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Source: *Review of African Political Economy*, Sep., 2006, Vol. 33, No. 109, Mainstreaming the African Environment in Development (Sep., 2006), pp. 497-513

Published by: Taylor & Francis, Ltd.

Stable URL: <https://www.jstor.org/stable/4007055>

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Can the Poor Help GM Crops? Technology, Representation & Cotton in the Makhathini Flats, South Africa

Harald Witt, Rajeev Patel & Matthew Schnurr

The adoption of Genetically Modified (GM) cotton in South Africa's Makhathini Flats in 1998 was heralded as a case in which agricultural biotechnology could benefit smallholder farmers, and a model for the rest of the continent to follow. Using historical, political economic and ethnographic data, we find the initial enthusiasm around GM technology to be misguided. We argue that Makhathini's structured institutional framework privileges adopters of GM technologies through access to credit and markets. The adoption of GM cotton is symptomatic not of farmers' endorsement of GM technology, but a sign of the profound lack of choice facing them in the region.

Recent literature in development journals has taken a robust and optimistic view regarding the potential of Genetically Modified (GM) crops to regenerate the agricultural sector in the global South. The claims for improved yield and pest-resistance seem to have been vindicated by a further claim, circulated across a range of scholarly articles and reports, that farmers have chosen GM crops of their own volition due to the advantages they confer.¹ One of the most widely cited success stories has drawn on the experiences of small-scale farmers cultivating GM cotton in the Makhathini Flats in KwaZulu-Natal, South Africa.

The stakes in the assessment are of concern elsewhere on the continent. Cotton farmers in West Africa have, for example, found it difficult to compete with cotton produced in the United States, because of the high levels of government subsidy enjoyed by cotton producers there. In response, the US has chosen not to reduce its subsidies, but offered GM cotton technology to farmers in West Africa, despite the fact that producers there are second in productivity only to Australia (Greenberg, 2004). In the promotion of GM cotton as suitable for African farmers *in toto*, the success story of Makhathini plays a key role. Yet precisely because the local circumstances are stripped away from any assessment of GM cotton's suitability, farmers' choice of GM seed can be represented and misrepresented as an endorsement of the technology, and by extension, an invitation to apply it elsewhere.

This study examines the adoption of GM cotton in the Makhathini Flats area, contextualising the laudatory findings of some researchers (see, e.g. Thirtle et al. 2003), and placing Makhathini's cotton monoculture in a longer history of imperial export agriculture, technology and policy. We draw on thirty in-depth interviews with the leaders of cotton-growing associations, interviews with local government officials, growers and processors, suppliers of inputs, together with debt data from regional and national creditors, data from the cotton industry, the findings from

three workshops involving a total of 80 farmers from the area, as well as survey data covering 50 residents. We begin with a brief history of cotton farming in KwaZulu-Natal, observing the development of a cotton monoculture destined for export, which GM technology extends. We then outline the limited choices facing cotton farmers, from a macro-economic, institutional and micro-local perspective.

We suggest that, in the light of current evidence, the considerable favourable attention accorded the Makhathini cotton farmers is indicative not of the appropriateness of the technology, but a symptom of a development policy and life-science industry which is keen for the technology to succeed. We argue that the adoption of GM cotton in the Makhathini area is symptomatic not of an endorsement of GM technology, nor a step on the road to regenerating the agricultural sector, but rather a sign of the profound lack of choice facing farmers in the region. Following Ferguson (1990), we conclude that the technology represents an anti-politics machine – offering a technological solution to a series of political problems around differentiated access to markets, and access to state resources including credit, agricultural extension services.

Context & Background

The Makhathini Flats cover the floodplains on either side of the Pongola River, stretching from just below the Jozini Dam to the confluence of the Pongola and Usuthu Rivers on the Mozambique border. More generally, the Flats comprise the low-lying areas east of the Ubombo mountains, covering some 13,000 hectares. The region falls within the Umkhanyakude district, and is characterised by chronic poverty, with 85.2 per cent of households within the municipality earning less than R1,500 per month (Iyer Rothaug Collaborative, et al. 2002) and by falling levels of employment from 13.4 per cent in 1996 to 9.8 per cent in 2001 – the period for which latest reliable figures are available. Socioeconomic data place the district as one of the poorest in the province (Jozini Municipality, 2004).

South Africa's Genetically Modified Organisms Act, No.15 of 1997 was passed into law in 1999.² A great deal of academic, corporate and governmental attention, both within South Africa and beyond, has been paid to the introduction of this agricultural technology, and its impact for local producers. The majority of farmers in the Makhathini area are smallholders, with average landholdings around 2.5 to 5 ha with some holdings smaller than one hectare (Hofs and Kirsten, 2001). In a series of publications, based on a single survey and including but not limited to these (Ismael, Bennett and Morse, 2002; Ismael et al. 2002; Ismael, Bennett and Morse, 2001, 2001; Thirtle et al. 2003), this team of researchers has sounded a note of 'cautious optimism' regarding the success of the introduction of genetically modified cotton, concluding that the majority of adopters benefited from reduced pesticide exposure and increased yields; others have been less reserved. In testimony to the United States Congress House Science Committee, Subcommittee on Research on 12 June 2003, Robert Horsch, Vice President for Product and Technology Cooperation at Monsanto Inc, suggested the following:

Monsanto's insect-protected cotton has been a particular advantage to growers in the Makhathini Flats region of South Africa, one of the poorer regions of the world, where bollworms traditionally have destroyed up to 60 per cent of growers' harvest. Average yields for biotech cotton in South Africa from 1998 and 2001 were 25 per cent higher than for conventional varieties, according to one study. Another study of the 1999-2000 growing season said average yields were 93 per cent higher than for conventional varieties – with an

average earnings increase of 77 per cent. T.J. Buthelezi one of the first farmers to plant biotech cotton in South Africa, says higher yields from biotech cotton have helped him invest for the future in more land and better equipment. T.J. recently told me, 'For the first time I'm making money. I can pay my debts.' The successful adoption of biotech cotton clearly shows the power and relevance of biotechnology for Africa (Horsch 2003).

That Horsch was able to call on Makhathini in this way, through the testimony of one of its farmers, but without substantive evidence for the durability or political economy of the intervention is of key significance. Such interventions shape the ideological climate in which donors and development agencies operate. Yet the testimony of how cotton has improved the lives of some Makhathini residents has been shorn of the area's history, and has left un-told the story of how Makhathini is one of cotton's last refuges in South Africa. This paper contextualises cotton growing in Makhathini by examining its historical political economy, its contemporary economic environment, its institutional framework, and the surging prevalence of debt. The findings from these investigations suggest an altogether different set of reasons behind the portrayal of success in Makhathini.

