

This article summarises the results of five years of research undertaken by Biowatch South Africa on the socio-economic impact of Bt cotton on small-scale farmers in South Africa. It forms part of a comprehensive research paper on the topic that will be published later this year.

Bt cotton

in South Africa

the case of the

Makhathini farmers



Elfrieda Pschorn-Strauss

In 2003, the chairman of the Ubongwa Farmers Union¹ in Makhathini, stood side-by-side with the US trade representative, Robert Zoellick. They announced together that the US would take the European Union (EU) to the World Trade Organisation (WTO) to challenge its stand on genetic modification (GM). The clear message to both the EU and Africa was that the US was standing by the African farmer by giving it access to GM technologies, whereas the EU was not.

The Bt cotton farmers of the Makhathini Flats,

in northern KwaZulu Natal, South Africa, had become a centrepiece of the GM industry's global promotion of GM crops as a solution to poverty and hunger. Why? A previous study, focussing on the agricultural economics of Bt cotton and published three years previously, had proclaimed huge yield increases for Bt cotton farmers in the Makhathini floodplains.² This study had a profound impact around the world. Bt cotton was heralded as an African success story by the biotech industry. Numerous delegations of African scientists, policy makers, farmer representatives and journalists, were brought to South Africa to

1 - The Chairman was Mr. TJ Buthelezi

2 - Ismael, Y., Bennet, R. & Morse, S. 2002. Benefits from Bt cotton use by smallholder farmers in South Africa. *AgBioForum*, 5 (1), pp.1-5. <http://www.agbioforum.org/v5n1/v5n1a01-morse.htm> A number of reports were spun off from this initial study of 100 farmers in Makhathini. See also Thirtle, C. Beyers, L. Ismael, Y and Piesse, J. 2003. *Can GM-Technologies Help the Poor? The Impact of Bt Cotton in Makhathini Flats, KwaZulu-Natal*. *World Development* Vol. 31, No. 4, pp. 717-732, 2003

Box: Monitoring Bt Cotton in South Africa

A number of research tools were used in an attempt to monitor the social, economic and environmental impact of the use of Bt cotton over a three year period:

- Semi-structured questionnaires with respectively 20 farmers in 2000 (2000-2001 season) and 40 farmers in 2003 (2002-2003 season), which included 16 of the original 20 farmers. Both dryland and irrigation farmers were interviewed.
- Semi-structured interviews and in-depth discussions with key informants, including government, private companies, farmers' associations and others.
- Direct observation, by establishing a permanent presence in the area from 2002 to 2005 (ongoing), through the appointment of a community worker to participate in fieldwork and interviews.
- Community participation which included attending of meetings of the farmers' associations and two meetings with the community including the feedback of the research results to the community. Their feedback and response were included in the results.
- A review of unpublished and published literature

High adoption rates of Bt cotton in 2000 - 2001, and the continuous switching of farmers between Bt cotton, conventional cotton, and no cotton planting at all made it impossible to maintain a control group of farmers and therefore to compare yields. The study collected data and information on the following issues:

- Income, costs of production and debt
- Adoption rates of Bt cotton
- Pesticide use
- Extension support, marketing and information on Bt cotton.
- The ecological and socio-political history of the area, including the changing involvement of various governments and companies and their impact on the community

meet with selected farmers in Makhathini and to showcase the benefits of GM crops for African farmers, all kindly funded by the GM industry and the US government.³

Even the FAO used this study as a basis for its widely criticised SOFA report⁴ in 2004.

Yet, it is now widely recognised that there is massive variability in the growing of Bt cotton; single surveys of farmers provide variable answers, each growing season provides very different results in the growing of Bt cotton. All in all, this initial economic study was a bit premature⁵ and the publicity generated from it, plainly misleading.

It is not only in South Africa that the GM industry has been proclaiming the benefits of Bt cotton. For example, in India, Monsanto led a massive media campaign of showing the wonderful benefits of Bt cotton, which, it turns out, have proved to be extremely misleading (see *Box: Bt Cotton in Andhra Pradesh - a three year assessment* on Page 19).

Therefore, we have a few widely publicised studies

proclaiming the benefits of Bt cotton for small farmers, including higher yields and reduced pesticide use. However, the growing evidence of farmers' experiences points to a darker reality, as shown by this article in South Africa. Bt cotton has not proved to be sustainable in terms of reducing pesticide use nor in terms of improving income for farmers. In many areas insect resistance management plans are not known by farmers and therefore not followed. Secondary pests are becoming a major problem and in some areas, such as in India, Bt cotton simply did not perform. Far from addressing the problems faced by small farmers, reports from the field show that Bt cotton exacerbates their poverty. Alternative methods for reducing pesticide use in cotton are not promoted even though it has proven to be very successful.⁶ Bt cotton is just a distraction that maintains the pesticide industry and lures countries of the South into accepting GM.

For it is clear that Bt cotton is also a Trojan Horse. By having one GM crop in place, it is then possible and far easier to grow other GM crops; the necessary legislation is in place, the relevant



3 - Biowatch has met with four of these delegations, including two Zambian delegations, a delegation from Mali and SADC. There have been many more delegations to Makhathini but these four specifically requested to meet with Biowatch.

4 - SOFA report: The State of Food and Agriculture (SOFA) is an annual report by the FAO. In 2003 / 4 the report written by economists focussed on transgenic crops and gave a ringing endorsement of the use of GM crops. Some of their evidence was based on the limited and short-term studies by Ismael, Bennet and Morse (see Footnote 2), and for other countries gathered evidence can only be described as highly selective. For more information visit: grain.org/front/?id=24.

