeding technologies. We argue that the retreat of Burkina Faso, one of the most prominent and

*Matthew A. Schnurr (matthew.schnurr@dal.ca) is Associate Professor in the Department of International Development Studies at Dalhousie University. Brian Dowd-Uribe (bdowduribe@usfca.edu) is Assistant Professor in the International Studies Department at the University of San Francisco. Fieldwork undertaken in summer 2015 was funded by the Social Sciences and Humanities Research Council of Canada. We would also like to acknowledge the indispensable insights and assistance offered by our friend and colleague Hamadou Diallo. Both authors contributed equally to this article.

1. GM cotton has also been grown in Sudan since 2012. See Nagala A. Abdallah, 'The story behind Bt cotton: Where does Sudan stand?', *GM Crops and Food* 5, 4 (2014), pp. 241–3.

vocal supporters of GM crops on the continent, could have significant implications for the future of GM crops in Africa.[2]

GM cotton in South Africa

The first GM crops grown on the continent were planted in South Africa, which permitted the commercialization of Monsanto's insect-resistant (Bt) cotton in 1997. Bt cotton is genetically modified by inserting a bacterial gene that secretes a protein fatal to larvae from the genus Lepidoptera, which are among the most pernicious cotton pests. Larger-scale, commercial growers, who immediately realized the financial benefit of reduced pesticide applications and increased yields, readily adopted Bt cotton. One year after its initial release, Monsanto launched a targeted campaign to increase adoption among smallholder cotton farmers in the Makhathini Flats, a remote rural district just south of the border with Mozambique. Initial accounts of Bt cotton's performance in Makhathini were extremely positive, reporting gains in average yields and profits, as well as a significant reduction in pesticide applications.[3] Makhathini emerged as the prototype for how GM crops could improve yields and livelihoods for farmers across sub-Saharan Africa.[4]

But the success of GM cotton in Makhathini did not last long. After only a few years of operation, the cotton company that operated the local gin and provided credit for the purchase of the more expensive GM seeds went bankrupt. Production levels recovered briefly following the arrival of a new cotton company, buoyed by joint ventures in which the company took over the management of farmers' lands to maximize economies of scale, as well as incentives that privileged the adoption of Bt seeds (by excluding appropriately sized packages of non-Bt seed and refusing to accept non-Bt seed for ginning). But this scheme also folded after only a few years, unable to transform a patchwork of smallholder producers into a more financially viable model that was centralized, heavily mechanized, and revolved around cotton monocultures. Within ten years of its introduction, most growers had abandoned Bt cotton altogether. The most recent cotton production figures

2. The interviews upon which this article is based were undertaken in person in Ouagadougou and Bobo in early July 2015. Subsequent interviews were undertaken by phone in August and September 2015. Recognizing the highly contentious nature of the debate over GM crops in Burkina Faso, we have decided not to reveal informant names. Instead, we refer to informants by affiliation and interview date only.

3. Richard Bennett, Stephen Morse, and Yousouf Ismael, 'The economic impact of genetically modified cotton on South African smallholders: Yield, profit and health effects', *Journal of Development Studies* 42, 4 (2006), pp. 662–77; Colin Thirtle, Lindie Beyers, Yousouf Ismael, and Jenifer Plesse, 'Can GM-technologies help the poor? The impact of Bt cotton in Makhatini Flats, Kwazulu-Natal', *World Development* 31, 4 (2013), pp. 717–32.

4. Matthew A. Schnurr, 'Inventing Makhathini: Creating a prototype for the dissemination of genetically modified crops into Africa', *Geoforum* 43, 4 (2012), pp. 784–92.

available from Makhathini reveal the extent of this collapse. The total number of Bt adopters in the 2014/15 growing season was below 5 percent of what it was in the peak production years that followed the introduction of GM.[5]

The South African case has three lessons for other African countries considering the introduction of GM crops. First, institutional dynamics are crucial to a new technology's success. In Makhathini, farmer enthusiasm for the technology eroded once the enabling institutional environment of easy access to credit and a guaranteed market disappeared. Second, GM crop evaluations relying on measures of average profits and yields fail to appreciate fully the comprehensive and longer-term impacts of these technologies. More specifically, these data often occlude which categories of farmers benefit from these technologies, as well as how these technologies disrupt farming systems. Aggregate data thus need to be contextualized and extended over longer time periods to determine the implications of new GM technologies for resource-poor and marginalized farmers, as well as the implications for different commodity-chain actors.