Historicising Makhathini

The history of cotton growing in KwaZulu-Natal is best characterised as a crop in search of a climate. Following annexation of Natal in 1843 plans were advanced to turn Natal into a 'cotton colony' which would satisfy the increasing demand of the Lancashire-based textile industry (Leverton, 1963). Cultivation was attempted throughout the colony but nowhere was cotton successful. Following the annexation of Zululand in 1897, agronomists and officials were optimistic that higher temperatures and lower incidence of frost during the growing season in Zululand would make for ideal growing conditions. While scattered cultivation did succeed at a very small scale near Eshowe and Mtubatuba, and more recently inland near Vryheid, by the 1970s most officials were convinced that for Natal to finally realise its potential as a cotton growing region, production would have to be anchored within the northern-most reaches of the province, including Makhathini.

It is uncertain as to when cotton was first introduced into the Makhathini area, although records show that white farmers near Ndumo were farming dryland cotton as early as 1919 (Henderson, 1992). Throughout the early 1960s and 1970s sporadic attempts at cotton cultivation were attempted in Ohlalwini, Mboza and KwaJobe, but large-scale production only emerged as a viable aspiration following the damming of the Pongola River to provide a predictable and controllable supply of water to the Flats. Influenced by the nearby Pongola Irrigation Settlement Scheme, the construction of the Jozini Dam in the 1960s was also intended to provide opportunities for poor unemployed whites who were to be settled on 20 ha plots on the Flats. It was estimated that some 652 million m³ of water would be available for irrigation purposes (Eksteen et al. 1994).

When the Dam opened in 1974, however, the influx of white farmers never materialised. Rapid economic growth of the South African economy in the 1960s had mopped up surplus 'poor white' labour, thus eliminating the need for additional settlement of the land.³ The fall in the international price of sugar during the 1970s, the inability to fill the Jozini Dam due to protracted negotiations with Swaziland, and high employment rates in urban areas further hindered the expected mass white migration. As a result, and given the prevailing resistance to apartheid and the concomitant need to build support for the regime in rural areas,

the state directed its efforts towards making the dam meet the perceived needs of local black populations. The reluctance of whites to settle thus ultimately assisted the broader aims of the apartheid state in seeking to legitimise the fragmented nature of its 'homeland' states through a process of both consolidation of state power and the devolution of responsibility to 'Bantustan' authorities.

The Jozini Dam and the subsequent establishment of the Makhathini Irrigation Scheme were expected to fulfil the role of 'growth engine' for the sub-region. But an incoherent and continually mutating institutional framework imposed upon a matrix of changing developmental and political philosophies led to a lack of continuity and poor co-operation. This was exacerbated by inappropriate farmer selection and the initial removal and resettlement of some 5,000 individuals to establish the Irrigation Scheme.⁴ These factors generated high levels of institutional mistrust, disillusionment with development as a process, and crippling levels of indebtedness. The inability of the Scheme to lead and shape agricultural and rural development in the sub-region also ultimately undermined the broader potential of small-scale dryland farmers located beyond the Scheme. The apartheid state's goal within these development initiatives was subtle; the state

... played the role of entrepreneur to generate ideological revenue – from those who were too poor to pay taxes – either through direct dispossession of land, or through the production process whereby smallholder farmers cultivate labour intensive crops that are considered to be in the national economic interests and in line with political interests of creating a black middle class (CORD, 1990).

State engagement not only provided the initial resources and vision for the construction of the dam, but continued to intervene in the institutional arrangements within the Flats as its own priorities and structures were constantly shifting. Once the Makhathini Irrigation Scheme was established it continued to rely on state support although there were consistent changes in the management of the scheme. In 1984 the previous government manager, the Corporation for Economic Development (CED), was disbanded and the South African Development Trust Corporation (STK/SADT), and more specifically its subsidiary – Mjindi Farming – was appointed as the new managing agent.⁵ Overall control remained with the Department of Cooperation and Development (DCD) and later the Department of Development Aid (DDA) which in turn was replaced in March 1992 by a consortium comprising the Department of Regional and Land Affairs, the Department of Agriculture, and the Natal Provincial Administration (Eksteen et al. 1994). In 1996 responsibility was transferred, once again, to the Department of Agriculture and Environmental Affairs.

Under STK, the Irrigation Scheme was geared primarily towards the production of cotton, which significantly accelerated the development of the infrastructure required for cotton production in the region (Eksteen et al. 1994). This also led to the expansion of extension services 'to include the burgeoning dryland cotton farming' (Mjindi, Farming (Pty) Ltd. n.d.). By the late 1980s, nearly 2,000 ha were under sprinkler irrigation, with a further 1,000 ha under dryland conditions. Yields of up to 3 tons/ha were recorded (Snyman, 1988). The surging interest in cotton as the key institutionally supported cash crop triggered a corresponding decrease in a number of food crops which had previously been planted regularly in the area.⁶ This shift coincided with the return of many retrenched migrant workers who, upon their return to the Makhathini Flats, began to explore alternative income generating opportunities.

The complicated and often confused development history of Makhathini reveals that the context in which a new technology is introduced is far from innocent. Exponents of the benefits that Bt cotton has conferred on Makhathini's farmers often portray GM technology as a separation from the past, a revolutionary new technology that will irrevocably alter the livelihoods of smallholder farmers. Serious engagement with the region's history overturns this notion. GM is best understood as the latest in a long series of technocratic interventions that have consistently failed to transform Makhathini into a hotbed of commodity production, but have instead been guided by a technocratic will to make cotton a lucrative cash crop, regardless of local conditions, needs or ecology.

Having outlined how regional history and geography have shaped the context of this technological intervention, we now turn to the political economy of cotton production in South Africa. We document the wide range of factors, both economic and institutional, that affect the choices available to the Makhathini cotton farmer. Policy decisions taken at all levels – international, national, and local – have important repercussions for small-scale farmers and fundamentally affect the benefit the farmer will receive from this new technology. Understanding how appropriate this GM technology is for the farmers of Makhathini can only be achieved once the range of political and economic factors that influence the adoption of cotton in the region have been unpacked.