5 - Gouse, M. Kirsten, J. Shankar, B. Thirtle, C. March 2005. Bt Cotton in KwaZulu Natal: technological triumph but institutional failure. www.agbiotechnet.com

scientists are trained up, the idea of genetically modified crops is more acceptable, etc....⁷ Bt cotton has been chosen as a Trojan Horse in Africa and India, as it is perceived as being less controversial (it is not a food crop) and it has been easy to convince farmers with little money to start growing it.

In the long term, the GM industry, such as Monsanto, are not that interested in Bt cotton (cotton is a very minor crop in South Africa) - they are far more interested in other more lucrative crops. For more information on Bt Cotton, GRAIN has set up a special section on the GRAIN website that focuses specifically on news and information on Bt cotton: visit <http://grain.org/go/btcotton>.

The Biowatch Makhathini Research Project

From 2000-2005, Biowatch researched and monitored the socio-economic impact of Bt cotton on small-scale farmers, interviewing farmers, industry, government and researchers. The approach followed for the Biowatch study is best described as a 'political ecology'⁸ one, questioning the links between economics, politics and the power relations that determine who benefits from technological interventions. A study of the political ecology of Bt cotton in India provides some useful parallels for South Africa.⁹ For more information about how the Biowatch Makhathini Research Project was carried out, see the *Box: Monitoring Bt cotton in South Africa*.

The Community

The study area for this research focused on the Makhathini Flats and Pongola Floodplain but also included farmers from the Mngqobokazi and Dondotha areas, all within the district municipality of Umkhanyakude. Interview sites on the Makhathini Flats and Pongola Floodplain included Mjindi, Ndumu and Bambanana. Both irrigation and dry-land farmers were interviewed. Farm sizes can vary considerably with farms from anything between 0.5 hectares (ha) and 43 ha with cotton usually grown on 1.5 to 10 ha plots. Almost all farmers practice mixed-cropping with maize, vegetables, beans, cowpeas and some sugarcane as an additional cash crop. None of the farmers interviewed kept any record of purchases, yields, amounts of insecticides sprayed. It can be safely assumed that hardly any small-scale farmer in the study area keep farming or financial records.

The Pongola River system is at the centre of this area and uniquely for South Africa, forms a floodplain of some 10,000 ha along the eastern foot of the Lebombo Mountains. The floodplain system incorporates about 90 pans¹⁰ that form feeding grounds for several migratory species but also provides crucial resources for local people, including fish, grazing, arable land, fuelwood, and materials for building and craftwork.

The community of Umkhanyakude is extremely poor. There is a 53% unemployment rate,

6 - For example see: GRAIN, 2004, *GM cotton set to invade West Africa. Time to Act!* - grain.org/briefings/?id=184 Also see 3-year study of Bt cotton in Andhra Pradesh where alternative methods of pest control is discussed: grain.org/research/?id=302

7 - GRAIN, 2005, *USAID: Making the world hungry for GM crops*, GRAIN Briefing, grain.org/briefings/?id=191

8 - "Political ecology is a term ... which variously queries the relationships between economics, politics and nature, and combined represents an explicit alternative to "apolitical" ecology, or approaches that typically tend to ignore the influence of political economic forces and institutions, and are often driven by market-orientated "technofixes" (Robbins, P. 2004. *Political Ecology: A critical introduction*. Blackwell).

9 Stone, G. 2004. 'Biotechnology and the Political Ecology of Information in India.' *Human Organisation*, Vol. 63, No.2.

10 Pans - can be defined as 'a near-level shallow, natural depression or basin, usually containing an intermittent lake, pond, or pool'



Photo: Woman hauling bagged cotton in South Africa



11 - Statistics South Africa 2002. *Measuring rural development. Baseline statistics for the integrated, sustainable rural development strategy*. Pretoria. Statistics South Africa.

12 - Dependency ratio is a measure of the portion of a population that is composed of people too young or too old to work and is often used as an indicator of the economic burden of a society. Poor households tend to have higher dependency ratios (Chronic Poverty Report, 2004). In 2003, the South African average was 56%, the KZN average was 63% and the dependency ratio for the study group was 70% (Health Service statistics, 2005).

13 - Gouse, M., Kirsten, J., Shankar, B., Thirtle, C. March 2005. *Bt Cotton in KwaZulu Natal: technological triumph but institutional failure*. www.agbiotechnet.com

14 - ICTSD, 2003, "Elimination of Cotton Subsidies: A Development Deliverable for Cancun", Bridges. Year 7 No. 4 - May 2003

15 - Hofs, J.L. and Kirsten, J. 2001. *Genetically Modified Cotton in South Africa: The Solution for Rural Development?* Working Paper 2001-17, Department of Agricultural Economics, University of Pretoria and CIRAD.

16 - Gouse, M., Kirsten, J. & Jenkins, L. 2002 'Bt Cotton in South Africa: Adoption and the impact on farm incomes amongst small-scale and large-scale farmers', Working Paper 2002-15. Dept of Agricultural Economics, University of Pretoria.



