

Failed promises

the rise and fall of
GM cotton in India

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Executive Summary

GM cotton and dancing girls

- This report explores the astronomical rise and catastrophic fall of GM cotton in India - the world's largest producer and second biggest exporter of cotton. Supporters of Genetically Modified (GM) crops claim they will solve a range of problems – feeding the world, eradicating poverty in developing countries, and increasing crop yields. In reality, the technology has consistently failed to deliver on these promises, and instead some of the poorest people in the world have paid a heavy price for the industry's hype.
- GM cotton was first introduced to India in 2002 by Mahyco Monsanto Biotech (India) Ltd, backed by an aggressive advertising campaign involving everything from dancing girls to celebrity endorsement. The technology soon became the dominant force in Indian cotton production, and today, about 90% of India's cotton area of 11.8 million hectares is GM.

The pink bollworm strikes back

- GM (Bt) cotton was claimed to be resistant to the most common pest of cotton in India, the pink bollworm. Nature abhors a vacuum, and when one pest is eradicated another is likely to take its place. While the GM technology was successfully keeping pink bollworm numbers at bay, other insects stepped into the gap, and the crops were attacked by pests like whitefly, jassid and thrips, requiring additional pesticide applications. In Punjab in 2015, whitefly destroyed two-thirds of the cotton crop, causing an estimated loss of \$629 million and leading to the suicide of 15 farmers.
- In 2006, just four years after Monsanto released its first-generation GM cotton, the pink bollworm had become resistant to it in Western India. Monsanto then released a more expensive, second generation Bt cotton, but within a few years, the pink bollworm had developed resistance to it too.
- Rapid development of resistance occurs because Bt cotton plants are engineered to continuously release toxins, and this constant, long term exposure encourages the survival of any pests that are genetically resistant to the toxin. As a result, insecticide use has increased in recent years, from a reported 0.5 kg per hectare in 2006 up to 1.20 kg per hectare in 2015.

GM cotton fails and farmers die

- In 2014, 80% of the cotton crop failed in the 150,000 acres of the Raichur district. Farmers incurred massive losses of over \$4 million.
- The Cotton Advisory Board of India has found a threefold increase in the cost of growing cotton, due to the high price of Bt seeds, and other input costs such as fertilisers and the pesticides needed to deal with the serious pest problems.
- Pro-GM advocates claim Bt cotton has increased yields, but most of the recent yield increases in India happened between 2002-5 when Bt comprised only 0.4-5.6% of India's cotton. From 2008 to 2012 as Bt cotton production rose from 67% to 92%, yields steadily dropped.
- A 2015 study led by a scientist from the University of California - Berkeley, found that annual suicide rates in rain-fed areas of India are directly related to increases in Bt cotton adoption. The study found that four of the seven factors that influence suicides are driven by the GM industry.
- In the Vidarbha region of Maharashtra province, factors linked to the cultivation of Bt cotton are reported to have led to 7,992 farmer suicides between 2006 and 2011.
- The chairman of a mission working to stop farmer suicides said: 'The downtrend started in 2006 when Bt cotton was introduced.... It led to massive economic losses, from which they [farmers] never came up. Subsequently, mounting debts and distress took their toll... Multinational companies showed them big dreams about crops like Bt cotton and ruined their lives completely'.
- One of the ministers responsible for the introduction of Bt cotton into India, former cabinet secretary TSR Subramanian, recently expressed his regret for the decision: 'In the 1990s, I introduced GM cotton in India. Twenty years later, I regret...I am responsible for suicide of thousands of cotton farmers'.

The beginning of the end for GM cotton?

- By 2012 non-GM and organic farmers faced huge problems as supplies of non-GM, and particularly organic seed became scarcer. GM was then considered one of the biggest threats to the future of sustainable organic cotton in the country and elsewhere. All that has now changed – the 2016-17 cotton season saw a drop in Indian Bt cotton sales of about 15%.
- In Andhra Pradesh, the government planned to reduce Bt cotton cultivation in 2016-17 from 670,000 hectares to 450,000 hectares following the 2016 devastation by pink bollworm, in addition to suggesting alternative crops for farmers to cultivate such as millet and pulses. In Punjab and Haryana, the cotton growing area has declined by 27% as farmers move away from cotton following last season's whitefly devastation. In Uttar Pradesh it has dropped by 19% for the same reasons.
- Overall, the area planted with Monsanto's seeds has declined by roughly 10 percent either because farmers have switched to desi (local strains of) cotton or have moved away from growing cotton altogether. As the Times of India reports, 'At one time Bt seeds were available at a premium... Now traders are offering them at a discount'.
- Farmers report comparable yields of desi cotton, at nearly half the input costs compared to Bt cotton.

Executive Summary Continued

GM cotton – in a mess worldwide A non-GM and organic future

- GM cotton has caused problems world-wide. Between 2011 and 2016 Burkina Faso lost \$82.4 million, and as a result, implemented a complete phase out of GM cotton for the 2017/18 season. Early indications suggest the phase out has been a success, with cotton output predicted to rise by 20% in the 2017/18 season. The introduction of GM into Nigeria was rejected by more than a hundred groups representing over 5 million Nigerians, on environmental and health grounds, and heeding the experiences of their near neighbour Burkina Faso. India's neighbour Pakistan, where 86% of the cotton crop is GM, has also been badly hit by the cotton crisis, with a 27.8% decline in cotton production during 2015.
- In the USA – Monsanto's home territory – the cotton bollworm is leading an assault on Bt cotton across the cotton growing belt from the Carolinas to Texas. Due to increasing problems with pest resistance, Southern states are facing another year of large pest populations. In Texas, some bollworm populations are resistant to both the original Bt cotton and its replacement.
- In India, organic cotton production is in a good position - before GM ran into difficulties organic cotton yields were just 14% lower than GM cotton, and the associated costs of organic were 38% lower, which puts organic at least on a par with conventional cotton in terms of profitability. India is the world's largest producer of organic cotton – responsible for around 70% of organic cotton worldwide.
- The organic market has been growing for several years and reached \$15.7 billion in 2015. Brands across the world are adding organic cotton to their portfolio, and top companies already using organic cotton are expanding its share within their overall fibre purchasing.
- To allow farmers to continue to switch from the failing GM technology, consumers need to buy organic cotton products and ask their favourite brands and retailers to stock them, and brands need to include or increase organic cotton in their sourcing portfolio.



