A DECADE OF BT COTTON IN MADHYA PRADESH: A REPORT

Background to this report

Madhya Pradesh was one of the first six states which received a regulatory go-ahead on the cultivation of India's first and only GM crop, Bt cotton in 2002. This year marks a decade of approved Bt cotton cultivation in the state. It is worth noting that this is also a state which holds the distinction of having the largest organic cotton cultivation in the entire country, while India itself ranks first in the world in organic cotton production. Further, Madhya Pradesh has around 41% of its cotton area under irrigated conditions, which is certainly lower than Punjab and Haryana but higher than other states like Maharashtra, Tamil Nadu, Karnataka etc.

Madhya Pradesh also adopted an organic farming policy for the state one year ago.

This report, called "A Decade of Bt Cotton in Madhya Pradesh" is being brought out to present to policy makers and the public a picture of the performance of cotton and Bt cotton in the state, as per various official reports and records, in addition to findings from a re-visiting survey taken up in Jhabua district of the state to collect primary data from sample farmers for their experiences in Kharif 2011 and compare the same with a sub-set of farmers who were surveyed in 2005 for their Kharif 2004 experiences.

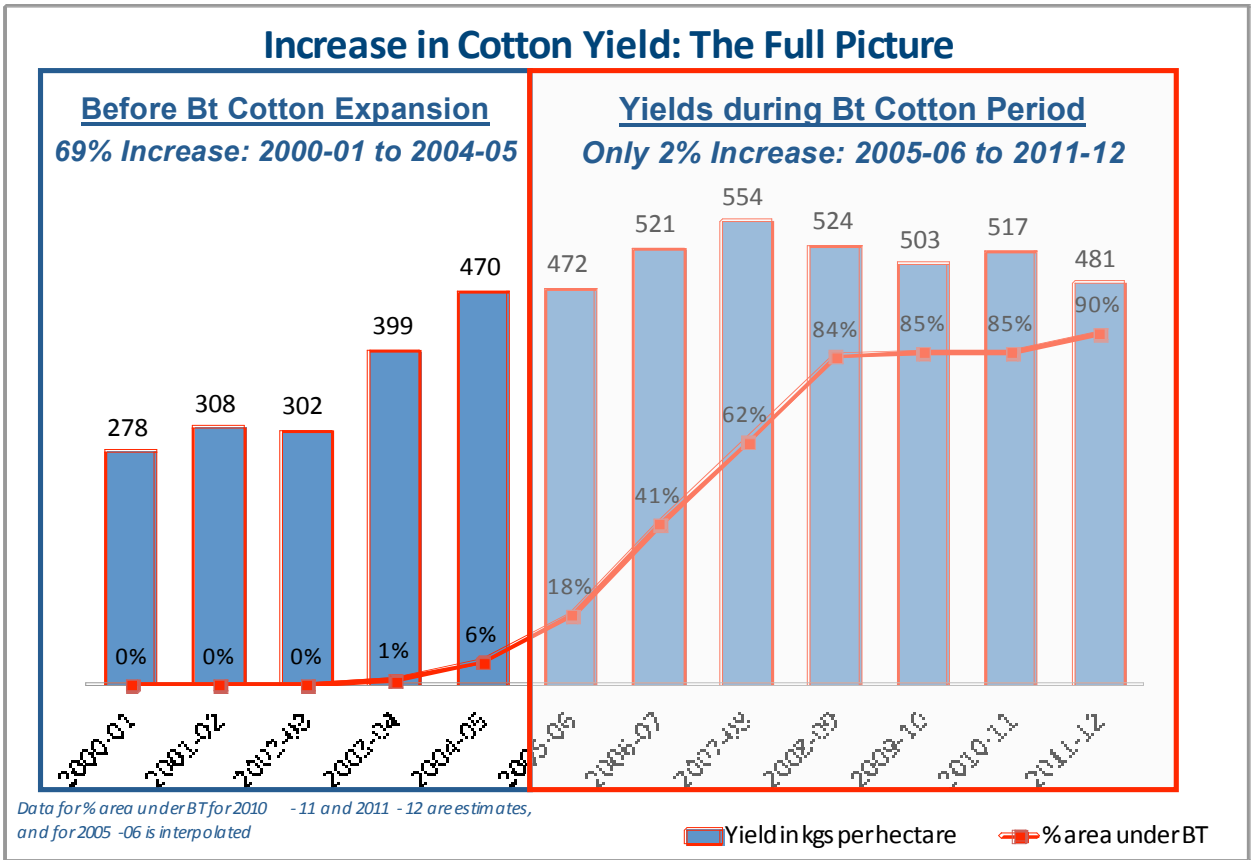
A Decade of Bt cotton in India

On March 26th 2002, Bt cotton (the first genetically modified crop in India) was officially approved in India for commercial cultivation, in the six states belonging to southern and central cotton cultivation zones of the country. Bt cotton, with the trade name Bollgard-I, developed by Mahyco-Monsanto Biotech Ltd approved in 2002 is genetically engineered with the *Bacillus thuringiensis* (Bt) gene, making the plant produce a new hitherto-not-present toxin that is fatal to the bollworm pest if expressed and ingested in appropriate dose. The Bollgard-I with a single Bt gene was followed in 2006 by Bollgard-II with two Bt genes. Currently Bt cotton hybrids expressing six 'events' (different combination of 3 Bt genes) have been commercialized in India. These have been introduced into 780 cotton hybrids. Bt cotton was introduced by the biotechnology industry with the lure that it will drastically reduce the use of synthetic pesticides on cotton and also give high yields (though this was not expressly stated, ostensibly from preventing crop losses and not by intrinsic potential to increase yield) providing farmers with enhanced income. Bt cotton is, in many policy and industry circles, being touted as the success story that needs to be replicated with other crops notwithstanding the desperate suicides that continue unabated among cotton farmers.