Photo: Picking cotton in South Africa

compared to a 37% national average¹¹ and there are few employment opportunities. The dependency ratio¹² is very high with an average household size of eleven people with eight dependants per household. The average literacy rate is 76% compared to the national figure of 90% but over the age of 47 years it drops drastically to 48% only. The majority (76%)¹³ of farmers are older than 40, implying a high level of functional illiteracy amongst them. The area has a high rate of HIV infection, with an estimated 41% infection rate under pregnant mothers.

Even though agriculture for food and cash crops is important for the survival of rural families and 48% of the population is engaged in field crop farming, few rely on agriculture as their only means of survival. Indeed, only a small number of farmers see the sale of farm products as a main source of income. Other sources of income include various government welfare payments. This differs widely from the majority of small-scale farmers in the rest of Africa.

Since the apartheid years, this area has been a repository of quick fix, high profile development plans to gather political support and showcase government concern for local economic development. None of these projects have managed to address the underlying causes of poverty and underdevelopment in the area.

As the *Table: Makhathini: a repository of*

development interventions shows, this history of intervention and erratic support to farmers in the Makhathini Flats is not typical of South Africa, it being a large development scheme, with an experimental farm and some extension services. Bt cotton was introduced with government and industry support and this made some success possible. Any problems experienced here will be harder to overcome in other areas where there is less support. It is clear, therefore, that initial results from the Makhathini cannot serve as a model for Africa.

What is crucial about the Makhathini Flats is that it is the largest concentration of small-scale cotton farmers in South Africa and this played an important role in the decision to introduce Bt cotton to the area.

Cotton farming in South Africa

The cotton market is notoriously volatile, heavily subsidised, and driven by the US, China and the EU - all subsidising their farmers to the tune of US\$2.3 billion, US\$1.2 billion and US\$700 million a year respectively.¹⁴ The primary problem faced by cotton farmers in South Africa, as in the rest of Africa, is not one of low crop yields due to insect attack but the absence of an equitable price for the cotton they produce. International prices are below the thirty-year average, and 2000/01 saw the lowest cotton prices in 29 years.

Cotton is a relatively minor crop in South Africa and the combined value of lint and seed production is not more than 1% of the total value of agricultural output. Cotton production is dominated by around 300 commercial farmers who grow on average 95% of South Africa's cotton. Small-scale farmers make up the rest with an ever-decreasing share of the market, 4% in 2000/1, an 8% drop from 12% in 1997/98 season.¹⁵ During a good year, about 3500 small scale farmers produce cotton and about 3000 of these farmers farm on the Makhathini Flats and surrounding area (KwaZulu Natal Province) while the remaining farms are in the Tonga area (Mpumalanga Province).

Cotton produced in South Africa is on average 70% under dryland and 30% under irrigation. Between 2000 and 2004, the area under cotton fell by 81% with most of this reduction seen in areas under dryland cotton which fell by 77%. This fall is due to a number of factors, including low cotton prices, a strong Rand, more attractive returns from competing crops such as maize and sunflowers, and the dry conditions experienced



Table: Makhathini: a repository of development interventions

1902	Makhathini floodplain is reserved for state development
1930	Labour in the area is assigned to the sugar industry, through an agreement between the Natal sugar industry and Johannesburg mining houses.
1948	Nationalist government comes to power, needs to create jobs for ex-servicemen and loyal voters, and implements a series of irrigation projects around the country
1974	The Pongolapoort Dam (Jozini Dam) is built, the largest in South Africa, to provide water for white sugarcane farmers. The process is accompanied by severe ecological and social disruption and many local communities lose livelihoods due to the disruption of flood cycles, and the loss of fishing and other natural resources.
1978	Cotton is first introduced in the area by the J. Clark Cotton Company
1984	Floods from the release of dam water destroy crops and local water committees are formed to influence the timing of releases and accommodate community needs.
1980s	The Makhathini (Mjindi) Irrigation Scheme is established as part of the formation of a black homeland in Zululand. 4,500 families are removed from the area and some are resettled onto 10 ha plots. 80% of people allocated land on the scheme are outsiders.
1989	Height of cotton production among small farmers on the Makhathini, with 3,500 ha of cotton under irrigation
1991	Demise of the Department of Development Aid. This was the home department of Mjindi Farming, the parastatal that managed the irrigation scheme from 1984.
mid-1990s	Mjindi Farming changes its role to become a manager of irrigation water.
mid-1990s	Lebombo Spatial Development Initiative is announced, focused on upmarket tourism, agribusiness, and plantation farming.
1998	Genetically engineered Bt cotton is introduced in the Makhathini Flats
1999	Media reports emerge of the 'astounding' yield increases of smallholder cotton farmers in the Makhathini Flats
2000	Severe flooding results in substantial financial losses for farmers.
2001/2002	Makhathini Cotton Company (Pty) Ltd and ginnery is launched in partnership with Danish and local investors as a public-private partnership with a R269 million government investment. The project is targeted by the government as a Black Economic Empowerment initiative, focused on emerging farmers. Makhathini Cotton leases land from farmers for large-scale GM cotton production.
2002	Closure of the cotton ginnery in Pongola. This is followed in 2003 by the withdrawal of Vunisa Cotton and the Land Bank from the area and a withdrawal of their financial support to smallholders.
2003	TJ Buthelezi, chairman of the local Ubongwa Farmers' Union, stands next to Robert Zoellick, US trade representative, to announce that the US were taking the EU to the World Trade Organisation to challenge its stand on genetic engineering.
2003 – 2004	Continued drought, low cotton prices and lack of credit lead to drastically reduced cotton plantings.