Finally, the South African case underlines the potential gulf between the representation and reality of GM adoption. GM proponents have used the Makhathini case to promote and advance the introduction of GM crops in other parts of sub-Saharan Africa, long after the benefits they offered to farmers had declined.[6] The South African precedent is a reminder of how an initial success story can endure and influence the political debate in other locales, even after the real benefits to end users have faded.

Burkina Faso and Bt cotton

Today, Burkina Faso has surpassed South Africa as the model for how GM crops can help African farmers. Many factors surrounding the introduction of Bt cotton in Burkina Faso distinguish it from South Africa. Unlike in South Africa, smallholders account for the vast majority of total cotton production in Burkina Faso, and the country was the top cotton producer in Africa in 2015 with over 700,000 MT of seed cotton produced.[7] Also unlike South Africa, Burkina Faso has a highly organized and regulated cotton industry. This vertically integrated cotton system, where companies operate regional monopolies with a shared cotton purchase price, ensures the operation of a reliable credit market. Cotton producers receive seeds and inputs such as pesticides and fertilizer on credit provided by the cotton company and later sell their cotton back to the same company for a guaranteed price. This centralized system has obvious

5. Cotton South Africa, 'Small-holder cotton farmer production estimates', 9 September 2015, <http://cottonsa.org.za/Report/GetReport/8> (10 September 2015).
6. Matthew A. Schnurr, 'Inventing Makhathini'.
7. Ecobank, 'Middle Africa briefing note, soft commodities, cotton' (Ecobank Research Centre, Lomé, 12 June 2015).

benefits in ensuring farmers access to premium seeds and expensive inputs required to achieve higher yields. It is also one of the crucial factors that made Burkina Faso such an appealing destination for Bt cotton. In the words of one Monsanto official, the heavily integrated and centralized administrative structure 'made it attractive in that it would be easier to capture value for our investment'.[8]

In 2003, the Burkinabè government signed a contract with Monsanto to test their insect-resistant Bt cotton in experimental field trials. The first few years of testing showed good resistance to Lepidopteron infestations and yield improvements. But Burkinabè officials expressed reluctance over the importation of American germplasm, which they considered to be inferior to their own domestic cultivars. The Burkinabè cotton industry was fiercely proud of the reputation of the cotton it produced, which, along with the output of its other Francophone West African neighbours, was considered to be the best on the continent after Egyptian Pima. Burkinabè officials vocalized these concerns to their Monsanto collaborators, insisting that the Bt trait needed to be inserted into their local cultivars, since these were adapted to local agro-climatic conditions and produced high cotton-quality characteristics. Monsanto deferred. In the words of one Monsanto representative:

> The government officials were not interested in us bringing our varieties in. So we decided to work with them and introgress the traits into their local germplasm … they wanted it that way and it preserves the agronomic qualities that they valued locally.[9]

Monsanto scientists proceeded to backcross the Bt trait into the three most widely grown cotton cultivars across Burkina Faso – FK 290, FK 37, and STAM 59A – inviting government officials to assist in assessing their agronomic performance.[10] After three generations of backcrossing. the company announced that the new GM lines were stable and ready for commercial release.[11]

The Burkinabè cotton industry and Monsanto patented the resulting Bt cultivars, releasing them to farmers in 2008. The adoption of Bt cotton within the country skyrocketed in the ensuing years. By 2013, almost 70 percent of total cotton hectares were planted with Bt cultivars.[12] This rate of adoption remained consistent up to 2015.[13] The only published studies regarding the performance of Bt cultivars in Burkina Faso report an average