Cotton Yield gains – pre-Bt and post-Bt cotton entry: Breaking the myth

From a low initial uptake in 2002, Bt cotton has spread to over 85% of the cotton area, covering 9.4 million hectares in 2010-11.[1] By 2004-05, only 5.6% of the cultivated cotton area was planted with Bt cotton. The graph below is based on data from Cotton Advisory Board and Dr.Keshav Kranthi, Director of Central Institute of Cotton Research. Considering the period from 2000-01 to 2004-05 as the pre-Bt Cotton expansion period and the phase from 2005-06 to 2011-12 as the Bt cotton period, the following picture of the yield gains emerges.

[1] Jishnu.L (2011). The cotton saga unravels. http://www.downtoearth.org.in/content/cotton-saga-unravels



Source: Data used from Office of Textile Commissioner of India, cited by Cotton Advisory Board (www.txcindia.com) and Cotton Corporation of India (cotcorp.gov.in/state-operations.aspx)

- Yield was already rising sharply in the pre-Bt cotton era due to non-Bt hybrid seed and other factors. In the 5-year period from 2000-01, yield increased by 69%.
- In the Bt cotton period starting from 2005-06, an increase in yield is seen for a couple of years, showing a moderate 17% increase over 3 years up to 2007-08 (554 kg/ha compared to 470 kg/ha). But the yields show a downward trend since then. Presently, the cotton yields have reached pre-Bt levels – 481 kg/ha compared to 470 kg/ha. In fact, the yield estimate of 481 kg/ha for 2011-12 is only an initial estimate from the Cotton Advisory Board and the actual number is likely to be lower.
- This trend is corroborated in the paper of Dr. Keshav Kranthi (CICR) reviewing the 10 years of Bt Cotton. "The main issue that worries stakeholders is the stagnation of productivity at an average of 500 kg lint per hectare for the past seven years. The gains have been stagnant and unaffected by the increase in area of Bt cotton from 5.6% in 2004 to 85% in 2010. The yield was 463 kg per hectare when the Bt cotton area was 5.6% in 2004 and reached a mere 506 kg per hectare when the area under Bt cotton increased to 9.4 M hectares at 85% of the total 11.1 M hectares." 2

It is clear from the above analysis that the revolutionary contribution of Bt cotton to the productivity is a myth. The trend shows that more stable yield gains remain from the pre-Bt cotton period – which are being attributed to various factors by government scientists.