Source: Bembridge, T.J. 1991. Farmer characteristics, innovativeness and cotton production at Makhathini Irrigation Scheme, KwaZulu. *Development Southern Africa*, 8(1): Institute of Natural Resources (INR) 2002. 'Proposed Development of an Agricultural Estate on the Makhathini Flats.' Environmental Scoping Report.

during planting time.¹⁶

This decline in cotton production has had an impact on jobs, with mainly seasonal workers losing employment at the rate of one job per hectare of cotton not planted. For example, De Grassi reports on a loss of 58,000 jobs in the cotton sector as a whole between 1998 and 2003.¹⁷

Cotton is planted between September and December, depending on when the first rains fall. As soon as the first shoots develop, farmers spray for cotton aphids (*Aphis gossypii*) and at six to eight weeks they spray for jassids (*Jacobellia fasciallis*). From the time that buds develop, they spray for bollworm and altogether apply five to eight sprayings per season for pests. Harvesting usually takes place between March and June. Weather

17 - De Grassi, A. 2003. *Genetically Modified Crops and Sustainable Poverty Alleviation in Sub-Saharan Africa: An Assessment of Current Evidence*. Third World Network. grain.org/research/?id=99



Table: Annual weather patterns: 1998-2004

Season	Period covered	Weather conditions	Rainfall (mm)
1998	Plant end 1997 Harvest in 1998	Normal	608.9 mm
1999	Plant end 1998 Harvest in 1999	Normal	856.1 mm
2000	Plant end 1999 Harvest in 2000	Flood conditions during February & March 2000	1064.7 mm
2001	Plant end 2000 Harvest in 2001	Flood conditions during November 2000	652.2 mm
2002	Plant end 2001 Harvest in 2002	Drought	277.4. mm
2003	Plant end 2002 Harvest in 2003	Drought	321.4 mm
2004	Plant end 2003 Harvest in 2004	Drought conditions during planting window at end of 2003; rains in late January too late for cotton crop	601.4 mm

The rainfall figures were measured at the Mkuzi Game Reserve weather station and obtained from the Institute of Soil, Climate and Water, Pretoria

conditions are erratic and can fluctuate between droughts and floods.

Who's who in Makhathini?

There have been a number of actors involved in Makhathini, all trying their best to make Bt cotton a success story.

Government

The Department of Agriculture has been behind the introduction of Bt cotton since the beginning in 1997 as part of a public-private partnership. The Land Bank (funded by the national government) has also been heavily involved in providing financial support (R269 million¹⁸) from 2002 onwards. The provincial government has also supported Bt cotton as part of their 'Green Revolution' policy, including mechanisation.¹⁹ So we find that both national and regional governments have injected money into supporting the expansion of Bt cotton in this area. This is a repeat of history of using Makhathini to showcase political ideologies and quick-fix solutions. However, such "solutions" appear to only benefit a handful of people, mostly from outside the community.

Marketing Monsanto

Monsanto's main task, apart from the provision of the Bt technology, has been marketing. Monsanto

has embarked on a promotional campaign in South Africa that targets both small and large-scale farmers, as well as sustaining the necessary pressure on the government. Monsanto promoted Bollgard™ (the Bt cotton) directly to farmers, such as advertising on minibus taxis; and holding farmers' days where farmers receive hats, pens, and pocket-knives. One Monsanto official said that they market Bollgard™ by telling farmers "*the muti is in the seed*", "muti" being the term used for traditional medicine in South Africa. The message being sent out to farmers is that should you use Bollgard, you will be rewarded in multiple ways: better yields and funding to purchase farming equipment. For an impoverished community this is more than enough incentive to use Bollgard.

Monsanto has also been uncomfortably close to the Ubongwa Farmers Association, for example donating in 2001 US\$10,000.²⁰ The Chairperson of this association, Buthelezi, has at times rented out some of his land to Delta & Pine Land and Monsanto for the planting of Bt cotton trials. He and other members of the steering committee have frequently travelled abroad to convince the world at large that Bt cotton has been the answer out of poverty for them.

Makhathini Cotton Company (Pty) Ltd

In 2002, in the middle of this study period, there was a radical change when a new company,



18 - Oricho, G. 2004. Report of the Acting Chief Executive Officer of the Land Bank to the Parliament of South Africa.

19 - Linscott, G 2002. 'Green Revolution gets a R10 million boost.' *The Mercury*, Tuesday May 14, 2002.

20 - Tania Sandberg. *Farmers Weekly*, 17 November 2000

Box: Bt Cotton in Andhra Pradesh - a three year assessment

In 2002, shortly after the start of commercial growing of Bt cotton in Andhra Pradesh, the Deccan Development Society (DDS) and the AP Coalition in Defence of Diversity (APCDD) began their research on Bt Cotton in Andhra Pradesh with a particular focus on the cotton district of Warangal. In their words, "we had no idea what we were walking into". Amongst the hype surrounding Bt cotton as a panacea for farmers and the environment, two scientists Dr Abdul Qayum, and Mr Kiran Sakkhari went about the job of unravelling the agro-socio-economic mystery of Bt cotton.

The scientists selected "a transparent and open methodology", being close to the farmers and gathering information from them on a regular fortnightly basis. Their data collectors were village based grassroots researchers with a deep understanding of agriculture. No other research group on Bt cotton in India had done season-long studies, and a job as thorough as this. Most groups came once a while after hearing of the cotton disaster, collected data at that point of time and went back. No one stayed continuously with farmers and farming communities to record their changing perceptions about Bt cotton. This makes the present study a unique one.