8. Interview, Monsanto official #2, by phone, St Louis, MO, 21 July 2015.
9. *Ibid.*
10. Oula Traoré, Sanfo Denys, Jeffery Vitale, K. Traoré, and Koulibaly Bazoumana, 'Testing the efficacy and economic potential of Bollgard II under Burkina Faso cropping conditions', *Journal of Cotton Science* 12 (2008), pp. 87–98.
11. Interview, cotton agronomy expert, by phone, Lubbock, TX, 11 September 2015.
12. International Service for the Acquisition of Agri-Biotech Application (ISAAA), 'Biotech facts and trends: Burkina Faso', 2015, <https://www.isaaa.org/resources/publications/biotech_country_facts_and_trends/download/Facts%20and%20Trends%20-%20Burkina%20Faso.pdf> (4 September 2015).
13. Ecobank, 'Middle Africa briefing note, soft commodities, cotton'.

yield gain of 22 percent over conventional cultivars, and a profit gain of 51 percent for a Bt cotton-producing household with just over 3 hectares.[14]

The Bt cottonseed price of US$60 per hectare remains much more expensive than the conventional cottonseed price of $2.[15] However, conventional cotton production requires more pesticide applications than Bt cotton; Bt cotton farmers report that pesticide use declined from an average of six sprays per growing season to two.[16] The profit gains for Bt producers stemmed from the significant reduction in pesticide applications coupled with increased yield, which outweighed the difference in seed cost.[17] The decline in the use of pesticides also led to a reduced incidence of pesticide poisonings.[18]

Burkina Faso's success with Bt cotton has supplanted the Makhathini Flats as the showcase for how GM crops can perform in the hands of African smallholders[19] GM crop advocates have mobilized the triumph of Bt cotton in Burkina Faso to encourage more permissive approaches to GM crops across the continent. For example, the case of Burkina Faso figured prominently in recent debates over the passage of the Nigerian biosafety law.[20] Burkina Faso also regularly hosts delegations from African nations to tour Bt cotton fields and visit with cotton officials and farmers. Since the introduction of Bt cotton in 2008, Burkina Faso has received delegations from at least seventeen different African nations, with many of these countries represented on multiple occasions.[21] The goal for these visits, which were organized by

14. Jeff Vitale and John Greenplate, 'The role of biotechnology in sustainable agriculture of the twenty-first century: The commercial introduction of Bollgard II in Burkina Faso', in David D. Songstad, Jerry L. Hatfield, and Dwight T. Tomes (eds), *Convergence of food security, energy security and sustainable agriculture* (Springer, Heidelberg and New York, NY, 2014), pp. 239–93.

15. Brian Dowd-Uribe and James Bingen, 'Debating the merits of biotech crop adoption in sub-Saharan Africa distributional impacts, climatic variability and pest dynamics', *Progress in Development Studies* 11, 1 (2011), pp. 63–8.

16. The remaining two sprays are generally undertaken late in the growing season to ward off damage by sucking pests such as aphids or jassids, which are not repelled by the Bt toxin.

17. Brian Dowd-Uribe, 'Engineering yields and inequality? How institutions and agro-ecology shape Bt cotton outcomes in Burkina Faso', *Geoforum* 53 (2014), pp. 161–71.

18. Jeff Vitale and John Greenplate, 'The role of biotechnology in sustainable agriculture'.

19. The Burkina Faso 'success' story relies on studies that demonstrate average yield and profit gain for farmers, though there remains more empirical work to be done on the potential differential impacts of Bt cotton. Brian Dowd-Uribe, 'Engineering yields and inequality?'.

20. *Business Day*, 'Why Burkina Faso has overtaken Nigeria in cotton production', 28 January 2015, <http://businessdayonline.com/2015/01/why-burkina-faso-has-overtaken-nigeria-in-cotton-production/> (24 September 2015); Jimoh Babatunde, 'Boosting cotton production: Why Nigeria needs biosafety law', *Vanguard*, 22 February 2015, <http://www.vanguardngr.com/2015/02/boosting-cotton-production-why-nigeria-needs-biosafety-law/> (24 September 2015).