The Contemporary Economic Context of Cotton

South Africa is a net importer of cotton, and South African cotton growers have always been vulnerable to the variability and vagaries of the international cotton market. With the recent entry into the global market of a growing number of low-cost cotton-producing countries in Asia, together with persistently high cotton subsidies in the United States, South Africa's cotton sector has become even more vulnerable. Cotton is a crop in decline in South Africa, although the impact of lower international cotton prices on South Africa's cotton growing regime has been uneven. Dryland areas, for example, have proved to be far more susceptible to the price slump within the industry than irrigated farmland, as Table 1 shows.

This year's estimates for cotton growth in the Makhathini Flats reflect the systematic decline in cotton cultivation in South Africa. Cotton SA estimates that 550 farmers⁷ in the Makhathini area are planting cotton in the 2004-2005 season – a significantly

Table 1: Dryland & Irrigated Cotton Area Planted in South Africa, 1993-2004

Growing season	Area planted under Irrigation (ha)	Dryland area planted (ha)	Total area planted (ha)
1993-94	11,258	55,941	67,199
1994-95	19,038	35,096	54,134
1995-96	17,609	72,809	90,418
1996-97	15,954	67,017	82,971
1997-98	20,361	69,578	89,939
1998-99	31,263	67,356	98,619
1999-00	10,486	40,282	50,768
2000-01	18,539	38,153	56,692
2001-02	9,791	28,897	38,688
2002-03	10,322	12,252	22,574
2003-04	18,269	17,450	35,719

Source: Cotton SA, 2005

lower figure than Thirtle et al.'s estimate of '3,000 Zulu smallholders growing cotton in Makhathini Flats' (2003:718). Table 2 shows crop production information for KwaZulu-Natal. Since areas of dryland production outside of Makhathini are marginal, the provincial dryland statistics are a reasonable proxy for cotton grown by smallholders in the Makhathini Flats, the only significant smallholder cotton producers in the province. Irrigated farming is a little more defuse, however, with cotton farms spread across Northern KwaZulu-Natal.

As Table 2 demonstrates, there is variability at the level of orders of magnitude in the adoption of cotton by dryland farmers as reflected in area under cultivation. The reason for this is fairly straightforward; without rain, cotton seed cannot be planted, and the fortunes of farmers without irrigation are therefore hostage to the region's variable climate.

Of particular significance within this data are the statistics on yield. Despite the claims of the Monsanto Corporation, the South African cotton trade industry body data suggests that yield cannot alone explain the adoption of GM cotton within Makhathini. Table 2 shows more or less constant yield levels before and after the adoption of Bt cotton, contradicting a correlation between the introduction of GM cotton and increased yields in the region. This is consistent with ecological modelling associated with yield spikes with Bt cotton (Gutierrez, Dos Santos, Pizzamiglio et al. 1991; Gutierrez, Dos Santos, Villacorta et al. 1991). At the beginning of the period for which data could be found in the production year 1997-98, dryland yield stands at 600kg seed cotton per hectare, with 0 per cent GM cotton adoption. In 2004-05, with close to 100 per cent GM cotton adoption, yields are once again 600 kg/hectare.

Increased yields are then unable to account for the almost unanimous decision of Makhathini cotton farmers to adopt Bt cotton. Thirtle et al. (2003) also suggest reduced pesticide exposure as a motivating factor in adoption. We were unable to collect data on pesticide use that would confirm this, though discussion with those familiar with pesticide application in the area suggests that while pesticide application to control boll-worm has fallen in the period since the introduction of Bt cotton, these reductions have been countervailed by increased pesticide application to ward off secondary insects such as jassid, whose appearances have substantially increased since the introduction of Bt cotton.⁹ While we cannot categorically dismiss reduced spraying costs as a possible explanation in the adoption of Bt cotton, and while our scepticism has been confirmed by recent research (Pschorn-Strauss, 2005),

Table 2: Cotton Production Data in KwaZulu-Natal

Production Year	Area planted under irrigation ha	Area Planted under dryland ha	Yield of cotton planted on irrigated land (kg seed cotton per ha)	Yield of cotton planted on dryland (kg seed cotton per ha)	Production (200kg bales cotton lint)	Crop % handpicked	% crop ginned
1997-98	1,144	6,459	2,100	600	1,130	90	95
1998-99	1,502	6,785	1,800	640	12,683	100	80
1999-00	1,155	5,926	1,400	420	7,493	100	99
2000-01	528	3,587	3,000	1,150	10,419	100	95
2001-02	620	10,593	2,400	400	10,486	100	74
2002-03*	1,403	321	2,135	300	5,500	91	98
2003-04	2,276	2,537	3,310	659	14,715	58	
2004-05*	1,173	2,242	2,860	600	8,695	65	

Source: Cotton SA; *estimates

we suggest that adoption is primarily a function of a structured institutional framework that privileges adopters, while marginalising and excluding those with aspirations of escaping the cycle of cotton. In a context in which many farmers feel abandoned by the provincial department of agriculture and by government extension services and credit services, it is only through cotton that farmers gain access to seed, credit and support.

Changing Institutional Arrangements

Much has changed in Makhathini since Thirtle et al. conducted their research. At the time, in 1999-2000, the Vunisa Cotton Company¹⁰ was the sole vendor of cotton seed and supplies and, together with Noordelike Sentrale Katoen (NSK), one of two buyers of cotton in the area. Since then, NSK has given way to the Makhathini Cotton Company (MCC). Vunisa, following a legal dispute with the Makhathini Cotton Company in 2002 (Makhathini Cotton (Edms) Beperk vs. Vunisa Cotton (Edms) Bpk 2002), has completely shut down its operations in the area. Despite its departure, Vunisa's legacy, especially as a facilitator of the extension of credit, remains. Officials report that the company was profligate in its extension of credit to farmers – this was cited in interviews as one of the contributing causes for Vunisa's departure.¹¹ Some farmers report that Vunisa would extend credit without ascertaining whether the prospective debtors in fact owned any land.¹²

Vunisa's widespread dissemination of credit explains the discrepancy between Thirtle et al.'s reported '3,000 Zulu farmers' and the suggestion by the local Monsanto representative that, were full production capacity to be resumed, the total number of farmers in the area adopting cotton would be between 1,500 and 2,000.¹³ The difference between this assessment and the larger previous one can be ascribed to large numbers of people declaring themselves as cotton farmers in order to access credit from the Land and Agricultural Development Bank of South Africa (Land Bank) through Vunisa, but with neither the intention nor the means to grow cotton.