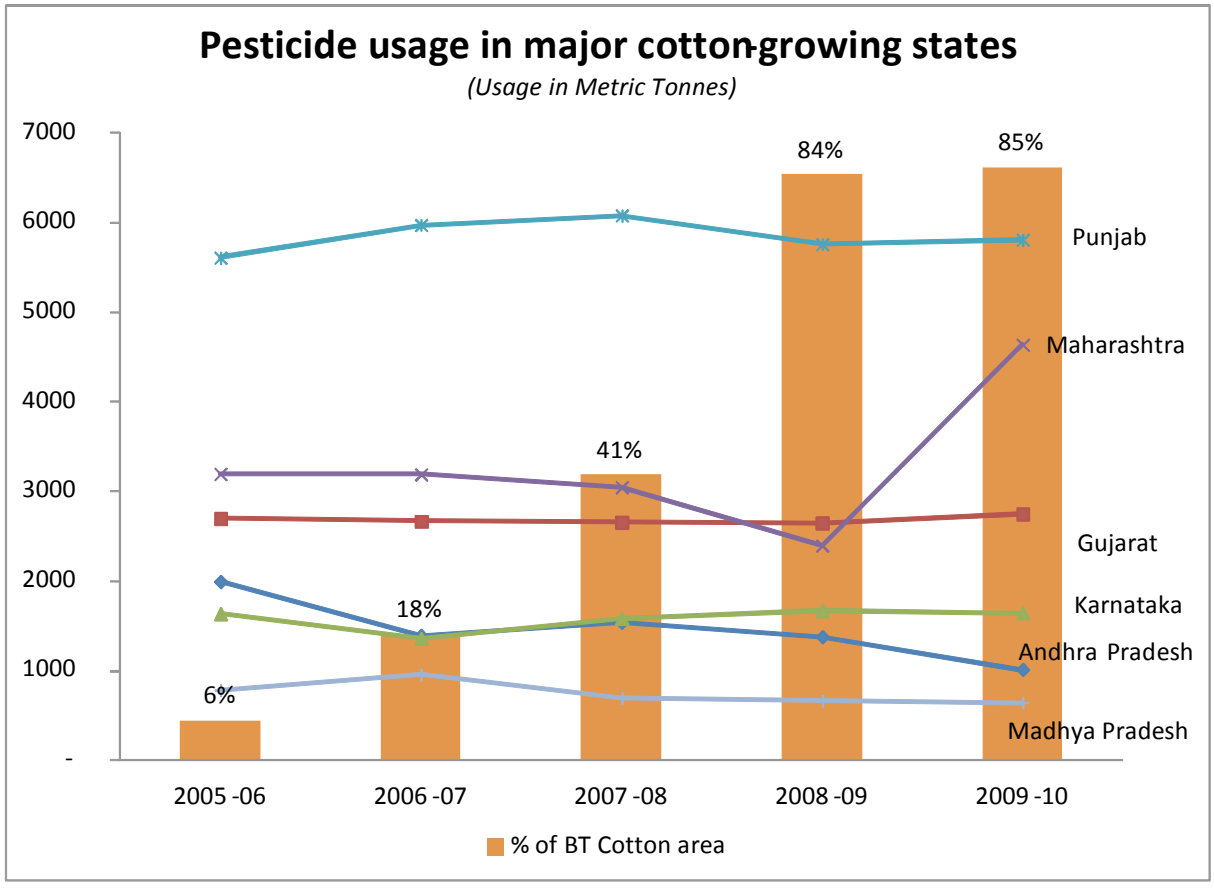
[2] Kranthi. K (2011). Part-3: 10 year of Bt in India. http://cotton247.com/news/ci/?storyid=2159

- Maximum yield gains were from Gujarat which brought 0.6 to 0.7 million hectares of new land under cotton (previously under groundnut) irrigated by a 100,000 new check dams (Kranti.K, 2011).
- In 2000, 40% of cotton area came under hybrids and the rest was under varieties. By 2009, 85.5% area came under hybrids and the rest were under cotton varieties.
- The use of irrigation facilities, bringing new lands under Bt cotton, low pest activity, well-distributed rainfall, the overwhelming shift towards hybrid cotton and introduction of pesticides with novel modes of action are some important factors that have helped cotton productivity and not just the introduction of the novel Bt gene. [3] [4]

Pesticide Usage, Pest Resistance and Emergence of New Pests

While Bt cotton came in with the promise of drastically reducing the use of pesticides in cotton, the experience of these 10 years shows that there is no sustained reduction in pesticide usage. The experience of farmers clearly shows that while a lower number of pesticide sprays was required in the first two years of Bt cotton adoption, thereafter the pesticide requirement has increased, and now the number of pesticide sprays required is equal to or more than that in the pre-Bt cotton period.

- **Cotton-growing states show no reduction in pesticide usage**



[3] Kranti. K (2011). Part-11: 10 year of Bt in India. http://cotton247.com/news/ci/?storyid=2159
[4] Kumar.V (2011). Navsari Agricultural University, Gujarat. "Bt Cotton : A Gujarat experience & issues", presented at State-level Dialogue on Emerging Concerns in Gujarat Agriculture, Vadodara, July 21-22, 2011

Table: Pesticide usage in Metric Tonnes, technical grade material

	2005-06	2006-07	2007-08	2008-09	2009-10
Andhra Pradesh	1997	1394	1541	1381	1015
Gujarat	2700	2670	2660	2650	2750
Karnataka	1638	1362	1588	1675	1647
Maharashtra	3198	3193	3050	2400	4639
Punjab	5610	5975	6080	5760	5810
Madhya Pradesh	787	957	696	663	645
All India	**39773**	**41515**	**43630**	**43860**	**41822**

Source: Directorate of Plant Protection, http://ppqs.gov.in/IpmPesticides.htm

The pesticide usage trends in the major cotton-growing states of Gujarat, Maharashtra, Andhra Pradesh, Punjab, Madhya Pradesh and Karnataka are shown above. While Maharashtra shows a significant upward trend from 3198 MT to 4639 MT, the other states show only marginal change, except for the downward trend in Andhra Pradesh.