Introduction

Genetically Modified (GM) crops have long been claimed by supporters of the biotechnology industry as the answer to a range of issues – feeding the world, eradicating poverty in developing countries, and increasing crop yields. Yet, in reality, the technology has consistently failed to deliver on these promises, and instead some of the poorest people in the world have paid the price for the industry's hype.

This report explores the astronomical rise and catastrophic fall of GM cotton in India which is the world's largest producer and second biggest exporter of cotton¹.

Backed by an aggressive advertising campaign involving everything from dancing girls to celebrity endorsement, Bt cotton became the dominant force in Indian cotton production.

Today about **90%** of India's cotton area of **11.8 million** hectares is **GM**

GM in India

GM cotton was first introduced to India in 2002 by Mahyco Monsanto Biotech (India) Ltd which is a joint venture between Mahyco Seeds and Monsanto India. The company sub-licences the GM technology to 49 Indian seed firms². Backed by an aggressive advertising campaign involving everything from dancing girls to celebrity endorsement, Bt cotton became the dominant force in Indian cotton production³. About 90% of the India's cotton area of 11.8 million hectares is GM⁴.

Such market domination became a big threat to the non-GM and organic cotton seed market, making it harder and harder for farmers to source local varieties of non-GM seed, thus cutting their choices and threatening seed sovereignty in the country.

In 2012, Textile Exchange – a global non-profit organization that works to make the textile industry more sustainable - put out a call to action and established a multi-stakeholder roundtable to try to address the problems faced by farmers as supply of non-GM, and particularly organic seed became scarcer. At that time GM was considered one of the biggest threats to the future of sustainable organic cotton in the country and elsewhere.

However, just five years later, the story is very different. As this report demonstrates, the tide has turned on GM, the false promises from the industry are proving to be a disaster for Indian farmers and GM looks set to all but disappear from the country, almost as quickly as it arrived.



What is GM cotton?

Developed by Monsanto, genetically modified cotton, often referred to as Bt cotton, is created by inserting one or more genes from strains of the bacterium *Bacillus thuringiensis* (Bt) into a cotton plant. Bt produces toxins which act as an insecticide⁵. Essentially, rather than using insecticide sprays, the plants themselves become the insecticide, as they are engineered to produce toxins in every part of the plant to defend against insect attacks. In the United States, Bt cotton plants are themselves registered as pesticides⁶.

The concept of Bt producing plants is certainly innovative, but unfortunately it fails to deliver in the long term and when applied in the real world. There are a number of reasons, based on the fundamentals of sound ecological science which both predict and account for many of the problems with GM cotton which have now emerged, with often tragic consequences. Some of these are highlighted in this paper.

The first cracks – pest resistance

In 2006, just four years⁷ after Monsanto released its first-generation GM cotton - Bolgard I - the main pest it was designed to combat (pink bollworm), had become resistant to it in four states of Western India⁸. Monsanto's response was to release the more expensive⁹ Bolgard II- a second generation Bt cotton which contained two, rather than one engineered trait, but within a few years, the pink bollworm had developed resistance to this too¹⁰. The addition of multiple genes to address the problem of resistance is flawed, as predicted and demonstrated by laboratory experiments which predicted that evolution of pest resistance would be rapid¹¹.

A key reason for the rapid development of resistance appears to lie with the fact that Bt cotton plants are engineered to continuously release toxins. Constant, long term exposure encourages the survival of any pests that are genetically resistant to the toxin. As stated in a report from the Union of Concerned Scientists, "over many generations, the proportion of resistant individuals in pest populations can increase, reducing the efficacy of the Bt. toxin as a pesticide."¹²¹³

As resistance begins to develop, farmers cannot rely on Bt cotton alone and need to also apply conventional pesticides to help protect their crops. Insecticide use on cotton has crept up in recent years, from a reported 0.5 kg per hectare in 2006 up to 1.20kg per hectare in 2015¹⁴.

Resistance can be slowed down if 'refugia' (areas planted with non-GM crops) are planted, but with rising costs and lower yields, the pressure on farmers to use all available land for cultivation is immense, so in practice, this rarely happens.

In early 2016 the Karnataka-based farmer's organisation KRRS held a State-level conference to put pressure on the State government to compel seed companies to pay compensation for the loss of the Bt cotton crop in the pink bollworm pest attack in several parts of the state¹⁵. A report by the non-profit Akshara Krishi Foundation found that in one area – 150,000 acres in the Raichur district, 80% of the crop had failed. The farmers incurred massive losses of 278.72 crore (278,720,000 rupees = 4,158,856 USD) as a result of the crop failure¹⁶¹⁷.

Criticisms have been levelled at the government and some research institutions for appearing to downplay the losses, with claims that "agriculture scientists were out to safeguard the interests of corporates in the farm sector"¹⁸.

Ironically, pink bollworm had a negligible population before Bt cotton was developed, but is now the main cause of the vast amount of damage¹⁹.

In order to prevent the pink bollworm infestation continuing into next season, not only have farmers destroyed affected Bt crops, but the Department of Agriculture has also stepped in to sanitise infected fields²⁰.

Farmers have registered complaints against seed companies and called for criminal cases to be launched and an inquiry initiated. Pamphlets and seed packets from the seed companies claimed that crops would be protected from American, spotted and pink bollworms and also from spodoptera and semi-loopers throughout their lifespan, but clearly the companies failed to live up to their promises²¹.