21. This number is derived from attendance at some of these events by the authors and ISAAA news reports dated 16 December 2011, 27 November 2013, 8 January 2014, and 12 November 2014. These reports can be found at <www.isaaa.org> (29 October 2015). Notably, many of these visits happened well after Burkinabè cotton sector officials knew about cotton quality issues with Bt cultivars. The list of countries is: Togo, Benin, Ivory Coast, Ghana, Chad, Niger, Nigeria, Senegal, Ethiopia, Kenya, Malawi, Tanzania, Sudan, Swaziland, Uganda, Zambia, and Zimbabwe.

the International Service for the Acquisition of Agro-biotech Applications (ISAAA) and Monsanto, was 'that the participants will use this experience to expedite the commercialization process in their respective countries for the benefit of cotton farmers'.[22]

The importance of quality

One of the most important traits distinguishing West African cotton from its international competitors is its quality. We use the term quality here to denote two groups of related phenomena. The first relates to the quality features of the fibre. Burkinabè cultivars are the product of decades of careful breeding that has resulted in premium cotton fibres, which are long, strong, and uniform. These traits are highly sought after for the production of high-end textiles and fetch a premium on the global market. The second reason why Burkinabè cotton fibre is of such high quality stems from it being hand-picked, which ensures that the fibre is free of other organic matter.[23] Hand picking influences the other quality trait valued by cotton companies, known as the ginning ratio, which is the percentage of fibre per unit weight of cotton delivered to the gin. The ginning ratio of Burkinabè cotton is high, the result of decades of targeted breeding and careful hand picking. A high ginning ratio is attractive to Burkinabè cotton companies since it increases the total amount of fibre that it can sell at a high value compared to the total harvest weight. Burkinabè cotton has gained a stellar international reputation and a premium price based on these quality traits.

The higher quality of Burkinabè conventional cotton is the result of a very successful breeding programme that has spanned almost seventy years.[24] In 1946, the French government founded the Institute for Research on Cotton and Tropical Textiles, known by its French acronym ICRT, to lead cotton-breeding programmes for its African colonies. The cultivation of breeding techniques begun by ICRT became part of the French agricultural research organization, CIRAD, in 1984, and was eventually absorbed into national research institutes. The main goal of the ICRT-CIRAD breeding programme was to create cultivars that were well adapted to the growing conditions in

22. International Service for the Acquisition of Agri-Biotech Applications (ISAAA), 'African delegation visits Burkina Faso Bt cotton fields', 26 November 2010, <http://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=6987> (4 September 2015).
23. Gérald Estur,'Quality and marketing of cotton lint in Africa' (Africa Region Working Paper Series No. 121, World Bank, Washington, DC, 2008).
24. It is worth noting that late nineteenth- and early twentieth-century colonial governments originally sought to improve cotton quality characteristics in Africa by introducing American cultivars of cotton. Now, over a century later, American transgenic cultivars are the reason for a decrease in the quality of African cotton.

West Africa, and exhibited desired quality characteristics such as a high ginning ratio and long staple length.[25] This breeding programme achieved considerable success. Between the 1970s and 2006/7, the average ginning ratio for Burkinabè cotton increased from 36 percent to 42 percent. The improved ginning ratios in the Francophone West African cotton sector in general, and the Burkinabè cotton sector in particular, were to a large extent the distinguishing feature that made them more competitive in the global market.[26] As Figure 1 shows, the ginning ratios in other African countries were unable to match this progress over the same period of time.

The cotton-breeding programme in Burkina Faso also made considerable improvement in staple length over this time period. The standard benchmark in the cotton industry for the more desirable medium-to-long cotton fibres is 1 $^{1}/_{8}$ (inches). The percentage of total Burkinabè cotton classified as longer than this benchmark rose from 20 percent in 1995/6 to 80 percent of total cotton production in 2005/6.[27]

Given the potential link between breeding and the beneficial traits of long fibre length and high ginning ratios, one observer wondered whether adopting Bt cotton would degrade these quality characteristics, as 'biotechnology changes may … modify cotton fibre quality and … Bt cotton may jeopardize West Africa's world cotton market advantage'.[28] But Burkina Faso went ahead with Bt cotton adoption despite these concerns. Burkinabè officials were initially satisfied with the quality characteristics present after reviewing early field trials, reporting that 'the fibre's characteristics were maintained'.[29] In the words of one Monsanto official familiar with the trials, 'All I can say is based upon the assessments that we made with their help, we were achieving things that were satisfactory to them at the time.'[30]

25. Tom Bassett, *A peasant cotton revolution* (Oxford University Press, Oxford, 2001); Jim Bingen, 'Cotton in West Africa, a question of quality', in Jim Bingen and Lawrence Busch (eds), *Agricultural standards: The shape of the global food and fibre system* (Springer, Dordrecht, 2006), pp. 7–8; Alfred Schwartz, 'L'évolution de l'agriculture en zone cotonnière dans l'Ouest du Burkina Faso'. In Jean-Claude Devèze (ed), *Défis Agricoles Africains* (Karthala, Paris, 2008), pp. 153–172.