- **Increased use of low-volume pesticides:** This same period has seen an enormous increase in the use of low-volume pesticides which require a much smaller quantity per acre. Therefore, the statistics of pesticide usage in metric tonnes in fact masks the increased use of pesticides.
- **Pink bollworm becomes resistant:** In early 2010, Monsanto disclosed that the cotton pest -pink bollworm- had developed resistance to the Cry 1Ac toxin (Bt) in Bollgard I in Gujarat[5] (the first State where Bt cotton was planted commercially).
- **Bollworm resistance to Bt**: Resistance monitoring studies done at CICR have demonstrated that bollworm (helicoverpa armigera), the target pest of Bt cotton, has developed tolerance for it. Other studies have also shown bollworm surviving and reproducing in Bt cotton both single gene and double gene Bt (Renjith et al, 2010).[6]
- **Emergence of secondary pests:** In his 2011 report Dr.Kranti states: "Productivity in north India is likely to decline because of the declining potential of hybrids; the emerging problem of leaf curl virus on the new susceptible Bt-hybrids; a high level of susceptibility to sucking pests (straight varieties were resistant); problems with nutrient deficiencies and physiological disorders; and mealy bugs, whiteflies and miscellaneous insect problems that are likely to increase."[7]. According to Dr.Kranthi, mealybug not observed in India before, has spread in the cotton regions and farmers have been spraying "extremely hazardous" pesticides to eliminate this hard-to-kill pest. The prolific spread of Bt cotton hybrids has created a conducive climate for the rapid spread of this pest.[8]
- **Pesticide expenditure increases:** At a meeting of the GEAC in early 2011, Dr KR Kranthi cautioned about the lack of refugia and resistance management. In his report to the MoEF, he said that with 90% of cotton area under Bt, resistance will develop sooner than later. There has been emergence of new sucking pests and pesticide expenditure has risen from Rs 597 crore in 2002 to Rs 791 crore in 2009".[9]

[5] Dinesh Sharma, "Bt cotton has failed, admits Monsanto", India Today, March 6, 2010 http://indiatoday.intoday.in/site/Story/86939/India/Bt+cotton+has+failed+admits

[6] M. T. Ranjith, A. Prabhuraj, & Y. B. Srinivasa. (2010). Survival and reproduction of natural populations of Helicoverpa armigera on Bt-cotton hybrids in Raichur, India. *Current Science*, *99*, (11) 1602-1606. Retrieved September 4, 2011, from http://www.ias.ac.in/currsci/10dec2010/1602.pdf

[7] Kranti.K (2011). Part-3: 10 years of Bt in India. http://www.cotton247.com/news/ci/?storyid=2171

[8] Mudur.G.S (2010) Cotton lessons for Bt brinjal. http://www.telegraphindia.com/1100216/jsp/nation/story_12110833.jsp

[9] ibid

THE PICTURE OF (BT) COTTON CULTIVATION IN MADHYA PRADESH

Let us now examine some data related to (Bt) cotton cultivation in the past decade in Madhya Pradesh specifically.

Area, Production and Yield of Cotton in Madhya Pradesh (1995-96 to 2011-12)

Year	Area in lakh hectares	Production in lakh bales of 170 kg/each	Yield in Kgs per hectare
1995-96	5.37	14.85	470.11
1996-97	5.27	18.75	604.84
1997-98	5.17	22.50	739.85
1998-99	5.01	18.75	636.23
1999-00	5.25	15.50	501.90
2000-01	5.06	19.25	646.74
2001-02	6.23	20.00	545.75
2002-03	5.45	18.00	561.47
2003-04	5.91	19.65	565.23
2004-05	5.76	16.00	472.22
2005-06	6.20	19.00	520.97
2006-07	6.39	19.00	505.48
2007-08	6.30	20.00	539.68
2008-09	6.25	18.00	489.60
2009-10	6.11	15.25	424.30
2010-11	6.50	17.00	445.00
2011-12 (P)	7.06	18.00	433.00