An area of 150,000 acres in the Raichur district had 80% crop failure

More problems - secondary pests

Nature abhors a vacuum. In reality this means that when one pest is eradicated, another pest is often ready to take its place – this is known as pest replacement²². When the GM technology was still working and successfully reducing pink bollworm numbers, other insects stepped into the gap. The crops were attacked instead by pests like whitefly, jassid and thrips. These require pesticide applications to control them, such as imidacloprid – a chemical from the controversial neonicotinoid family of pesticides which have been linked with the significant decline of pollinator species, pollution of waterways and wild areas, and the death of birds and mammals²³.

Genetic modification also makes Bt cotton more susceptible to secondary pests because modified plants contain reduced levels of induced terpenoids which is the chemical that helps the plant resist other pests²⁴.

Whitefly has been a particular problem, and has led to a sharp increase in pesticide applications, crop devastation and farmer suicides in some areas such as Punjab and Haryana²⁵. In fact, in Punjab in 2015, whitefly destroyed two-thirds of the cotton crop, causing an estimated loss of Rs 4,200 crore (629 million US dollars) and leading to the suicide of 15 farmers²⁶.



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Regional refusals

Following the significant problems with pest attacks, thousands of farmers are turning their backs on Bt cotton.

In Punjab, Haryana and northern Rajasthan – areas devastated by whitefly in 2015 – many farmers have shunned Bt cotton and either stopped growing cotton altogether or have turned to 'Desi' cotton – varieties indigenous to India which are less susceptible to whitefly²⁷.

In Andhra Pradesh, the government planned to reduce Bt cotton cultivation in 2016-17 from 670,000 hectares to 450,000 hectares following the previous year's devastation by pink bollworm, in addition to suggesting alternative crops for farmers to cultivate such as millet and pulses²⁸.

In Punjab and Haryana, the cotton growing area has declined by 27% as farmers move away from cotton following last season's whitefly devastation. In Uttar Pradesh it has dropped by 19% for the same reasons²⁹.



Bt cotton problems around the world

GM cotton has been grown in several African countries – namely South Africa, Burkina Faso and Sudan, and trials have taken place in several others³⁰. After initial glowing reports of success, within a few seasons problems began to emerge including yield reductions, pest resistance and shorter fibre lengths. In fact, a report by a senior researcher from the African Centre for Biodiversity stated, "Scrutiny of actual experiences reveals a tragic tale of crippling debt, appalling market prices and a technology prone to failure in the absence of very specific and onerous management techniques, which are not suited to smallholder production."³¹

The quality problems experienced in Burkina Faso – Africa's biggest cotton grower – are an example of the inherent risks with GM. The technology is based on the assumption that one gene has one expression, in other words that specific genes have a specific function, when in fact genes can have multiple functions (known as pleiotropy) and can interact with one another in ways that are often unknown and unpredictable.

In Burkina Faso, Bt genes were inserted into the local Burkinabè cotton, which was famous for its excellent quality³². However, the pleiotropic effect of inserting the Bt genes meant that as well as conferring resistance to pests, the quality of the cotton was also affected. Four years after its introduction, over two thirds of the cotton crop was classified as lower quality and the ginning ratio (which is the ratio of the actual cotton fibre to the weight of the raw cotton which comes in from the field) was well below the 42% of non-GMO varieties³³. This has had an impact not only on the livelihoods of smallholder farmers in Burkina Faso, but has also compromised the international reputation of the Burkinabè cotton³⁴. Between 2011 and 2016 the sector had losses of around 48.3 billion CFA francs (\$82.4 million)³⁵. As a result, a complete phase out of GM cotton in Burkina Faso was implemented in time for the 2017/18 season³⁶. Early indications suggest the phase out has been a success, with cotton output predicted to rise by 20% in the 2017/18 season³⁷.

The Burkina Faso experience has acted as a warning to other African countries where Monsanto is trying to gain a foothold. Recently,

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the proposed introduction of GM into Nigeria was rejected by more than a hundred groups representing over 5 million Nigerians, on environmental and health grounds, and heeding the experiences of their near neighbour Burkina Faso³⁸.

India's neighbour Pakistan, 86% of whose cotton crop is GM³⁹, has also been badly hit by the cotton crisis. The country's economy is heavily reliant on agriculture, but the 27.8% decline in cotton production during 2015 was a heavy contributor to the failure of the Pakistan economy to meet financial growth targets for 2015-16⁴⁰. Whilst there were several reasons for the poor 2016-17 harvest, pest attacks from bollworm were a key factor which led to the worst harvest in 17 years, and a consequent tripling of cotton imports for the world's fourth largest cotton producer⁴¹. In one province – Punjab – over 60% of the cotton crop was damaged by bollworm⁴². The introduction of Bt cotton to Pakistan did not lead to the promised increase in yields. Although official figures do not immediately reflect this because the measure used to determine output was changed in 2011. Output is measured in bales, a bale used to be 176kg but is now 150kg⁴³.

In the USA – Monsanto's home territory – the cotton bollworm is leading an assault on Bt cotton across the cotton growing belt from the Carolinas to Texas. Due to increasing problems with pest resistance, southern states are facing another year of large cotton pest populations. In Texas, some bollworm populations are resistant to both the original Bt cotton and its replacement which farmers are dealing with through largescale applications of pesticides^{44,45}.



Bt cotton wasn't designed to directly increase yields, but rather to control bollworm and reduce the need for insecticides needed to control bollworm – both of which it has failed to do

Increasing costs for farmers

Figures from the Cotton Advisory Board of India show a marked increase in the cost of growing cotton. The inflated price of Bt seeds, and other input costs such as fertilisers and the pesticides needed to deal with the serious pest problems, has led to a threefold increase in costs over the last decade⁴⁶.

Farmers must buy new Bt cotton seeds every year – they cannot be saved from the previous harvest. As prices have risen uncontrollably, and crops harvests have failed, this has led to a dire situation for many farmers⁴⁷.