26. The difference of just a few percentage points in the ginning ratio can lead to severe fluctuations in revenues. Consider Burkina Faso's cotton output in 2008/9. In that year Burkina Faso produced 452,000 tons of seed cotton. At an average ginning ratio of 42 percent this translates to 189,840 tons of cotton lint at a price of roughly $1,000 per ton. A 2 percent drop in ginning ratio to 40 percent would translate into 180,800 tons, or a difference of about 9,000 tons of fibre, valued at more than US$9 million.

27. Gérald Estur,'Quality and marketing of cotton lint in Africa'.

28. Jim Bingen, 'Genetically-engineered cotton: Politics, science and power in West Africa', in William. G. Moseley and Leslie C. Gray (eds), *Hanging by a thread: Cotton, globalization, and poverty in Africa* (Ohio University Press, Athens, OH, 2008), pp. 227–57.

29. Interview, cotton company official, Ouagadougou, Burkina Faso, 2 July 2015.

30. Interview, Monsanto official #2.

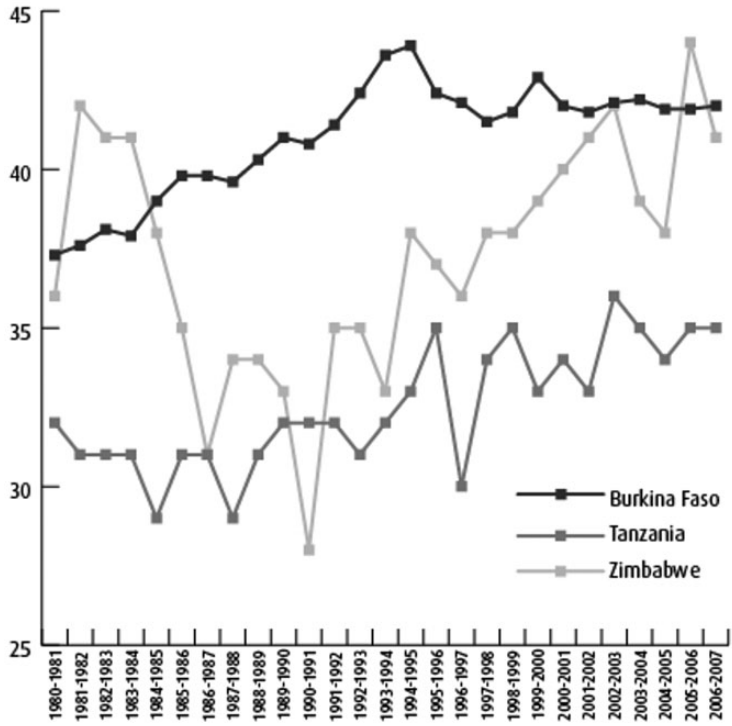

Figure 1. Ginning ratios in three African countries, 1980–2007
Source: David L. Tschirley, Colin Poulton, and Patrick Labaste, 'Organization and performance of cotton sectors in Africa: Learning from reform experience' (World Bank, Washington, DC, 2009), pp. 180–1.

Problems with quality

Burkinabè officials noticed declines in both staple length and ginning ratios during the first years of commercial release.[31] Monsanto officials were sceptical, suggesting that these initial declines in staple length and ginning ratios were due to exceptional water stress and other climatological variations.[32] But this deterioration in ginning ratios and staple length persisted over time. Reports from Burkinabè officials, which were corroborated by

31. Brian Dowd-Uribe, *Engineered outcomes: The state and agricultural reform in Burkina Faso* (University of California, PhD thesis, 2011); Interview, cotton company official.
32. The Burkinabè cultivars in use were known to exhibit variance in ginning ratios due to environmental considerations. Dominique Dessauw and Bernard Hau, 'Cotton breeding in French-speaking Africa: Milestones and prospects', paper presented at the World Cotton Research Conference 4 (Omnipress, Lubbock, TX, 2008).