Source: Cotton Corporation of India, http://cotcorp.gov.in/state-operations.aspx accessed on March 24, 2012

A look at the above table reveals clearly that even though the area of cotton has expanded significantly in Madhya Pradesh, the production and yield are showing a downward trend. In fact, a record yield figure of 739.85 kilos per hectare was achieved in 1997-98, years before the advent of Bt cotton into the picture. ***The annual average yield figure between 1995-96 and 2002-03 in Madhya Pradesh is: 588.36 kgs/ha while the corresponding figure between 2003-04 and 2010-11 (eight year annual average yield after Bt cotton's entry) is 495.31 kgs/ha. This is nearly a 15% decline in yield!***

The following is the picture of Bt cotton spread (as per questionable industry sources) over the years in Madhya Pradesh, expressed first in absolute numbers (thousands of hectares) and then percentage share within total cotton area in the state, year-wise.

	Cotton area, in '000 Ha	Bt cotton area, in '000 Ha	Bt cotton %age in total cotton area
2002-03	545	2	0.37
2003-04	591	13	2.20
2004-05	576	80	13.89
2005-06	620	146	23.55
2006-07	639	310	48.51
2007-08	630	500	79.37
2008-09	625	620	99.20
2009-10	611	621	101.64

Source: Cotton area from Cotton Corporation of India and Bt cotton area from industry sources

The above incongruity in 2009-10 is an illustration of the unreliability of industry figures of Bt cotton adoption. Unfortunately however, no official data is maintained on the subject and seed sales figures are utilized to extrapolate the adoption in area. Be that as it may, ***it can be seen that in 2006, a substantial jump in Bt cotton adoption can be seen (25% more) in addition to a jump in 2007 also, by another 31% approximately. However, yield figures in 2006 Kharif and 2007 Kharif offer no such increases, despite the greater spread of Bt cotton.*** This only reinforces what many analysts point out that yields are a complex phenomenon and Bt cotton is no magic bullet that can be claimed to have increased cotton yields in the country or the state.

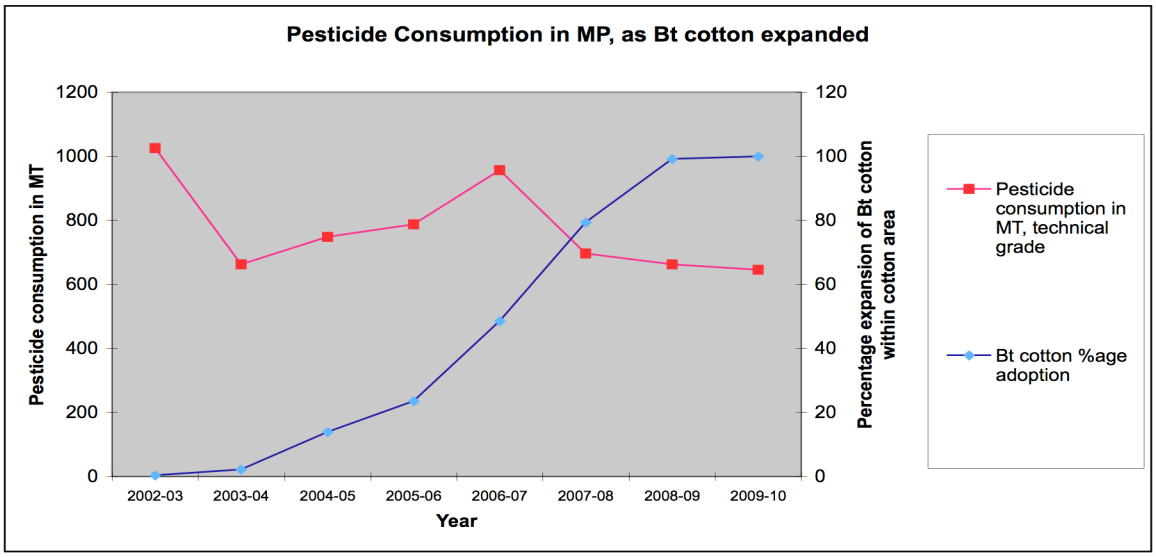
Pesticide Consumption in the state of Madhya Pradesh over the years

What is more interesting to note is the pesticides consumption in the state in Kharif 2006 and Kharif 2007, given in the table below for India and Madhya Pradesh, in metric tons of technical grade material, juxtaposed against Bt cotton expansion figures.