After three years of study, the truth is out. Here is a summary of what Mahyco-Monsanto Bt hybrids have brought to Andhra Pradesh:

- Low yield - Non- Bt has, on an average, surpassed Bt in terms of yield by nearly 8% with 12% less expense.
- No reduction in pesticide use - In reality, the volume of pesticide use by both Bt farmers and Non-Bt farmers was so little that it was untraceable (2% of their total cultivation costs).
- Disastrous losses for farmers - The three year average tells us that the non-Bt farmers earned 60% more than Bt farmers. In place of profit, Bt cotton, especially the Mahyco-Monsanto varieties, brought untold misery to farmers culminating in violent street protests and the burning of seed outlets in the city of Warangal. Farmers tied up Mahyco-Monsanto representatives in their villages and the police had to go and rescue the hapless salesmen.
- Increased cost of cultivation - On average, Bt farmers incurred 12% more costs in cultivating their Bt crops compared to non-Bt cotton farmers.
- Increased spread of disease - Researchers found that a special kind of root rot was being spread by Bt cotton. Farmers came out with complaints that they were not able to grow other crops after Bt because it had infected their soil very badly. As against this, the soil in which the farmers grew non-Bt hybrids was extremely friendly to other crops.

What is most disturbing is that Mahyco-Monsanto continue to insist that yields of Bt cotton in Andhra Pradesh are up. Mahyco-Monsanto commissioned a study to a market research agency, and with its devious manipulation of data claimed that Andhra Pradesh farmers had seen a five-fold increase in yield compared to non-Bt yields. This is direct contradiction to the evidence amassed by DDS and APCDD and shown in farmers' interviews (see below of details of the film).

UPDATE:

Since the publication of the report, the Genetic Engineering Approval Committee (GEAC) has rejected the growing of all three Monsanto varieties of Bt cotton in Andhra Pradesh due to their failure, as described in this box. Furthermore one hybrid Bt cotton (Mech-12 Bt) has been banned throughout South India. The main worry is that old stocks of Bt cotton (estimated to be a minimum of 300,000 bags) will continue to be sold in Andhra Pradesh. Farmers' organisations and NGOs have all called for these stocks to be destroyed

NOTES:

The study Bt Cotton in Andhra Pradesh: a three year assessment provides the data and details on the three year study. To complement the report, an associated film Bt Cotton in AP; a three year fraud, brilliantly captures the mood and feelings of the farmers as they are led up the garden path by the false promises of a ruthless industry. Both these are historic documents in analysing the impact of Bt cotton in India. The first film is also available in French.

To obtain a copy of the report online: <http://www.ddsindia.com> or <http://grain.org/research/?id=302>

To obtain a copy of the film or a copy of the report, please contact:

Deccan Development Society
101, Kishan Residency,
Street No. 5,
Begumpet, Hyderabad - 500 016
Andhra Pradesh,
India

E-mail: hyd1_ddshyd@sancharnet.in
Telephone: +91-40-27764577 or +91-40-27764744

(The text in this box is extracted from the report.)



Field trials and commercial releases of Bt cotton around the world

Argentina	Monsanto's Bt cotton approved in 2001, yet only planted on an estimated 5% of total cotton area in 2002/2003.
Australia	Bt cotton introduced in 1996. Reports are mixed. Initially pesticide use declines dramatically then increases year after year. Farmers do not see economic benefits. Still, by 2002/2003, 30% of total cotton crop is Bt cotton and this increases to 80% in 2004 with the release of Monsanto's Bollgard II variety, which involves less stringent insect resistance management plans.
Brazil	In March 2005, following the adoption of a new biosafety law strengthening its powers, the pro-GM National Technical Biosafety Committee approves the commercial release of Monsanto's Bt cotton.
Burkina Faso	In 2003, Monsanto, Syngenta and Burkina Faso's Institut National de l'Environnement et la recherche Agronomique (INERA) begin field tests of two Bt cotton varieties without the involvement or consent of the national biosafety committee which is tasked with developing a national regulatory regime for GMOs.
China	Bt cotton released in 1997. Currently Bt cotton is planted on over half of the national cotton area. Bt cotton seed costs around 50-60% more than regular seed, but there is a high level of unauthorised use. While Bt cotton has reduced pesticide use, it still remains high and there are problems with secondary pests. In Shandong province, farmers spray 12.7 times per season on Bt cotton. It is also widely assumed that insect resistance will soon be a major problem.
Colombia	Monsanto imports Bt cotton in 2002, without an environmental clearance. Popular legal action results in the suspension of the authorisation.
Costa Rica	Monsanto conducts field trials without regulatory oversight in 1992.
Egypt	Monsanto and Egypt's Agriculture Genetic Engineering Research Institute currently collaborating in field trials of Bt cotton. They claim commercial introduction could take place as early as 2006.
India	In 1998 Monsanto's first field trials of Bt cotton disrupted by farmer protests. Commercial introduction of Bt cotton occurs in 2002. By 2004, Bt cotton accounts for 6% of total cotton area and is only permitted for cultivation in six states. Reports from Andhra Pradesh, one of the country's major centres of cotton production, bring to light the failure of Bt cotton. In May 2005, the Genetic Engineering Approval Committee rejects Monsanto's application to renew its temporary authorisation for the sale of its three Bt cotton varieties in Andhra Pradesh.
Indonesia	Monsanto's Bt cotton commercialised in South Sulawesi province in 2001. However, two years later it is withdrawn after its failure to perform triggers farmer protests. Due to poor harvests, some 70% of the 4,438 farmers growing Bt cotton were unable to repay their credit after the first year of planting.
Kenya	Monsanto imports Bt cotton into Kenya in 2004 for field trials.
Mexico	Bt cotton introduced in 1996. Government subsidises purchase of Bt cotton seeds. In 2002/3, 25% of the national cotton area planted to Bt cotton, slightly less than the percentage in 2000.
Philippines	In January 2005, the Cotton Development Authority signs a memorandum of agreement with the Philippine Rice Research Institute to begin field trials of Bt cotton.
Senegal	National cotton company (SODEFITEX) and Monsanto undertake field trials in the Senegal River Valley without notifying regulatory agencies or informing the local population. SODEFITEX backs away from project after early results show no reduction in pesticide use.
South Africa	Bt cotton approved for commercial planting in 1997. Adoption very rapid and by 2002/3, an estimated 75% of national cotton area planted to GM cotton.. In 2003/4 only 35,700ha of cotton was planted, an 80% reduction since 2000, ascribed to low world prices and droughts. In 2004/5 the area planted was 21,700 ha, an extraordinary 40% drop in area planted to cotton in one year. It is estimated that 60% of GM cotton is Bt cotton and 30% RR cotton. Small-scale farmers. 90% of whom adopted Bt cotton, are in debt with the total debt amongst small-scale cotton farmers in Northern KwaZulu Natal estimated at over US\$ 3 million in 2004.
Thailand	Monsanto imports Bt cotton seeds in 1995 and begins field-testing in 1997. In 1999, farmer's groups monitoring plantings of cotton find samples taken from locations outside Monsanto's approved sites testing positive for the presence of the Bt gene. It is estimated that 8,000 hectares of Bt cotton are being grown illegally. An alliance of 35 farmer groups and NGOs threaten to stage a mass rally unless the government responds to their calls for a stop to the testing and commercial release of genetically engineered crops. The government reacts by setting up such a ban and terminating field trials of Monsanto's Bt cotton.