Also omitted from Thirtle et al.'s account is Mjindi Farming (Pty) Ltd. Mjindi is a parastatal that administers the water and state land connected with irrigation from the Jozini Dam. Ten years ago, they were in receipt of grants in the region of R13 million, with a staff of 180. Today, the same operation runs with a staff of 12, and with a slimmed-down grant of only R2 million.¹⁴ This dramatic decline in funding has focused Mjindi's efforts towards full cost recovery. Owed R7,538,233 by 325 farmers and collectives, Mjindi has been scrambling to establish stricter means of enforcing repayment, the latest of which is the introduction of pre-paid water meters. So far, ten farmers have had their water cut off for inadequate repayment. The operation, however, remains unable to mitigate its financial collapse. A report by the Department of Water Affairs and Forestry (DWAF) suggested that the simple maintenance of existing capital equipment required a subsidy in excess of R100,000 per month.¹⁵ This untenable financial situation has led many to speculate that it is merely a matter of time before DWAF sells the organisation, the most likely buyer being the local industrial giant, the Makhathini Cotton Company.

Before we consider the formidable position of the MCC within Makhathini's political economy, it is important to consider the role of debt as an accelerating engine of cotton adoption rates. Mjindi Farming's cost recovery exercises, and its liabilities, reflect the parlous situation of irrigated farmers. Many of these farmers choose to grow sugar cane instead of cotton in order to service their debt. For dryland

farmers, such options have never been available. Yet while the options for dryland farmers are more constrained than their irrigated-land counterparts, they share a common history in their exposure to debt. In September 1988, the KwaZulu Finance Corporation (KFC) became the primary agent responsible for advancing and managing production loans on the Mjindi Scheme.¹⁶ KFC lending soon expanded to funding dryland farmers, in response to a request from the KwaZulu cabinet. From 1988 to 1994, the KwaZulu Finance Corporation advanced R11,998,317, mainly as cotton production loans.¹⁷ Due to poor repayment rates, KFC eventually decided to cease lending in the area on 31 August 1994.

The supply of credit during this period was sporadic, uneven, and confused. Yet demand remained high. Farmers repeatedly articulate that the reason so many of them turned to cotton was that it was the sole source of credit in the region.¹⁸ After KFC's withdrawal, the only access to credit available to farmers in the region was through the cotton companies themselves (namely, Vunisa). Lending undertaken on behalf of the cotton industry was excessive and irresponsible. According to one respondent in the banking sector, during the 1980s:

*Mjindi Farming ... provided interest free credit with very little attempt to recover monies lent, neither were farmers charged rent for the land nor for the irrigation water supplied to them. A culture of non-payment soon came to dominate.*¹⁹

This reckless lending was exacerbated by the inability of cotton farmers to extract high yields from their crops. In the 1988-89 season, irrigation farmers averaged 1,383 kg per hectare which was considerably lower than the 'break-even high technology yield of approximately 2,000 kg per hectare' (Bembridge, 1993). By 1991, average irrigation farmer debt was R17,155, up to R31,158 when water and other costs were included. These spiralling levels of debt meant that only 25 per cent of farmers qualified for seasonal crop loans in that season (Bembridge, 1993). As a result, the number of cotton farmers on the Irrigation Scheme declined from 259 in 1988 to just 131 in 1991 (Woodburne, 1993).

Levels of indebtedness were then exacerbated further by the Vunisa Cotton Company's decision in 1993 to distribute free cotton seed to farmers. The climate that year was unfavourable, and the subsequent poor yields meant that farmers were unable to recoup input costs (Woodburne, 1994). The situation of farmers on the irrigation scheme was equally depressing. By 1994 the outstanding cotton debt of both dryland and irrigation farmers owed to the KFC already stood at an estimated R2 million, swelling to over R5 million when land rental arrears, accumulated water charges and SADT loans are included. Although an agreement on debt consolidation was reached, a 1994 report on the Makhathini area stated that 'irrigation and dry land farmers are in a desperate situation ... continued attempts to cultivate cotton will serve only to drive them further into debt' (Woodburne, 1994).

The debt burden is exacerbated by difficult climatic conditions only marginally suitable for cotton, compounded by fluctuating and recently declining international commodity prices. The seasonal reliance on financial assistance, often channeled through cotton interests, has created a dependent cyclical relationship between small-scale cotton farmers and an ever-changing set of developmental institutions, that has served to entrench farmers in a high risk, low-return system of agriculture that is neither financially nor ecologically tenable. This dependent relationship is constituted by the institutional arrangements that prevail in the area. The story of

debt informs part of this. The monopsony of the Makhathini Cotton Company is a further, central component, and it is to this that we now turn.

Makhathini Cotton (Pty) Ltd

The most recent member of the institutional matrix defining the developmental context of the Makhathini Flats is Makhathini Cotton (Pty) Ltd or the Makhathini Cotton Company (MCC) as it is more commonly known. The physical presence of the Company in the region is characterised by its recently relocated and re-assembled cotton gin and the necessary infrastructure required to ensure an adequate level of direct access to cotton markets. In some respects Makhathini Cotton (Pty) Ltd embodies the post-apartheid development discourse which has emphasised privatisation and the role of private capital in economic development, as well as the redistribution of economic opportunities to previously disadvantaged individuals. The MCC also represents the vanguard to the much vaunted public-private initiatives in the province designed to facilitate a 'green revolution' in the area.

The MCC was founded in 2002 at the behest of prominent provincial politicians²⁰ and as an initiative of the late J.S. Eriksen.²¹ The founding partner was the cotton company Noordelike Sentrale Katoen (NSK), which had established a small presence on the Makhathini Flats in the 2001/2002 season.²² The vision of the company was, as with every other initiative before it, to bring enduring development to Makhathini. Furthermore, with 70 per cent of the shares owned by a black South African, the MCC also fulfilled the role of an Agricultural Black Economic Empowerment (Agri-BEE) company. This policy justifiably seeks to redistribute control of the economy to previously disadvantaged groups. Yet in the context of Makhathini it has still not addressed the fundamental flaws in the overarching development paradigm.

Although the MCC does not sell cotton seed directly, the Company does have 'friendly relations' with Monsanto and other key input suppliers such as Wenkem, a local agrochemical and seed distributor. Wenkem operates from a container adjacent to the MCC property and it is from here that the Bollgard™ cotton seed primarily used by Makhathini farmers is sold. To ensure that some of the concerns surrounding outstanding production loans, licensing 'violations' and the illegal distribution of patented seed is monitored and controlled a list of licensees is provided by the seed distributor to the MCC. In addition, the MCC now only provides sacks for baling cotton free of charge to registered licence holders. Previously the Company had distributed sacks to all cotton farmers, but the sacks were sometimes returned filled with cotton that 'wasn't theirs', which was perceived by MCC as being a source of conflict.²³

The MCC also has institutional links with the Land Bank although, unlike Vunisa, it does not provide farmers with credit for seed, inputs or irrigation. Rather, the MCC has offered to collect 'voluntary' repayments of Land Bank loans. More important however, is the role of the Land Bank as the primary provider of finance for the ongoing operations of the MCC.