From March 2016, the Indian central government began controlling the prices of cotton seed – capping both the prices and royalties, which was a major blow to Mahyco Monsanto⁴⁸. The central government argued that royalties charged for the GM technology must come down because the effectiveness of the Bt cotton in resisting pest attacks has declined⁴⁹. Monsanto tried to challenge the government's decision in the courts, but failed. The government's decision has outraged Monsanto, which is likely to lose tens of millions of dollars of revenue as a result. Monsanto has subsequently withdrawn an application for its latest variety of GM cotton and at one point threatened to pull out of India altogether^{50,51}. The 2016-17 cotton season saw a drop in Indian Bt cotton sales of about 15%⁵².

Yields

The introduction of Bt cotton into India had been touted by many as the reason for an upsurge in cotton harvest yields. However, this is a significant oversimplification of the real story. As Dr. Keshav Kranthi, former director of India's Central Institute for Cotton Research put it,

"While there is a general perception that Bt cotton technology was singularly responsible for the dramatic improvement of cotton fortunes in India, it is pertinent to examine other probable factors that may have contributed to the higher yields..."⁵³

When Bt cotton was first introduced, new non-GM hybrid seeds, pesticides, and irrigation systems were also growing in popularity and played an important role in increasing production and productivity.



In fact, a closer look at the statistics, taken by Glenn Davis Stone (Professor of Anthropology and Environmental Studies at Washington University in Missouri, U.S.), revealed that, "Most of the yield increase happened between 2002-5 when Bt comprised between 0.4-5.6% of India's cotton", and in fact between 2008 and 2012 as Bt cotton production rose from 67% to 92%, yields steadily dropped⁵⁴.

A recent scientific study pointed out that many econometric analyses of yield tend to disregard underlying agro-ecological principles of yield formation and the underpinning ecology of the system. Variety improvements, fertilizer, rainfall, pesticide use, planting densities etc. all have large effects on yield, independent of Bt technology, which isn't actually a yield enhancing technology after all, but rather is intended to protect yield potential.⁵⁵ In other words, Bt cotton wasn't designed to directly increase yields, but rather to control bollworm and reduce the need for insecticides needed to control bollworm – both of which it has failed to do⁵⁶.



The Indian regulatory body responsible for regulating biotechnology in India - the Genetic Engineering Appraisal Committee (GEAC) – has come under fire after it came to light that several GEAC officials are also associated with global organisations that lobby for GM crops. This is significant because it is GEAC's job to decide whether GM crops can be commercialised in the country⁷⁵.

The Indian parliamentary report on cultivation of genetically modified food crops also heavily criticised government regulatory bodies for failing to protect the interests of the public and farmers. They highlighted the grossly inadequate regulatory mechanism for assessment and approval of GM crops, the conflict of interest of various stakeholders involved in the regulatory mechanism and the lack of monitoring and surveillance of GM crops once commercialised^{76,77}.

Regulatory bias?

Suicides

Indian cotton production has been strongly associated with large numbers of farmer suicides, mainly due to indebtedness. In the past, this link has proved controversial, but more recent evidence has confirmed the link beyond doubt.

In 2012, an expert committee of the Indian Parliament carried out an investigation into GM crops. Their subsequent report noted that farmers in the Vidarbha region of Maharashtra province had initially cultivated Bt cotton on a large scale due to the promise of high yields and pest resistance. However, small and marginal farmers soon felt losses due to high input costs and the development of resistance to pests. At the same time, local traditional cotton varieties were wiped out. The report found that these factors, combined with indebtedness caused 7,992 farmer suicides in the region between 2006 and 2011⁵⁷. In more general terms, the final report stated, "...the Committee are more than convinced that there are better options available for increasing food production and productivity than transgenics [GM] technology..."



A study from the University of California - Berkeley found that suicide rates in rain-fed areas of India are directly related to increases in Bt cotton adoption

A 2015 study led by a scientist from the University of California - Berkeley, found that annual suicide rates in rain-fed areas of India are directly related to increases in Bt cotton adoption. The study found that economic distress can be a proximal cause of suicide and identified seven factors that influence this, four of which are driven by the GM industry⁵⁸. Another recent study showed that Bt cotton farmers often have a significantly higher average debt exposure than those adopting organic methods. This is particularly the case for resource poor and small scale farmers⁵⁹.

The Maharashtra government has stepped in and started to distribute indigenous 'desi' cotton varieties in the suicide prone region in order to promote a positive alternative to Bt cotton – one which is less reliant on pesticides, better adapted to local conditions, and which isn't associated with the pest resistance problems of Bt cotton⁶⁰.

The chairman of the Vasant Naik Sethi Swalamban Mission, which is working to stop farmer suicides, said: "The downtrend started in 2006 when Bt cotton was introduced.... It led to massive economic losses, from which they [farmers] never came up. Subsequently, mounting debts and distress took their toll... Multinational companies showed them big dreams about crops like Bt cotton and ruined their lives completely"⁶¹.

One of the ministers responsible for the introduction of Bt cotton into India, former cabinet secretary TSR Subramanian, recently expressed his regret for the decision. "In 1990s, I introduced GM cotton in India. Twenty years later, I regret...I am responsible for suicide of thousands of cotton farmers"⁶².

The future

The Indian government has actively begun promoting home-grown 'desi' seeds as a positive alternative to Bt cotton. In 2016, official estimates from the Central Institute of Cotton Research indicated that 72,280 hectares in northern India had been planted with desi cotton, compared to just 3,000 the previous year.⁶³ Already, the area planted with Monsanto's seeds has declined by roughly 10 percent either because farmers have switched to desi cotton or have moved away from growing cotton altogether⁶⁴. As the Times of India reports, "At one time Bt seeds were available at a premium... Now traders are offering them at a discount"⁶⁵.

Initial reports about the switch are encouraging. In trials, farmers reported comparable yields at nearly half the input costs compared to Bt cotton⁶⁶. One advantage of using local varieties is that the seeds may be saved by the farmers, who then don't have to buy more each year, as is the case with Bt cotton.