USA	Around 40% of the cotton area in the US is Bt cotton. Studies show reduction in pesticide use since Bt cotton introduced in 1996, but now secondary pests are becoming an increasing problem.
Vietnam	Although IPM techniques have dramatically reduced the use of pesticides on cotton in Vietnam over the last two decades, Vietnam Cotton Company is pursuing Bt cotton in an effort to expand dry-season irrigated cotton production. Field trials of Bt cotton have taken place.
Zimbabwe	Monsanto planted a Bt cotton crop in 1998 without official permission. Crop was burnt before flowering when uncovered by authorities.

For more information: visit <http://grain.org/go/btcotton>, a resource centre on Bt cotton around the world, providing relevant news, links and documents.

Makhathini Cotton Company (Pty) Ltd appeared on the scene. Makhathini Cotton is a private company that obtained finance from Danish donors and financial support from the government through the Land Bank to build a ginnery and expand the irrigation scheme. As the majority of farmers had debts with the original company Vunisa Cotton (who supplied everything that a cotton farmer needed plus credit), many farmers switched to delivering their cotton to the new Makhathini Cotton gin (a cotton gin separates the cotton from the seed). This meant that few of the loans were recouped and as a result, Vunisa Cotton closed down, leaving Makhathini Cotton with a monopoly in the area. The Land Bank used to operate through Vunisa Cotton and because they could also not recoup monies owed to them, withdrew direct credit support to farmers and instead now supports Makhathini Cotton who collects outstanding debts for them. Makhathini Cotton leases land from the farmers to plant cotton and has plans to hugely expand the area under irrigation, raising questions around water availability and environmental impact on the floodplain. It employs farmers as labourers on their land and put in place a one-channel marketing system that is in control of ginning, credit and irrigation.

Key Findings and Conclusions from the Makhathini Research Project

Here we summarise the key findings of the Makhathini Research Project carried out by Biowatch. An academic-style report with full details of the Makhathini Research Project will be available in late-2005.

Adoption rates were high in the first three years and then dropped dramatically

The initial high rate (90%) of adoption of Bt cotton can be attributed to a number of factors, including the marketing strategies of Monsanto

and Vunisa Cotton as well as political pressure from farmers' leaders. Another factor that played a role in farmers' adoption of Bt cotton is simply that their choices of cotton varieties have been very limited. The seed distributors offered twelve varieties countrywide in 2001 yet in 2003, only four varieties, three of them GM.

The total area planted by the interviewed farmers declined from 276 ha in 2000/01 to 193 ha in 2001/02 and 180 ha in 2002/03. In total 66% of the farmers reduced the area planted to, or completely stopped planting, cotton. By the end of 2003, very few farmers planted cotton, with most farmers pointing to the successive drought and lack of credit as the reason. The price of cotton also plays a role in farmers' decisions with the price recently dropping to a very low 50 US cents per kilogram. In 2004, only 700 farmers delivered cotton at the Makhathini Cotton ginnery - down from a total of 3,000 farmers planting cotton in 2000, equivalent to an 80% drop in farmers growing Bt cotton (see *Graph: Reducing Bt cotton production* for an example of how farmers are stopping to grow cotton).