As was alluded to earlier, the MCC is not merely a ginning facility, but also actively engages in the production of cotton in both a direct and indirect capacity. The company has three distinct cotton production arrangements. First, it grows cotton itself on 350 ha on the existing Mjindi irrigation scheme, and on a further 732.91 ha on land leased from Mjindi Farming (Pty) Ltd.²⁴ Second, cotton is grown in a

subleasing arrangement with farmers on the Mjindi irrigation scheme where the average farm size is 10 ha. The payment arrangements for this scheme are a flat rental of R12,500/ha per crop per year over a five year period, with 50 per cent of the profits returning to the Land Bank, 25 per cent of profits returning to the MCC and 25 per cent to the farmer. Within this scheme there are two sub-arrangements which include a self-help scheme (chosen by only five farmers) where the farmer supplies labour in the growing of cotton. Alternatively, farmers may choose an arrangement whereby the entire farming operation is taken over by the company (chosen by the majority of around 35 farmers). The overall production scheme is currently in its third year, but is already proving to be financially problematic for the MCC.²⁵

Third, the MCC is also engaged in joint venture partnerships with farmers south of the core Mjindi area. It has succeeded in setting up small joint-venture companies with farmers in which the MCC holds 51 per cent stake of shares and farmers own 49 per cent. In these schemes, while there is no guaranteed payment, the companies will, over a ten year period, share profits along the same lines as the Mjindi scheme, with Land Bank receiving 50 per cent of profits, 25 per cent going to the farmer, and 25 per cent going to the MCC.²⁶ Irrigation equipment will be fitted by the MCC, and charged to the joint venture company. With the profits generated through this business, farmers will be able to repurchase shares from the MCC, with the aim finally of owning the joint venture as a community. Three key features of this scheme are that the area under cultivation will be relatively large (180 ha in Makhathini's Section 6 area), that irrigation will be installed, and that it makes credit available to farmers through their joint venture.²⁷ Despite this, the chances of farmers buying back any shares from the MCC based on cotton revenue seem unlikely. This year, the most profitable plot of land on which the MCC grew cotton turned in a profit of only R141.63/ha.²⁸

The issue of scale is equally critical here as the areas in the joint venture are to be irrigated with a centre-pivot system. Once the pivot is installed, the marginal cost of adding an extra section of irrigation boom decreases (because the surface area covered by each extension to the radius of the pivot increases with scale). The irrigation technology therefore favours large-scale operations. All land under the sweep of the pivot must be part of the same scheme as it is not viable to turn off the pivot for plots of land that are not congruent with the overall scheme.²⁹

Clearing obstructions for the centre pivot system has also meant relocating families. The need for contiguous plots of land under the pivot demands the full and complete participation of every land-holder in the area. This has led to allegations of intimidation tactics being used by local committee members against individuals hesitant to relocate in order for these companies to be formed.³⁰ Furthermore, while R6,000 has been allocated per farming family for temporary accommodation, the farmers are still waiting for permanent housing. At present neither the Jozini Municipality nor the MCC seem to want to take responsibility for this, despite farmers' understanding that both institutions had committed to providing housing in exchange for relocation.³¹

The motive behind MCC's massive expansion plans is most likely financial. In order for the gin to turn a profit it will have to process over 10 million kg a year, a figure that has not yet been approached in the first years of operation. In the 2003/2004 season, for instance, the gin processed only 8 million kg.³² With the MCC incurring heavy losses on cotton farming, these must be compensated by profit generated by the ginning process, which can only be realised with accelerated production volumes.³³

Choices, Farmers & the Adoption of Genetically Modified Cotton

Having articulated the historical, economic, political and institutional contexts that frame the decision-making ability of Makhathini cotton farmers, we now turn towards evaluating which factors are most pivotal in shaping the lack of choices available. Informing this are data from a series of workshops, and in-depth interviews with leaders of local cotton associations. This struck us as an appropriate methodological intervention, not least because in the reporting of the Makhathini GM phenomenon, the voices of all but a few farmers – invariably those willing to promote GM cotton – have been silenced. Through these conversations, the following were suggested as key factors in Bt cotton adoption.

Few Alternatives for Dryland Farmers

Above all else, and repeatedly throughout our discussions, dryland farmers in the Makhathini area made it clear that they had few alternatives to cotton. A constant refrain in our workshops was the call for additional markets and expanding irrigation. With irrigation would come the possibility of growing sugar-cane and other crops, especially maize. Some floodplain farmers, reliant on the floods from the Jozini dam but not connected to its irrigation system, grow cane, but the crop exhibits increasing returns to scale, and transport fees and distance to the mill in Pongola some 70 km away from Jozini make it a barely economic proposition. Other disincentives to sugar-cane cultivation are the fact that Makhathini farmers are restricted to only marketing the cane from 1,420 hectares in terms of national sugar milling policy, and that cane require more than twice as much water than does cotton (INR, 2002). Despite this, farmers were nearly unanimous in favouring sugar cane over cotton.³⁴ Farmers explained that in the absence of markets for alternative crops, cotton remains the only possible source of income in the area.

Effective Prevention of Access to Conventional Cotton Seed

The absence of alternatives at a crop level is replicated at the level of seed purchasing or seed supply. Choices are already limited by the fact that Cotton South Africa puts forward an annual short list of three recommended seed varieties to ensure consistency in the processed fibre.³⁵ Yet farmers report and employees at the MCC confirm that conventionally improved cotton seed is not being grown anywhere on the Makhathini Flats. While Delta Opel, an improved non-GM variety, is available for sale at the official Wenkem outlet situated adjacent to the MCC gin, it is only sold in quantities of 25kg, as opposed to the Bollgard™ NuCOTN 37-B seed which is marketed in an 'Ecombi' 5kg package, an ideal size for the small acreage farmers that prevail within the Flats. Even more prohibitively, the MCC gin only purchases cotton packed in wooolsacks that the MCC provides. These wooolsacks are allocated to farmers at the beginning of the season based on information derived from lists provided to MCC by Wenkem of those licensed to grow Bt seed. Thus, MCC excludes the potential of non-GM growers by only allowing Bt cotton to pass through its gin.