In Punjab and Haryana, which produce about 15% of India's cotton and which suffered devastating pest attacks and resultant farmer suicides in the 2015-16 season, a joint committee was appointed to investigate the causes and suggest remedies. A key recommendation has been to switch to traditional cotton varieties. The government expect to replace 15-20% of the area under Bt cotton with traditional varieties in the 2016-17 season, and 50% in the next few years as traditional varieties become more widely available with growing demand⁶⁷.

Organic farmers have known the benefits of using local varieties for years. A long-term study which was produced even before GM cotton ran into difficulty, found that organic cotton yields were just 14% lower than GM cotton, and that associated costs of organic were 38% lower which puts organic at least on a par with conventional cotton in terms of profitability. The situation is even better for organic farmers when the bigger picture is considered too. Income from organic farming tends to be much more stable because organic farmers grow a variety of crops which can provide food and an additional source of income⁶⁸.

An Indian farmers' union Bharatiya Kisan Sangh (BKS) which represents over 2 million farmers is also pushing for a move away from GM towards

A long term study found that organic cotton is at least on a par with conventional cotton in terms of profitability

sustainable and organic production. It has been reaching out to scientists as part of its strategy, and is in good company. The International Assessment of Agricultural Science & Technology for Development (IAASTD) report produced by over 400 of the world's best scientists over a three-year period, and ratified by 60 countries, has indicated that GMOs are no solution to the agricultural challenges facing the world. The BKS secretary Dinesh Kulkarni described the so-called inevitability of GM adoption for food security as 'false propaganda' by GM lobby groups⁶⁹.



Photo: Joerg Boethling provided by Remei AG

Organic future

Despite the grave threat and huge pressure placed on Indian cotton by the dominance of GM, the non-GM, and particularly organic cotton market has weathered the storm. India is the world's largest producer of organic cotton – responsible for around 70% of organic cotton worldwide⁷⁰. The outlook for organic cotton in India is extremely positive, underpinned by a range of small and large initiatives and investments across the country. These include projects to improve the availability of good quality organic seed, such as the Green Cotton Project in Madhya Pradesh, Chetna's Seed Guardians Program in Odisha and the Organic and Fair Cotton Secretariat (OFCS) seed trials, as well as the Government's strategy for a 'cluster' approach to chemical-free zones⁷¹.

Organic cotton offers the chance to turn around the story of cotton in India, and build a realistic and positive future where the livelihoods and health of people and the protection of the environment come before corporate interests.

The organic market has been growing for several years and reached \$15.7 billion in 2015. Brands across the world are adding organic cotton to their portfolio, and top companies already using organic cotton are expanding its share within their overall fibre purchasing⁷². Several important global initiatives have been set up in order to support the demand for more sustainable cotton, such as Cotton 2040⁷³ and the recently launched Clarence House Sustainable Cotton Communiqué which saw thirteen of the world's biggest clothing and textile brands committing to using 100% sustainable cotton by 2025⁷⁴.

Conclusion

As has been shown, organic cotton can be just as profitable as non-organic cotton, incomes are more secure as farmers grow other crops alongside their cotton, and organic farmers have the opportunity to supply a market that has been growing for years. This, combined with the grave problems caused by GM, demonstrates a strong case for organic cotton to be welcomed and supported by consumers, brands and retailers alike.

The story of GM cotton in India and beyond shows that now, more than ever, is the time to act.

Leading designers, manufacturers and retailers are already supporting the 148,000 organic cotton farmers around the world, and they and others need to do more to grow organic cotton production.

The fashion and textiles industries should recognise that the pioneers of environmentally sustainable, organic methods are helping to avoid GM, fight climate change, eliminate pesticide use and greatly reduce water consumption - setting a standard for all cotton producers.

Individual consumers can make an impact by choosing organic cotton clothing, bedding and other products.

The whole supply chain needs to cotton on to organic, by creating the right conditions to support the healthy and sustainable uptake of organic cotton from field to fashion.

Have you cottoned on yet?



References

¹Bhardwaj, M., and Jadhav, R. (2016). 'Indian farmers cotton on to new seed, in blow to Monsanto' available at <http://www.reuters.com/article/us-india-monsanto-idUSKCN10E05C> (accessed November 2016)

²PTI. (2015). 'Centre to control Bt cotton seed prices by fixing MRP' available at <http://economictimes.indiatimes.com/news/economy/agriculture/centre-to-control-bt-cotton-seed-prices-by-fixing-mrp/articleshow/50158688.cms> (accessed November 2016)

³Green Peace. (2005). 'Marketing of BT cotton in India: Aggressive, unscrupulous and false...' Available at <http://www.greenpeace.org/india/Global/india/report/2005/9/marketing-of-bt-cotton-in-indi.pdf> (accessed November 2016)

⁴Das, S. (2016). Centre sticks to stand, to cut BT cotton price 70%' available at <http://www.financialexpress.com/markets/commodities/centre-sticks-to-stand-to-cut-bt-cotton-price-70/221109/> (accessed November 2016)

⁵Choudhary, B. And Kadambini, G. (2010). 'BT cotton in India: A country profile' available at http://www.isaaa.org/resources/publications/biotech_crop_profiles/bt_cotton_in_india-a_country_profile/download/BT_Cotton_in_India-A_Country_Profile.pdf (accessed November 2016)

⁶EPA (2016). 'Introduction to Biotechnology Regulation for Pesticides' available at <https://www.epa.gov/regulation-biotechnology-under-tsca-and-fifra/introduction-biotechnology-regulation-pesticides> (accessed November 2016)

⁷Kazmin, A. (2015). 'Monsanto faces growing troubles in India' available at <https://www.ft.com/content/7197ffa8-7551-11e5-a95a-27d368e1ddf7> (accessed November 2016)

⁸Kurmanath, K. (2015). 'Wily pink bollworm survives Monsanto' Bollgard-II' available at <http://www.thehindubusinessline.com/economy/agri-business/wily-pink-bollworm-survives-monsantos-bollgardii/article7814810.ece> (accessed November 2016)