Farmers have accumulated massive debts and the community and government is subsidising cotton production

During the first interviews held in 2001, farmers were generally positive about the income derived from Bt cotton, even though most of them lost their crops in the 2000 floods, as they felt that during the previous years there were good incomes from Bt cotton. During the second set of interviews in 2003, farmers were asked more detailed questions about cost and income from Bt cotton but also about other sources of income as well as what the situation was with their loan repayments to their creditors.

In the final analysis of income, only four farmers of the total sample of 36 farmers made a profit. The



total loss of these 36 farmers came to US\$ 83,348. The study found that most of the farmers had accumulated a massive debt. In a 2004 interview, a Land Bank official said that the debt figure for the whole area totalled just over US\$ 3 million owed by 2,390 farmers, an average of US\$ 1,322 per farmer. Around 80% of farmers have defaulted on their loans.

Cotton production in the area is dependent on a system of credit. Until the mid-1990s a strong welfare development approach prevailed in the area and there is a history of soft loans.²¹ Vunisa Cotton was acting as an agent for the Land Bank and introduced different systems for dealing with the repayment of loans and the approval of new applications.

These small-scale cotton farmers have always been dependent on a credit system, but the introduction of Bt cotton has increased their exposure and risk, as it is more expensive to buy. Because of the aggressive marketing campaign there was a high level of adoption, so many more farmers are in debt than might have been the case otherwise.

Low cotton prices have had a devastating effect in all of Africa. Farmers started planting Bt cotton when the prices had been better. One farmer said: *"When the prices drop you can't leave the crop at home, you can't eat it, you can't feed it to the chickens. You are forced to sell it for whatever small price you can get. Farmers do not have the power to influence markets"*. Another farmer commented: *"Four years*

ago we were told we would make lots of money but we work harder and make nothing".

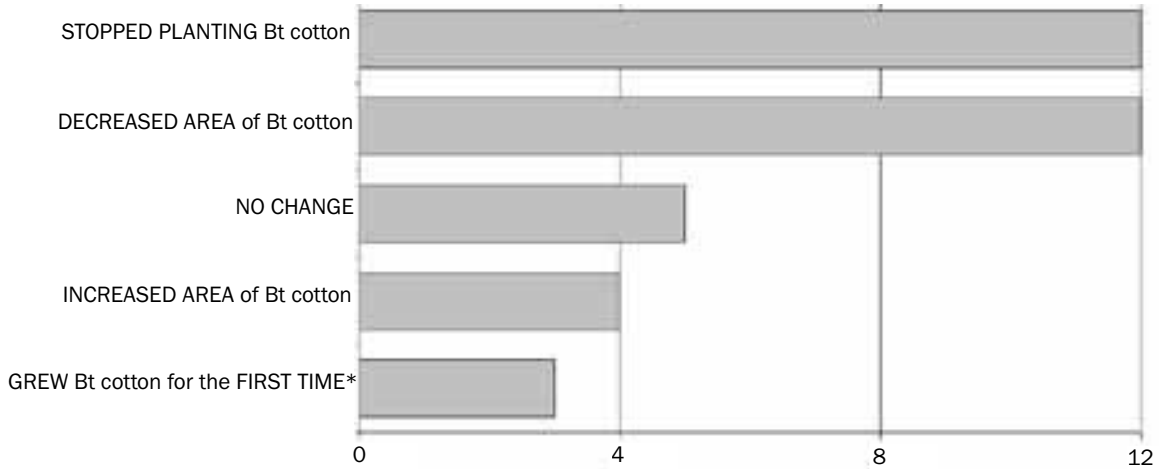
The introduction of the expensive Bt cottonseed occurred at the same time as a depression in world cotton prices, a strengthening Rand and subsequent droughts, cutting margins for farmers and making it unprofitable to grow cotton. (See *Table: Annual weather patterns: 1998-2004* on page 18)

Once access to credit dried up, farmers that continued with cotton production started using other family resources to finance their production costs, such as the salaries of their spouses. Others, that had borrowed money from family and neighbours, are now concerned as to how they will pay it back. Some farmers said their poor cotton harvests negatively affected their status in the community, which had an impact on family members and affected their family relationships. Non-farm income also included child grants, disability grants and pensions. In other words, welfare grants from the State aimed at supporting the community and alleviating poverty, as well as family income is used to subsidise cotton growing in the area. If farmers substitute credit with non-farm income and the burden of debt thus shifts to the community, it must have major implications for their socio-economic status, in terms of access to health care, schooling, and nutrition for example.



Graph: Reducing Bt cotton production

Adoption Rates of Bt cotton for 36 farmers between 2000 – 2003



* adopted since 2000-2001 season

number of farmers

Farmers planting Bt cotton still use pesticides.

In contrast with reports from China, the savings in pesticide use have not been high in Makhathini, mainly because farmers originally "underused" pesticides anyway.²² Small-scale farmers in South Africa have to deal with a range of pests and they use broad-spectrum pesticides to control this. All the farmers still have to spray for secondary pests such as aphids and jassids (sometimes known as leafhoppers), which would otherwise reduce yields. Since 2000 new insect pests appeared and especially stink bugs have caused extensive damage.²³ This correlates with reports from the US and China where the stink bug has also emerged as a major new pest. All Bt crops must be grown amongst non-GM varieties within refuges to avoid insect resistance to Bt building up. However, as these farmers do not plant refuges, it is expected that insect resistance will build up quickly, forcing them to go back to the old spraying patterns, erasing any environmental benefit gained.