Water

This is the third year in which rain has been unseasonably low during the cotton planting season.³⁶ The drought has meant that dryland farmers have been unable to plant cotton seed. T.J. Buthelezi, the farmer that Monsanto has flown to over 13 different countries to speak on his positive experience growing Bt cotton,³⁷ had invested R6,000 into plowing and disking his soil, and but had yet to plant a single

seed in the 2004/2005 growing season. In an early February 2005 interview, he indicated that were he to plant at that time, he would barely recoup his costs. He reported that: 'my head is full. I do not know what I'm going to do. I will have to speak to my wife so that we can make a plan'. His situation epitomizes that of many farmers in the region. At the Ndumo A irrigation project near the Mozambican border, only 60 ha of the 488 ha set aside for cotton were being utilised in the 2004/2005 growing season due to water constraints.³⁸ Farmers at nearby Ndumo B reported similar shortages and as a result 300 ha of land designated for cotton lay untouched due to a lack of water.³⁹

Debt

The final variable that constrains the choices available to the cotton farmers of Makhathini is that of escalating debt. We have outlined how profligate lending practices on the part of KFC and Vunisa Cotton Company led to spiralling levels of farmer debt and eventually forced both institutions to abandon credit provision in the region. Lending in the post-GM era has now become the sole responsibility of Land Bank. Easy access to credit needed to be widely available during these introductory years since small-scale farmers required ready cash to cover the increased seed and input costs associated with GM cotton seed. Buoyed by the initial surge in enthusiasm that accompanied the introduction of GM in 1998, Land Bank was extravagant in its loans, giving out more than R8 million to small-scale cotton farmers in the first growing season (see Table 3). Due to the institutional and climate constraints detailed above farmers were unable to meet their repayment schedules, forcing Land Bank to close 1447 out of the 1648 loans after only one year.

In subsequent years Land Bank was more restrained in its lending, attempting first a reduced loan amount per farmer, then consolidating loans among groups of farmers in the hopes of improving loan repayment. Revenues from Bt cotton were still insufficient to allow farmers to meet their repayment schedules. Land Bank eventually ceased lending in Makhathini in 2004, with R22.7 million outstanding in defaulted loans.

The volatile and unpredictable pattern of lending undertaken by Land Bank mirrors the roller coaster experience of small-scale farmers with Bt cotton. Initial enthusiasm during the first few growing seasons obfuscated the institutional and political economic realities that make cotton-growing in Makhathini an unpredictable and precarious undertaking. Land Bank's disastrous lending figures confirm farmers'

Table 3: Loan Accounts to Dryland Farmers in KwaZulu-Natal Issued & Closed by Land Bank, 1998-2004

Year in which loan granted	No. of loans granted	Original loan amount (ZAR)	No. of accts. closed	Final arrears owed to Land Bank in this year (ZAR)
1998	1,648	R 8,110,985.40	0	0 -
1999	11	R 214,450.00	1,447	16,185,855.33
2000	795	R 1,389,375.00	83	1,103,838.55
2001	1	R 25,000.00	793	3,387,492.68
2002	77	R 1,173,485.00	5	81,132.81
2003	5	R 53,960.00	154	1,176,875.79
2004	0	R -	139	812,952.39
Total	2,537	R10,967,255.40	2,621	22,748,147.55

Source: Land Bank 2005.

reports which were adamant that their debt situation had deteriorated following the introduction of Bt cotton.⁴⁰

Conclusion

The development of cotton in Makhathini suggests that the success story of GM cotton has been ascribed a prematurely happy ending. Technical interventions, even relatively easily adaptable ones such as Bt cotton, are not inserted into a vacuum. The ecological and political economic contexts have been shorn away from the accounts that, on balance, find grounds for 'cautious optimism' in the Makhathini area. Yet the political economy of Makhathini has been consistently transformed to accommodate the needs of cotton, despite the ongoing uncertainty around the compatibility of small farms and the scale-based returns necessary to sustain modern cotton economics. The political economy of cotton production puts the MCC in a position in which it seeks to increase its land holdings, resulting in sleight profit-sharing arrangements for some, coerced eviction for others, and widespread indebtedness for many. This results in the exclusion and disempowerment of the very farmers Bt cotton is intended to empower.

Yet, the MCC remains committed to its planned expansion. We can make sense of this, despite the potential losses currently sustained by the company, not because of the intrinsic benefits conferred on it by genetically modified seed, but because the company is merely the latest in a succession of large-scale development efforts in the Makhathini region. As with previous efforts, it is important for the development intervention to appear as if it is 'benefiting the poor'. It is perhaps for this reason that the MCC has recently relaunched its website, hosting a 2005 news article from the 'life-sciences' industry-funded Council for Biotechnology Information (Company, 2005; Council for Biotechnology Information, n.d.) in which T.J. Buthelezi claims: 'Normally, at the end of the year, I would ask my wife how we are going to pay our bills,' he says. 'Now I ask her, how are we gonna spend this money?' Our interviews with Buthelezi, as well as with other leading cotton farmers, contradict this rather favourable scenario.

We have shown that farmers on the Makhathini Flats adopt Bt cotton not because they consider themselves to be innovative adopters of biotechnology, but because agrarian choices are severely limited. The principal intervention in the bringing of GM cotton to the region has been the facilitation of access to cotton markets for local farmers. Absent from the area has been any serious and consistent engagement by government to offer genuine sustainable alternatives or to promote a viable model suitable to small-scale agricultural development. In this context the rhetoric of 'GM technology helping the poor' seems to serve the needs of the promoters of the technology, rather than the residents of Makhathini. With the spectre of similar interventions haunting other parts of Africa, sanctioned through the 'success' of Makhathini, we sincerely hope that this prioritisation can be reversed.

Harald Witt, Rajeev Patel & Matthew Schnurr, c/o Raj Patel, e-mail: patel@ukzn.ac.za. This project could not have been completed without the invaluable skills of our workshop facilitators and translators Nonhlanhla Dlamini, Thulani Ndlazi, and Dumisani Nyathi. We are grateful to Zeph Nyathi, Gama Mathe, Sjoerd van den Heuve, Vusi Zikhali and the many officials and community members who were willing to speak with us. We would also like to thank Benjamin Cousins, Bill Freund,

Mariam Mayet, Vishnu Padayachee and two anonymous reviewers for helpful comments on the initial draft. A version of this paper was presented at a workshop hosted by the School of Development Studies at the University of KwaZulu-Natal. This project was funded by the Centre for Civil Society, School of Development Studies, University of KwaZulu-Natal, Durban 4041, South Africa. All authors contributed equally to the paper. The usual disclaimer applies. All correspondence should be directed to Raj Patel, Centre for Civil Society, School of Development Studies, University of KwaZulu-Natal, Durban 4041, South Africa.