Monsanto, confirm that Bt cultivars produced fibres that were $^{1}/_{32}$ of an inch shorter than conventional varieties.[33] In the 2013/14 season, over two-thirds of the nation's total crop was classified as lower-quality medium (with a staple length between 1 $^{3}/_{32}$ and 1 $^{1}/_{16}$), with only a third retaining its previous classification as medium to high staple length. This represented a decline of over 40 percent since 2005/6.[34] The precise decline in ginning ratios is more difficult to measure, though Burkinabè officials confirm that it remains well below the 42 percent achieved by conventional cultivars.[35]

This decline in staple length has undermined the reputation of Burkinabè cotton and cut into its value on the international market. When coupled with the decline in overall lint due to the lower ginning ratio, the inferior quality characteristics of the Bt cultivars have compromised the economic position of Burkinabè cotton companies. The lower-quality fibre was valued less highly by spinners who could only use the poorer grade for the production of lower-quality textiles, such as bedding. It also complicated trading arrangements among other West African producers such as Côte d'Ivoire and Mali. All Francophone West African producers aim for a homogeneous product that can be interchanged to facilitate timely delivery to clients, but Burkina Faso's poor staple length undercut this flexible sourcing mechanism.[36] In the most recent growing season, Burkina Faso produced over 700,000 MT of cotton, while its western neighbour Mali produced only 500,000 MT, yet within a few months Mali's entire product had been sold on the international market, while most of Burkina Faso's languished awaiting export. As one high-ranking official lamented, 'What is the point in being the top producer if you can't even sell your cotton?'[37]

Breeders are struggling to account for these declines in ginning ratio and staple length. In theory, inserting the Bt gene into the Burkinabè germplasm should have left the resultant progeny identical to its parent in every way except for the inserted trait conferring insect resistance. But, in reality, the process of introgressing the Bt trait into the local variety appears to have interfered with some of its most important characteristics. Monsanto scientists are at a loss to explain the precise mechanism that has created these problems.[38] The company is attempting to identify and correct this fault. In the short term, Monsanto has proposed forming a technical committee of local and international experts to investigate this issue of declining

33. Interview, Monsanto official #1, Bobo, Burkina Faso, 1 July 2015; Interview, cotton company official, Ouagadougou, Burkina Faso, 2 July 2015.
34. Ecobank, 'Middle Africa briefing note, soft commodities, cotton', p. 2.
35. Interview, cotton company official.
36. Ecobank, 'Middle Africa briefing note, soft commodities, cotton', p. 3.
37. Interview, cotton company official.
38. Interview, Monsanto official #1.

quality and propose recommendations for moving forward. In the medium-to-long term, Monsanto has embarked upon a new process of backcrossing the Bt trait into a new local cultivar, known as FK64. The company promises to use 'new tools and processes' to ensure that the resulting backcrosses do not suffer similar deteriorations in quality.[39]

Burkina Faso's cotton companies have grown impatient and decided to take matters into their own hands. Frustrated with Monsanto's inability to identify and correct these declines in quality, the companies set a timeline for abandoning Bt cotton and returning to conventional Burkinabè cultivars. Their centralized control over the country's seed supply allowed them to reduce the availability of Bt cottonseed from the peak rate of adoption of 73 percent in 2014/15 to 53 percent in 2015/16. They plan on reducing this amount to 30 percent in the 2016/17 growing season, with the goal of a complete return to conventional cotton in time for the 2017/18 season. The cotton companies also made a formal request to Monsanto for losses incurred due to these declines in quality. They are demanding more than FCFA 30 billion (approximately US $280 million) as compensation for losses sustained since 2010.