Bt cotton does not address farmers needs and constraints

Underlying the persistent poverty in this region is a history of dispossession and discrimination. Farmers' key constraints are lack of markets and infrastructure, and lack of cash, making high input investments at the beginning of the season, such as GM seeds, an enormous financial risk. Erratic weather patterns resulting in either droughts or floods also cause problems. The first adopters of Bt cotton were the farmers that were most able to weather such risks and overcome constraints: older farmers with additional non-farm income, more livestock and larger farms, in other words, the better-off farmers with access to credit. Another constraint for farmers is insecure land tenure as most farmers have access to tribal land only.

Bt cotton has benefited better-off farmers and businessmen at the expense of the poor.

It is no surprise that there has been political tension in this area over the years, with such a history of displacement, political favouritism and resource disputes. Bt cotton has contributed to the conflict in the area by favouring better-off farmers and in particular strengthening the political power of the Ubongwa Farmer's Association. This power was used to lobby for the earlier release of the water in the Pongolapoort Dam to favour cotton farmers, a practice that is not in the interest of the area's women farmers who grow food crops.

A further concentration of power took place with the introduction of the Makhathini Cotton Company Project. This project is in line with government's policy of agricultural reform that favours better-off, 'entrepreneurial' farmers, mechanisation and consolidation of land. Government funding now flows to a single company that leases land from the farmers to plant GM cotton on a large scale. Makhathini cotton also negotiated a deal with the Nyawo Tribal Trust to whom the land belongs, to lease the land in exchange for a 10% profit. Farmers are becoming further removed from their land and knowledge and do not participate in the farming operations but apparently they can choose to be 'employed' in their own fields to do menial tasks, such as weeding.

GM cotton would therefore appear to perpetuate the injustices of the past and exacerbate the inequities in land access and ownership.

There is little support for farmers and no implementation of biosafety practices.

There is an utter lack of awareness amongst the farmers of GM cotton and its implications. Bt cottonseed is more expensive than other cotton because of the license fee payable to Monsanto. Every grower must sign a Monsanto Technology Agreement, called a "certificate" by the small-scale farmers, agreeing not to save or exchange seed or ratoon²⁴ any Bt cotton and to plant a refuge. During the 2001 survey, only one farmer understood the contents of the contract. Of the 36 farmers surveyed in 2003, only 6 indicated that they understood the contracts or knew about refuges. Monsanto clearly did not consider the high illiteracy rate amongst their small farmer clients nor the dominant language spoken by them (Zulu).

Farmers in the area get little support, and rely on seed and chemical sales people for information. There is no monitoring of insect resistance nor has any environmental impact assessment been done in the area. Officially the KwaZulu Department of Agriculture is doing extension work in the area. However, when farmers were asked where they get advice from, none mentioned government extension services while a number said that they had no advice at all. Most of the respondents indicated that they get advice from Vunisa (which was still operating at the time), Monsanto or Delta & Pineland. Buthelezi, from the Ubongwa Farmers Union, was also singled out as an advisor.

21 - Soft loans are loans from government - they are easily written off as part of the welfare approach that used to prevail in the area. Farmers also know they can delay payment. This has now changed and instead of obtaining credit from government, they use family income to finance cotton farming.

22 - Shankar, B and Thirtle, C. 2003. *Pesticide overuse and Bt cotton - evidence from South Africa*. Paper presented at the 7th ICABR Conference, Ravello, Italy.

23 - Hofs, J. & Kirsten, J. 2002. *Genetically modified cotton in South Africa: the solution for rural development*. CIRAD/ University of Pretoria Working Paper, University of Pretoria

24 - Ratoon: When cotton is cut, and allowed to re-grow the next year.



Conclusion

Bt cotton has not been the answer to the problems of the Makhathini farmers and has proved to be unsustainable. Their problems are highly complex and they cannot be resolved by quick techno-fixes. In the specific context of Makhathini, we find that GM technologies had some initial success, but in the end proved to be too risky for small farmers, leaving them demoralised, in debt, and ultimately poorer. It has led to a concentration of power in the hands of fewer companies, contributing to greater control by these corporations. It has also encouraged the concentration of farms, the deskilling of farmers and will inevitably lead to their displacement from the land.

GM crops should not have been introduced before a serious assessment of the needs of small farmers

in South Africa took place, with an in-depth look at the country's agricultural, food, and rural development policies and in particular, how they benefit the poor. Ironically, both government and industry promote this technology as the fix for poor farmers - a technology that has been developed for industrial agriculture.

Yet the results are clear - Bt cotton has failed the Makhathini farmers. And from this, it is clear that Bt cotton and many other GM crops will fail the majority of farmers throughout Africa. In Africa, small-scale farmers should be able to make choices that empower them and provide them with opportunities that will ensure food security and sustainable livelihoods, not dependency and debt. 2



Elfrieda Pschorn-Strauss

This paper has been written by Elfrieda Pschorn-Strauss, a researcher with Biowatch South Africa. The research has been done with the assistance of Lawrence Mkhaliphi, Charles Louw, Wendy Forse and Gwendolyn Wellmann.

Elfrieda Pschorn Strauss first became involved in the environmental NGO sector almost 15 years ago. In 1999 she set up the Biowatch South Africa office and has worked in research and advocacy for Biowatch until January 2005 when she joined GRAIN as the Anglophone Africa Programme Officer. This is a new position, and she will focus on agricultural research and information support to promote autonomy amongst small-scale farmers and local communities in Africa.