Table: Pesticide Consumption in Madhya Pradesh over the years

Year	India	Madhya Pradesh	%age change (Year On Year)	Bt cotton %age in MP
2000-01	43584	871		NIL
2001-02	47020	714	(-) 18%	NIL
2002-03	48350	1026	(+) 44%	0.37
2003-04	41020	662	(-) 36%	2.2
2004-05	40672	749	(+) 13%	13.89
2005-06	39773	787	(+) 5%	23.55
2006-07	41515	957	(+) 22%	48.51
2007-08	43630	696	(-) 27%	79.37
2008-09	43860	663	(-) 5%	99.2
2009-10	41822	645	(-) 3%	100

Source: For data till 2004-05, www.cibrc.nic.in and for latter years: http://ppqs.gov.in/IpmPesticides.htm , both under the Ministry of Agriculture, Govt of India

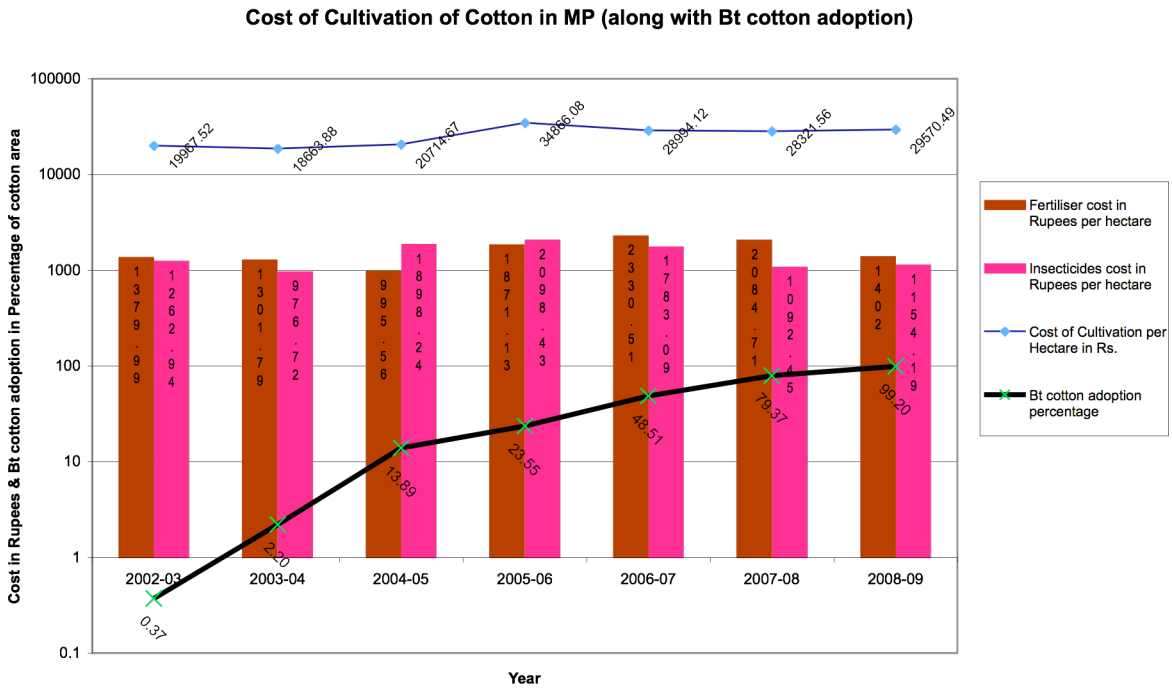


The above table and graph shows 36% pesticide reduction in an year when Bt cotton had not begun spreading and a 22% increase in the year when Bt cotton spread quite rapidly, followed by a 27% reduction in the next year. ***The above table clearly demonstrates that a fluctuating trend in pesticide consumption exists in the state, with or without Bt cotton and the low quantum of pesticide consumption in 2003-04 when Bt cotton area was just 2.2% of cotton cultivation area, has been further reduced to 645 only in the last year of reporting in all these years, even though the trend is now towards low volume-high value pesticides!***

COST OF CULTIVATION OF COTTON IN MADHYA PRADESH

Another official measure of what is happening to cotton cultivation in any given state could be the cost of cultivation data put out by the Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. While the data does not pertain only to Bt cotton, it cannot be interpreted as findings from official survey of Bt cotton cultivation. However, since the crop cutting experiments are supposed to have scientific sampling, the data must certainly include Bt cotton farms too, as the adoption rate of the GM seeds went up over the years in the state.

The following are the figures for Madhya Pradesh (some chosen relevant components):



Source: www.eands.dacnet.nic.in/cost_of_cultivation.htm accessed on 24/3/2012

The above graph clearly shows that during the years of Bt cotton expansion there have been no dramatic decreases in cost of cultivation per hectare of in fertilizer or insecticide costs (as bars above, brown and pink respectively).