Endnotes

1. See, for example, the rationale behind the Global Environment Fund's 'West Africa Regional Biosafety Project', GEF Project 2911, which explicitly mentions insecticide resistance as a rationale for the development of GM crops, available at http://www.thegef.org/Documents/Council_Documents/GEF_C28/WP.html
2. The first trials in South Africa of genetically modified cotton had, however, taken place almost a decade earlier. In 1989 the Department of Agriculture received its first application for GM cotton. In 1990 Calgene had conducted field trials with GM cotton to test for Bromoxynil tolerance. The first trials with Bt cotton were initiated in 1993.
3. Interview, Pete Derman, Director, Community Outreach Research and Development (CORD), 1 December 2003.
4. Settlement on the irrigation scheme began in 1982 and by 1988/89 there were 284 farmers on 3,500 ha. Average area per farmer was about 10 ha (Bembridge 1991).
5. The SADT was gradually phased out and replaced by Natal Trust Farms but continued to be represented locally by Mjindi Farming. In November 1993 Mjindi Farming (Pty) Ltd was established and the shareholdings were transferred from the SADT to the national Department of Agriculture. The new structure reported to a board of directors which comprised of shareholders and local representatives.
6. Ndumo A Workshop, 26 January 2005.
7. Interview, Phineas Gumede, Cotton SA Representative, 7 February 2005.
8. Interview, Barry Janse van Rinsberg, Operations Manager, Makhathini Cotton, 3 February 2005.
9. These observations were corroborated by Monsanto employees; Interview. Andrew Bennett, Biotechnology Lead, Monsanto, 28 February 2003 and Charles Motlu, Monsanto Field Representative, Makhathini, 4 February 2005.
10. Originally created by Clark Cotton and the Tongaat Cotton Company. Clark Cotton had come to dominate the local market since its arrival in 1978.
11. Interviews with David McAllister, Makhathini Cotton Company Agricultural Development Manager, 3 February 2005; Mr. Nkosi, Municipal Manager, Jozini Municipality, 4 February 2005; Juri Stein, Cotton Researcher, Makhathini Research Station, 28 January 2005.
12. Water Committee Workshop, Mboza, 1-2 February 2005.
13. Interview, Charles Motlu, Monsanto Field Representative, Makhathini, 4 February 2005.
14. Interview, Pieter Pretorius, Irrigation Manager, Mjindi Farming, (Pty) Ltd, 2 February 2005.
15. Interview, Pieter Pretorius, Irrigation Manager, Mjindi Farming, (Pty) Ltd, 2 February 2005.
16. The KwaZulu Finance Corporation had begun lending in the area in 1985-86 for small-scale capital goods such as tractors.
17. Additional development funding for the expansion of the Irrigation Scheme was also made available by the Development Bank of South Africa (DBSA).

18. Water Committee Workshop, Mboza, 1-2 February 2005.
19. Tim Bradley, Agricultural Loans Manager, Ithala Bank (successor to KwaZulu Finance Corporation), response to email questions, 22 February 2005.
20. Personal Communication, Graham Hefer, Director, NSK, 24 March 2005.
21. Personal Communication, Harry Strauss, Head, KwaZulu-Natal Department of Agriculture, 1 April 2005.
22. According to Harry Strauss, the principal actors were Mr. J.S. Eriksen, Mr. P. Sokhela, Mjindi (Pty) Ltd and the provincial government (Personal Communication, 1 April 2005). It should be noted that Mr P. Sokhela also has extensive interests in sugar where recent acquisitions such as Illovo Sugar's Gledhow and Umfolozi sugar mills have also been heralded as major BEE advances.
23. Interview, Barry Janse van Rinsberg, Operations Manager, Makhathini Cotton Company, 3 February 2005
24. Interview Barry Janse van Rinsberg, Operations Manager, Makhathini Cotton Company 3 February 2005. According to its website, Makhathini Cotton Farming (Pty) Ltd successfully negotiated with the government to lease 15 000ha of state land and has obtained water rights for 4 000ha. As at the end of 2004, 1 500ha of land has been developed under irrigation (Makhathini Cotton Company 2005).
25. Interview Barry Janse van Rinsberg, 3 February 2005.
26. Interview Barry Janse van Rinsberg, 3 February 2005.
27. Thirtle et al. did not consider access to water as a variable in their adoption model. Although there were floods in the year they conducted their survey, the infrastructure for water is a more permanent feature of the area, and their omission of it as a variable is surprising. Their findings on economies of scale are inconclusive – their sample found that there were returns to scale for adoption of Bt cotton, but could not rule out that adoption was scale-neutral. Qualitative data suggests that there are indeed returns to scale, and the business strategy of MCC is based partly on this assumption.
28. Interview, David McAllister, Agricultural Development Manager, Makhathini Cotton Company, 3 February 2005.
29. Interview, David McAllister, Agricultural Development Manager, Makhathini Cotton Company, 3 February 2005. Economies of scale in cotton farming are also suggested by qualitative data from a forthcoming study by Van der Hueve, who found that farmers who reported increasing their cotton hectareage did so because they thought that in so doing, they might be able better to recoup their costs, having failed to do so with smaller areas under cultivation.
30. One woman, who would give her name only as Mrs. X for fear of reprisals, reported that her local committee had intimidated her into signing over the rights to her land as without her consent the entire project would have had to be halted.
31. Interview with Mr. B. C. Nkabinda, Manager Jozini District Office, Department of Agriculture, 25 Jan 2005
32. Interview, Barry Janse van Rinsberg, 23 November 2004.
33. Interview, David Macallister, 3 February 2005.
34. Water Committee Workshop, 1-2 February 2005. Gross crop water requirements at Makhathini vary between 1475-1522 mm for sugar and 593-649 mm for cotton (Cedara Agricultural Development Institute 1994).
35. Interview, Koot Louw, Statistician, Cotton S A, 30 January 2003.
36. Interview, David Macallister, 3 February 2005.
37. Water Committee Workshop, 1-2 February 2005.
38. Ndumo A Workshop, 26 January 2005.