⁹Jebaraj, P. (2010). 'Monsanto 'admission' has business motives?' available at <http://www.thehindu.com/todays-paper/tp-national/article727420.ece> (accessed November 2016)

¹⁰Kazmin, A. (2015). 'Monsanto faces growing troubles in India' available at <https://www.ft.com/content/7197ffa8-7551-11e5-a95a-27d368e1ddf7> (accessed November 2016)

¹¹Fabrick, J, A. et al. (2015). 'Multi-toxin resistance enables pink bollworm survival on pyramided BT cotton' available at <http://www.ncbi.nlm.nih.gov/pubmed/26559899> (accessed November 2016)

¹²Shiva, V. (2015). 'Pests, pesticides and propaganda: the story of BT cotton' available at <http://vandanashiva.com/?p=317> (accessed November 2016)

¹³Union of Concerned Scientists (1998). 'Now or never: Serious New Plans to Save a Natural Pest Control' available at http://www.ucsusa.org/sites/default/files/legacy/assets/documents/food_and_agriculture/now-front.pdf (accessed November 2016)

¹⁴Bhardwaj, M., and Jadhav, R. (2016). 'Indian farmers cotton on to new seed, in blow to Monsanto' available at <http://www.reuters.com/article/us-india-monsanto-idUSKCN10E05C> (accessed November 2016)

¹⁵Buradikatti, K. (2016). 'Firms producing BT cotton seeds should compensate farmers' available at <http://www.thehindu.com/news/national/karnataka/firms-producing-bt-cotton-seeds-should-compensate-farmers/article8052538.ece> (accessed November 2016)

¹⁶Buradikatti, K. (2015). 'Govt. has to look into BT cotton crop failure in Raichur: Experts' available at <http://www.thehindu.com/news/national/karnataka/govt-has-to-look-into-bt-cotton-crop-failure-in-raichur-experts/article8025665.ece> (accessed November 2016)

¹⁷Menasinakai, S. (2016). 'Raichur farmers suffer 278.72-cr loss due to failed BT cotton: report' available at <http://timesofindia.indiatimes.com/city/hubballi/Raichur-farmers-suffer-278-72-cr-loss-due-to-failed-BT-Cotton-Report/article-show/52393826.cms?from=mdr> (accessed November 2016)

¹⁸Buradikatti, K. (2016). 'Firms producing BT cotton seeds should compensate farmers' available at <http://www.thehindu.com/news/national/karnataka/firms-producing-bt-cotton-seeds-should-compensate-farmers/article8052538.ece> (accessed November 2016)

¹⁹Buradikatti, K. (2015). 'Pink bollworm a nightmare for BT cotton growers' available at <http://m.thehindu.com/news/national/karnataka/pink-bollworm-a-nightmare-for-bt-cotton-growers/article7950687.ece> (accessed November 2016)

²⁰Staff correspondent. The Hindu. (2016). 'Sanitising BT cotton fields begins in Raichur district' available at <http://www.thehindu.com/news/national/karnataka/sanitising-bt-cotton-fields-begins-in-raichur-district/article8611378.ece> (accessed November 2016)

²¹Buradikatti, K. (2016). 'Complaint registered against 15 BT cotton seed companies' available at <http://m.thehindu.com/news/national/karnataka/complaint-registered-against-15-bt-cotton-seed-companies/article8444287.ece> (accessed November 2016)

²²Pest Warning and Quality Control of Pesticides, Government of the Punjab. (2014). 'Cotton crop and its pests' available at <http://www.pestwarning.agripunjab.gov.pk/Cotton%20Crop%20and%20its%20Pests> (accessed November 2016)

²³Goulson, D. (2013). 'REVIEW: An overview of the environmental risks posed by neonicotinoid insecticides'. *Journal of Applied Ecology*. 50(4), 977–987. Available at <http://doi.org/10.1111/1365-2664.12111> (accessed November 2016)

²⁴Hagenbucher, S. et al. (2013). 'Pest trade-offs in technology: reduced damage by caterpillars in BT cotton benefits aphids' available at <http://rspb.royalsocietypublishing.org/content/280/1758/20130042> (accessed November 2016)

²⁵Nair, R, J. And. Bhardwaj, M. (2015). 'After pest attack, some Indian farmers shun GM cotton' available at <http://www.dailymail.co.uk/wires/reuters/article-3306602/After-pest-attack-Indian-farmers-shun-GM-cotton.html> (accessed November 2016)

²⁶Varma, S. And. Bhattacharya, A. (2015). 'Whitefly destroys 2/3rd of Punjab's cotton crop, 15 farmers commit suicide' available at <http://timesofindia.indiatimes.com/india/Whitefly-destroys-2/3rd-of-Punjab-cotton-crop-15-farmers-commit-suicide/article-show/49265083.cms?from=mdr> (accessed November 2016)

²⁷Chaba, A, A. (2016). 'Cropping patterns: Non-BT desi cotton makes comeback in North-West India' available at <http://indianexpress.com/article/india/india-news-india/cropping-patterns-non-bt-desi-cotton-makes-comeback-in-north-west-india-2912422/> (accessed November 2016)

²⁸TNN, The Times of India. (2016). 'AP to cut BT cotton crop area' available at <http://timesofindia.indiatimes.com/city/hyderabad/AP-to-cut-Bt-cotton-crop-area/articleshow/52017542.cms> (accessed November 2016)

²⁹Punjab Update Bureau (2016). 'Cotton area in Punjab, Haryana shrinks 27 pc this year' available at <https://www.punjabupdate.com/2016/06/27/cotton-area-punjab-haryana-shrinks-27-pc-year> (accessed November 2016)

³⁰Swanby, H. (2015). 'Cottoning on to the lie: the introduction of genetically modified cotton in Africa will harm, not help, small-holder farmers' available at <http://acbio.org.za/wp-content/uploads/2015/06/GM-Cotton-report-2015-06.pdf> (accessed November 2016)