While we do not claim that the increase in cost of cultivation is or could be because of Bt cotton, we would certainly like to draw the attention of readers once again to the fact that Bt cotton is no magic bullet that would reduce pesticide usage or costs for the farmers as official survey findings show.

MADHYA PRADESH: ORGANIC COTTON IN JEOPARDY IN AN ORGANIC STATE

Organic cotton cultivation and production are on a steady increase in India. According to APEDA, there were 144 projects in states like Andhra Pradesh, Madhya Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu, Odisha etc. by 2008-09.

Madhya Pradesh has the unique distinction of contributing the highest area and production when it comes to India's organic cotton progress. In 2009-2010, at 2.49 lakh hectares of certified organic area and 0.10 lakh hectares in conversion, as well as 4.94 lakh metric tons of production from the state, it contributed to nearly 68% of India's organic cotton production (a note by Dr G S Kaushal, former Director of Agriculture, Government of Madhya Pradesh, dated 14/8/2010). Pratibha Syntex, BioRe India, EcoFarms Ltd etc., are some of the prominent players in Madhya Pradesh.

However, the organic cotton sector and Madhya Pradesh's edge on this front are being seriously threatened now due to non-availability of non-GM cotton seed. Naemi Nemes (2010)[10], a German researcher (whose study centred around whether the possibility of maintaining organic cultivation of cotton exists with the current seed systems) warns that with the current seed systems being dominated by the private sector, ignorance of public sphere and unorganized civil sector, the situation could become irreversible for organic cotton's seed security. She points out that seed insecurity is further exacerbated by the fact that genetic and physical contamination of organic cotton from GM cotton is a continuous risk.

Maintaining isolation and segregation throughout the value chain, and preserving the identity are serious challenges in the current context. This is all the more so, in a state like Madhya Pradesh which is striving to be an organic state.

[10] Nemes, Noémi (2010): Seed Security among organic cotton farmers in South India, Master's Thesis, Institute for Social Sciences of the Agricultural Sector, University of Hohenheim

BT COTTON OVER THE YEARS: PRIMARY SURVEY IN 2012 OF KHARIF 2011

In the following pages, we present a comparative picture of Bt cotton in Kharif 2011, as compared to its performance in Kharif 2004 as panel data, based on a primary survey undertaken in the month of February 2012. In 2005, Sampark, an organization working on sustainable development issues with primarily tribal communities in Jhabua district of Madhya Pradesh took up a survey of 26 farmers to capture their experience of Bt cotton cultivation in Kharif 2004. The same set of farmers were re-visited in 2012, for their Kharif 2011 experience this time, in addition to a set of new farmers also for 2011. The following pages present the main findings of this survey.

Sample farmers in the two years

Particular	2005	2012
Number of farmers surveyed in both years & total landholding	26	26 (however, 8 of them have not opted for any cotton cultivation this year) – ***effectively, 18***
New farmers surveyed this year	-	21 farmers
Villages covered	Barkhet, Gamdi, Heeraninamapada, Jamli, Junakheda, Mahudipada and Tikiriya (7 villages): all in Petlawad block, Jhabua district	All 7 villages in the adjacent box PLUS Bani, Manasiya, Narsipura, Ramgarh and Sagdiya (12 villages in all): all in Petlawad block, Jhabua district
Total Landholding	236.30 acres (n=18)	236.30 acres (n=18) PLUS 205.50 acres (n=21 new farmers)
Total Bt cotton land amongst survey farmers	22.36 acres, amongst 18 farmers (9.46% of total landholding)	20.87 acres amongst 18 farmers PLUS 58 acres amongst 21 newly-surveyed farmers (17.85% of total landholding was under Bt cotton)

It is interesting to note that in this region, many earlier farmers opted out of cotton cultivation itself in the past couple of years – reasons stated are decreasing yields and increasing costs in addition to labour availability. This trend is reflected in our sample too. While prices that cotton farmers obtained in the market from 2010 season spurred a great increase in the area in other states and regions, this did not happen in the area surveyed. Within the farmers who chose to continue with cotton, there is a marginal decline in land under cotton cultivation, from the earlier set of farmers. Most of the farmers surveyed in 2005 as well as in 2012 have access to irrigation, mainly through open wells/tube wells except two each in each set of sample farmers.

ARE THESE TWO YEARS COMPARABLE?

Month	2004 Rainfall (mm)	2011 Rainfall (mm)
June	59	81
July	378	318
August	59	576
September	180	120
October	0	0
	673	1095

In terms of pest and disease incidence, both 2004 and 2011 are considered to be comparable, while rainfall in 2011 was higher, especially in the month of August, as per data obtained from the block office of Petlawad.