39. Ndumo B Workshop, 27 January 2005.
 40. Water Committee Workshop, 1-2 February 2005.

Bibliographic Note

- Bembridge, T.J.** (1991), Farmer Characteristics, Innovativeness and Cotton Production at Makhathini Irrigation Scheme, KwaZulu. *Development Southern Africa* 8 (1); (1993), 'Upgrading Extension Services on the Makhathini Irrigation Scheme', Mjindi Farming. First Phase Report.
- Cedara Agricultural Development Institute** (1994), 'Report of the Workgroup for the Collection of Data Relevant to Irrigation Planning on the Makhathini Flats', edited by K.-N. Department of Agriculture.
- Company, Makhathini Cotton** (2005), *Small Farmer in Africa Gets Big Gains From Bt Cotton - 04 Feb 2005* 2005; cited 12 February 2005.
- Community Organisation Research and Development (CORD)** (1990), 'Overcoming Apartheid's Land Legacy in Maputaland (Northern Natal)', Durban: University of Natal.
- Cotton South Africa (Cotton SA)** (2005), Cotton production statistics from Cotton SA's own data; Pretoria, South Africa, 23 February.
- Council for Biotechnology Information** (2005), *Small Farmer in Africa Gets Big Gains From Bt Cotton* n.d.; cited 12 February 2005.
- Eksteen, van der Walt & Nissen** (International) (Pty) Ltd. (1994), 'Makhathini Operational Study Phase 2: Documentation and Description of Current Scheme Management and Farming Practices', Pietermaritzburg.
- Ferguson, James** (1990), *The Anti-Politics Machine: 'Development', Depoliticization, and Bureaucratic Power in Lesotho*, Cambridge: Cambridge University Press.
- Greenberg, Stephen** (2004), 'The Venoms Of Scorpions And Spiders ...': Global Agriculture and Genetically Modified Cotton in Africa, Johannesburg: Africa Centre for Biosafety; cited 6 July 2006 Available from http://www.biosafetyafrica.net/_DOCS/GMCottonInAfrica.pdf.
- Gutierrez, A. P., W. J. Dos Santos, A. Villacorta, M. A. Pizzamiglio, C. K. Ellis, L. H. Carvalho & N. D. Stone** (1991), 'Modelling the interaction of cotton and the cotton boll weevil. I. A comparison of growth and development of cotton varieties', *Journal of Applied Ecology* 28:371-397.
- Gutierrez, A.P., W. J. Dos Santos, M. A. Pizzamiglio, A. M. Villacorta, C.K. Ellis, C.A.P. Fernandes & I. Tutida** (1991), 'Modelling the interaction of cotton and the cotton boll weevil. II. Boll weevil (*Anthonomus grandis*) in Brazil', *Journal of Applied Ecology* 28:398-418.
- Henderson, C.M.** (1992), 'Environmental Evaluation of Proposed Crop Irrigation Schemes at Ndumu Farm', Ndumu, Pietermaritzburg: Institute for Natural Resources (INR).
- Hofs, J.L., & J. Kirsten** (2001), Genetically Modified Cotton in South Africa: The Solution for Rural Development? Pretoria: University of Pretoria and the Agricultural Research Centre for International Development (CIRAD).
- 108th U.S. Congress** (2003), House Science Committee, Subcommittee on Research; *Plant Biotechnology Research and Development in Africa: Challenges and Opportunities*, 108th Congress, First Session, Thursday, 12 June.
- Institute for Natural Resources (INR)** (2002), 'Environmental Scoping Report: Proposed Development of an Irrigated Agricultural Estate on the Makhathini Flats', Draft for Comment: Institute of Natural Resources.
- Ismael, Y., C. Thirtle, J. Piesse & L. Beyer** (2002), 'Can GM-technologies help the poor? The efficiency of Bt cotton adopters in the Makhathini Flats of KwaZulu-Natal', *Agrekon* 41 (1):62-74.
- Ismael, Yousouf, Richard Bennett & Stephen Morse** (2001), 'Can Farmers in the Developing Countries Benefit from Modern Technology? Experience from Makhathini Flats, Republic of South Africa': ISAAA Publication (www.isaaa.org/kc); (2001), 'Farm level impact of Bt cotton in South Africa', *Biotechnology and Development Monitor* (48):15-19; (2002), 'Farm level impact of biotechnology: smallholder Bt cotton farmers in South Africa', *Outlook On Agriculture* 31 (2):107-111.
- Iyer Rothaug Collaborative, Maseko Hlongwa Associates & For The Independent Development Trust** (2002), 'Umkhanyakude District Municipality Integrated Development Plan', edited by U. D. Municipality: Umkhanyakude District Municipality.

- Jozini Municipality** (2004), Jozini Local Municipality IDP Review (2005/2006) (First Draft, 10 December).
- Leverton, B. J.** (1963), *The Natal Cotton Industry 1845-1875: A Study in Failure*, Pretoria: Communications of the University of South Africa.
- Makhathini Cotton (Edms) Beperk vs. Vunisa Cotton (Edms) Bpk.** (2002) in 1681/2002: Pietermaritzburg High Court.
- Makhathini Cotton Company** (2005), *About us 2005*, cited 1 April; available from <http://www.makcotton.co.za/AboutUs2.aspx>.
- Mjindi Farming (Pty) Ltd.**, (n.d.), Makathini Irrigation Scheme Information Booklet.
- Pschorn-Strauss, Elfrieda** (2005), 'Bt cotton in South Africa: the case of the Makhathini farmers', in *Seedling*, Barcelona, Spain: Grain.
- Snyman, Nic.** (1988), 'Farming a Wasteland: This Large Development Project is Turning the Makatini Flats into a Viable Farming Area', *Farmer's Weekly*, 6-8.
- Thirtle, Colin, Lindie Beyers, Yousouf Ismael & Jenifer Piesse** (2003), 'Can GM-Technologies Help the Poor? The Impact of Bt Cotton in Makhathini Flats, KwaZulu-Natal', *World Development* 31 (4):717-732.
- Woodburne, S.J. et al.** (1993), 'Case Study on Support Services Supplied to Small Scale Cotton Farmers by Government and Non-Government Organisations and Commercial Enterprise', by Land and Agricultural Policy Centre (ed.).
- Woodburne, S.J. et al.** (1994), 'Makathini Sugar Project: Updated Demographic, Socio-Economic and Attitudinal Overview', by Lonrho (ed.).
- Woodburne, S.J. & R-D. Heinsohn** (1994), 'Makathini Sugar Project: Updated Demographic, Socio-Economic and Attitudinal Overview', by Lonrho (ed.).