³¹Swanby, H. (2015). 'Cottoning on to the lie: the introduction of genetically modified cotton in Africa will harm, not help, small-holder farmers' available at <http://acbio.org.za/wp-content/uploads/2015/06/GM-Cotton-report-2015-06.pdf> (accessed November 2016)

³²Dowd-Urube, B. And. Schnurr, M, A. (2016). 'BRIEFING: Burkina Faso's reversal on genetically modified cotton and the implications for Africa' available at <http://afraf.oxfordjournals.org/content/early/2016/01/04/afraf.adv063.extract> (accessed November 2016)

³³Robinson, C. (2016). 'Burkina Faso abandons GM BT cotton' available at <http://www.gmwatch.org/news/latest-news/16677-burkina-faso-abandons-gm-bt-cotton> (accessed November 2016)

³⁴Dowd-Urube, B. And. Schnurr, M, A. (2016). 'BRIEFING: Burkina Faso's reversal on genetically modified cotton and the implications for Africa' available at <http://afraf.oxfordjournals.org/content/early/2016/01/04/afraf.adv063.extract> (accessed November 2016)

³⁵Agence France-Presse. (2016). "Top African producer bans GM cotton" available at <http://www.dailymail.co.uk/wires/afp/article-3555958/Top-African-producer-bans-GM-cotton.html> (accessed November 2016)

³⁶Dowd-Urube, B. And. Schnurr, M, A. (2016). 'BRIEFING: Burkina Faso's reversal on genetically modified cotton and the implications for Africa' available at <http://afraf.oxfordjournals.org/content/early/2016/01/04/afraf.adv063.extract> (accessed November 2016)

³⁷Gongo, S. (2017). 'Burkina Faso Sees Cotton Output Rising 20% in 2017-18 Season' available at <https://www.bloombergquint.com/business/2017/07/31/sbi-slashes-savings-bank-interest-rate-for-most-customers> (accessed July 2017)

³⁸Home of Earth Mother Foundation. (2015). 'Nigerians overwhelmingly reject Monsanto's risky GM maize and cotton' available at <http://www.homef.org/pressrelease/nigerians-overwhelmingly-reject-monsanto%E2%80%99s-risky-gm-maize-and-cotton> (accessed November 2016)

³⁹Shahid, J. (2016). 'Govt asks farmers to feed livestock BT cotton waste despite warnings' available at <http://www.dawn.com/news/1230393> (accessed November 2016)

⁴⁰Mustafa, Z. (2016). 'Cotton crisis' available at <http://www.ipsnews.net/2016/06/cotton-crisis/> (accessed November 2016)

⁴¹agrimoney. (2016). 'Pakistan cotton imports to triple, as output hits 17-year low' available at <http://www.agrimoney.com/news/pakistan-cotton-imports-to-triple-as-output-hits-17-year-low--9166.html> (accessed November 2016)

⁴²Amin, T. (2016). 'Cotton production to register huge decline' available at <http://www.brecorder.com/market-data/stocks-a-bonds/0/37874:cotton-production-to-register-huge-decline/?date=2016-04-20> (accessed November 2016)

⁴³Mustafa, Z. (2016). 'Cotton crisis' available at <http://www.ipsnews.net/2016/06/cotton-crisis/> (accessed November 2016)

⁴⁴Fabrick, J.A.; Unnithan, G.C.; Yelich, A.J.; DeGain, B.; Masson, L.; Zhang, J.; Carrière, Y.; Tabashnik, B.E. 'Multi-Toxin Resistance Enables Pink Bollworm Survival on Pyramided Bt Cotton' available at <https://www.nature.com/articles/srep16554> (accessed August 2017)

⁴⁵Unglesbee, E. (2017) 'Worm Rebellion Continues' available at <https://www.dtnpf.com/agriculture/web/ag/news/crops/article/2017/07/20/bollworm-populations-threaten-bt?referrer=twitter#.WXbA8CUMHMo.twitter> (accessed August 2017)

⁴⁶Yadav, S. (2016). 'Fly in the face of BT cotton' available at <http://www.thehindubusinessline.com/blink/know/fly-in-the-face-of-bt-cotton/article8561303.ece> (accessed November 2016)

⁴⁷Yadav, S. (2016). 'Fly in the face of BT cotton' available at <http://www.thehindubusinessline.com/blink/know/fly-in-the-face-of-bt-cotton/article8561303.ece> (accessed November 2016)

⁴⁸PTI. (2015). 'Centre to control BT cotton seed prices by fixing MRP' available at http://economictimes.indiatimes.com/article-show/50158688.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst (accessed November 2016)

⁴⁹Bera, S. And. Sen, S. (2016). 'Centre tells Delhi high court BT cotton's resistance to pests has waned' available at <http://www.livemint.com/Politics/oZHYGceXXVZB3lit9PytEN/Centre-tells-Delhi-high-court-Bt-cottons-resistance-to-pest.html> (accessed November 2016)

⁵⁰Bhardwaj, M. (2016). 'Exclusive: Monsanto pulls new GM cotton seed from India in protest' available at <http://www.reuters.com/article/us-india-monsanto-idUSKCN10Z1OX> (accessed November 2016)

⁵¹Bera, S. (2016). 'Govt backtracks on stringent licensing rules for BT cotton seeds' available at <http://www.livemint.com/Politics/lqi-yCWAQjx06CApgK2MWJM/Govt-to-withdraw-stringent-licensing-rules-for-GM-seeds.html> (accessed November 2016)

⁵² Bhardwaj, M., and Jadhav, R. (2016). 'Indian farmers cotton on to new seed, in blow to Monsanto' available at <http://www.reuters.com/article/us-india-monsanto-idUSKCN10E05C> (accessed November 2016)

⁵³ Kranthi, K. (2011). 'Part II: 10 Years of Bt in India' available at <http://www.cottongrower.com/uncategorized/part-ii-10-years-of-bt-in-india/> (accessed July 2017)