Implications for GM crop adoption across Africa

The story of Bt cotton in Burkina Faso raises important questions about the commercial production and dissemination of GM crops in Africa. The first concerns the narrow scope of the GM insect-resistance breeding programme. Bt cotton was originally bred in the United States with the sole aim of conferring the Bt trait into a cultivar that would express the toxin consistently. This exclusive focus on pest mitigation contrasts sharply with the Francophone West African breeding programmes, which spent decades integrating a broad spectrum of adaptability to growing conditions alongside multiple characteristics of fibre quality. The Burkinabè cotton industry astutely tried to remedy the undesirable characteristics of the American cultivar by backcrossing it into its own cultivars. But quality suffered. This failed breeding programme calls into question the potential for combining GM technology and local cotton cultivars to produce new technologies that offer desired performance across multiple criteria, as well as focusing on the GM trait rather than the suite of characteristics of the germplasm into which it is conferred.

The second question concerns the role private ownership played in Bt cotton's decline in Burkina Faso. Three generations of backcrossing were undertaken, which is standard practice in the United States where quality issues are much less pronounced given the heavy reliance on mechanized

39. *Ibid.*

pickers. But in Burkina Faso, where quality concerns are paramount, some breeders advise a minimum of five generations of backcrossing to ensure the carry-over of the desired beneficial traits.[40] As a result, the desire for stability and quality clashed with the desire to get to market, as each backcrossed generation takes a year of careful breeding and selection. Monsanto officials acknowledged that they 'wanted to go faster', and were confident that three generations of backcrossing were sufficient to maintain these quality characteristics.[41] The process of introgression is complex and time-consuming, and potential conflicts can emerge when the priorities of private patent holders clash with those of other actors.

A third set of questions revolves around the nature of Burkina Faso's pull-back from Bt cotton. In Burkina Faso, the decision to phase out Bt cotton was made by the cotton companies, not cotton farmers. Burkinabè cotton companies were frustrated by the declining profits associated with the poorer lint quality of Bt cultivars. The position of the cotton companies contrasts with most of the farmers we have spoken to over the past few years, who tended to be enthusiastic adopters of Bt. Both farmers and cotton companies benefit from a vibrant and profitable cotton sector; the cotton price paid to farmers is ultimately a function of the price at which the cotton company sells it on the world market. In this particular case, though, the interests of the companies and the farmers diverged: the higher yield of Bt cotton meant more income for farmers while the lower ginning ratio and shorter staple length meant less fibre, and of a lower quality, for cotton companies to sell. The case of Bt cotton in Burkina Faso exposes the conflicting interests within the cotton value chain, underlining how GM crops can produce different outcomes for different stakeholders.

It remains to be seen how the news of the phase-out in Burkina Faso will influence the positions taken by other African countries in their deliberations over whether to adopt Bt cotton. Unless these quality characteristics are fixed, other Francophone African countries such as Mali, Côte d'Ivoire, Togo, and Benin are unlikely to adopt Bt cotton given the implications for their own highly valued reputations. By contrast, some Anglophone African countries, whose ginning ratios and staple lengths do not achieve the heights of their Francophone African counterparts, might be less concerned, and move forward with adoption regardless of this latest controversy.

Perhaps a more enduring legacy of the Burkina Faso case will be its effect on the polarized debate over GM crops across Africa. As occurred with the example of Makhathini, the representation of Burkina Faso's experiences with Bt cotton may end up straying far from the reality. Actors on both

40. Interview, cotton agronomy expert.
41. Interview, Monsanto official #1.

sides of this debate will work hard to shape the narrative that emerges. GM crop opponents are likely to use this case to raise questions about public trust: will GM crops perform as intended or will they have unknown impacts and risks? Can the institutions charged with the creation and regulation of GM crops be trusted to ensure the proper development and regulation of these crops? On the other side, supporters are likely to stress the yield and profit gains achieved in Burkina Faso, asserting that concerns with germplasm expression are isolated to this particular case and do not signal a broader issue with GM crops in general.

A number of African countries – including Uganda, Kenya, and Ghana – are poised to make decisions about whether to adopt Bt cotton in the next few years. The version of Burkina Faso's experience with Bt cotton that filters down to key decision makers will play an important role in deciding whether these countries move forward with this technology. A key determinant in these debates will be the extent to which African governments and citizens are reassured that the transplantation of GM traits into their own cultivars will leave their most valued characteristics unchanged.