⁵⁴ Field Questions. (2012). 'BT cotton, remarkable success, and four ugly facts' available at <https://fieldquestions.com/2012/02/12/bt-cotton-remarkable-success-and-four-ugly-facts/> (accessed November 2016)

⁵⁵ Gutierrez, A, P. et al. (2015). 'Deconstructing Indian cotton: weather, yields and suicides' available at <https://enveurope.springeropen.com/articles/10.1186/s12302-015-0043-8> (accessed November 2016)

⁵⁶ Jainl, B. (2017). 'Bt cotton falling to pest, Maharashtra tensed' available at http://timesofindia.indiatimes.com/city/mumbai/bt-cotton-falling-to-pest-maharashtra-tensed/articleshow/59449010.cms?utm_source=toimobile&utm_medium=Twitter&utm_campaign=referral (accessed July 2017)

⁵⁷ Balani, S. (2012). 'Cultivation of genetically modified crops – prospects and effects' available at <http://www.prsindia.org/parliamenttrack/report-summaries/cultivation-of-genetically-modified-food-crops-prospects-and-effects--2514/> (accessed November 2016)

⁵⁸ Gutierrez, A, P. et al. (2015). 'Deconstructing Indian cotton: weather, yields and suicides' available at <https://enveurope.springeropen.com/articles/10.1186/s12302-015-0043-8> (accessed November 2016)

⁵⁹ Desmond, E. (2016). The legitimization of development and GM crops: The case of Bt Cotton and Indebtedness in Telangana, India. *World Development Perspectives*, 1, 23-25. <http://www.sciencedirect.com/science/article/pii/S2452292916300881>

⁶⁰ Press Trust of India (2016). 'Maharashtra to distribute indigenous seeds among farmers' available at http://www.business-standard.com/article/pti-stories/maharashtra-to-distribute-indigenous-seeds-among-farmers-116061700844_1.html (accessed November 2016)

⁶¹ Ganjapure, V. (2017). 'Over 3,600 farmers end lives in Nagpur division in 17 years' available at http://timesofindia.indiatimes.com/city/nagpur/over-3600-farmers-end-lives-in-nagpur-division-in-17-years/articleshow/59746666.cms?utm_source=toimobile&utm_medium=Twitter&utm_campaign=referral (accessed August 2017)

⁶² Press Trust of India (2017). 'Ex-Cabinet secy regrets over introducing GM cotton in India' available at <http://indiatoday.intoday.in/story/ex-cabinet-secy-regrets-over-introducing-gm-cotton-in-india/1/1008110.html> (accessed July 2017)

⁶³ Bhardwaj, M., and Jadhav, R. (2016). 'Indian farmers cotton on to new seed, in blow to Monsanto' available at <http://www.reuters.com/article/us-india-monsanto-idUSKCN10E05C> (accessed November 2016)

⁶⁴ Bhardwaj, M., and Jadhav, R. (2016). 'Indian farmers cotton on to new seed, in blow to Monsanto' available at <http://www.reuters.com/article/us-india-monsanto-idUSKCN10E05C> (accessed November 2016)

⁶⁵ Aryal, S. (2016). 'Demand for BT cotton seeds sharply down' available at <http://timesofindia.indiatimes.com/city/nagpur/Demand-for-Bt-cotton-seeds-sharply-down/articleshow/52930167.cms> (accessed November 2016)

⁶⁶ Kesireddy, R. R. (2015). 'Swelling input costs push Telangana and AP cotton farmers to traditional hybrid varieties' available at http://economictimes.indiatimes.com/articleshow/49576845.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst (accessed November 2016)

⁶⁷ Gera, K.A. (2016). 'Haryana, Punjab may cut Bt cotton sowing' available at http://www.business-standard.com/article/markets/haryana-punjab-may-cut-bt-cotton-sowing-116021800315_1.html (accessed November 2016)

⁶⁸ Forster, D. et al. (2013). 'Yield and economic performance of organic and conventional cotton-based farming systems – results from a field trial in India' available at <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0081039> (accessed November 2016)

⁶⁹ Karunakaran, N. (2016). 'End of the road for BT cotton in India' available at <http://gmwatch.org/news/latest-news/16845-end-of-the-road-for-bt-cotton-in-india> (accessed November 2016)

⁷⁰ Textile Exchange. (2016). 'Organic cotton market report' available at <http://textileexchange.org/wp-content/uploads/2016/07/2016-TE-Organic-Cotton-Market-Report.pdf> (accessed November 2016)

⁷¹ Ibid.

⁷² Ibid.

⁷³ Forum for the Future (2017) 'Cotton 2040 Integrating and accelerating efforts for sustainable cotton' available at <https://www.forumfor-thefuture.org/project/cotton-2040/overview> (accessed August 2017)

⁷⁴ Coristine, H. (2017) 'Big Brands Commit To Sustainable Cotton' available at <https://www.soilassociation.org/blogs/2017/may/thirteen-of-world-s-biggest-brands-commit-to-more-sustainable-cotton-by-2025/> (accessed August 2017)

⁷⁵ Haq, Z. (2016). 'GM crop: biotech regulators' career paths show conflicts of interest' available at <http://www.hindustantimes.com/india-news/gm-crop-biotech-regulators-career-paths-show-conflicts-of-interest/story-CHR6TSfbpnojEHWrkOuDgN.html> (accessed November 2016)

⁷⁶ Robinson, C., Antoniou, M. and Fagan, J. (2015). *GMO myths and truths: a citizen's guide to the evidence on the safety and efficacy of genetically modified crops and foods*. Earth Open Source.

⁷⁷ Lok Sabha Secretariat (2012). 'Cultivation of genetically modified food crops – prospects and effects' available at http://164.100.47.134/lssccommittee/Agriculture/GM_Report.pdf (accessed November 2016)



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The Soil Association was founded in 1946 by farmers, scientists, doctors and nutritionists to promote the connection between the health of the soil, food, animals, people and the environment. Today the Soil Association is the UK's leading membership charity and certification body campaigning for all things organic across food, farming, health & beauty, fashion & textiles and forestry.

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