The two years are not very similar in terms of rainfall in the month of August; however, they are also similar in many other ways including pest and disease incidence.

FINDINGS ABOUT SEED FOR CULTIVATION

Particular	2005 survey	2012 survey
Number of Bt cotton hybrid brands used by farmers	4 (only of Rasi and Mahyco)	14 brands of various companies
Seed rate per acre (expressed in terms of packets of Bt cotton of 450 gms each)	1.44 packets	1.78 packets
Cost of Seed per acre	Rs. 2117.62/-	Rs. 1853.25/-

From the table above, ***it is apparent that even though the seed rate per acre has been increased by the farmers in the region (24% increase), the seed cost is lower by nearly 12.5%***. This reduction in seed price had not happened by itself but because of strong government action in several states in regulating price of Bt cotton seed, given that it was exorbitantly priced in the name of royalty payments and license fees to Monsanto in the initial years. Similarly, the number of brands in the market is reflected in the sample too, with our sample farmers opting for nearly 14 brands of different companies.

CHEMICAL FERTILISER USE

Particular	2005 survey	2012 survey
Average chemical fertilizer use per acre, reported in bags of 50 kgs each	7.42	7.64
Average cost on chemical fertilizers per acre	Rs. 1811.27	Rs. 2827.69

Jhabua district is notorious for its high chemical fertilizer use across different crops. The picture that emerges from these surveys is no different. ***While a marginal increase in the quantity of fertilizers used is being reported from Kharif 2011 (up by 11 kilos on an average), in terms of cost, a substantial increase is being borne by the farmers (56% higher).***

Top cotton scientists (like the Director of CICR, Nagpur) in the country in their own reviews of a decade of Bt cotton have pointed out that there has been a depletion of nutrients in the soil due to repeated cultivation of Bt cotton hybrids, which draw more nutrients and water from the soil.

CHEMICAL PESTICIDE USE

It has to be remembered that Bt cotton's main claim is its in-built toxin production system through the transgenic technology used to create it, with a bacterial gene inserted from *Bacillus thuringiensis,* which is thereby supposed to bring down the use of external chemical pesticides on the cotton crop. This is then supposed to reflect in reduced number of sprays as well as reduced cost of plant protection.

Particular	2005 survey	2012 survey
Average number of sprays per acre	3.13	6.87
Range of sprays	0-3 times: 9 farmers; 4-6 times: 7 farmers; >7 times: 2 farmers	0-3 times: 4 farmers; 4-6 times: 9 farmers; 7-9 times: 17 farmers; 10-12 times: 8 farmers; 16 times: 1 farmer
Average cost on pesticides per acre	Rs. 1317.67	Rs. 2239.48

The above table has important findings which raise questions yet again about the sustainability of the science of Bt crops. ***The average number of pesticide sprays per acre, in the 7 years between the two surveys, has gone up by 119.5%***. Another finding that raises serious concern is that 43.5% of the sample farmers in the 2012 survey have sprayed between 7-9 times on their Bt cotton crop, while in 2005, 50% of the farmers surveyed had sprayed less than 4 times.

The increased number of sprayings could be because of a variety of reasons including pest resistance or emergence of secondary pests etc. At the national level too, information put out by Dr K R Kranthi, Director of Central Institute for Cotton Research, cost of insecticide use in cotton has gone up from 597 crores in 2002 to 880.40 crores in 2010, implying an additional burden on crisis-ridden cotton farmers of the country, despite the massive expansion of Bt cotton which was brought in on the claim that it would bring down insecticide usage in the crop.

Additionally, the cost of chemical pesticide usage has gone up by Rs. 921.81/- per acre, which is an increase of nearly 70%, compared to 2005 cost.

IRRIGATION REQUIREMENTS

In our survey, we found that despite good rains reported in 2011, farmers provided more irrigation in 2011 than in 2004. This is an increase of 22%.

Particular	2005 survey	2012 survey
Average number of times irrigation was provided, per acre	1.88	2.30

Some cotton scientists have pointed out that Bt cotton needs to be irrigated more frequently, especially at peak bolling period when the need for water is higher. It may otherwise lead to wilting. Bt hybrids need more water in a short span because of shorter duration of reproductive phase vis-à-vis conventional hybrids, as per Dr V Kumar, cotton scientist in Navsari Agriculture University in Gujarat.

REFUGE MAINTENANCE

Neither in 2004 Kharif nor in 2011 Kharif did the surveys find even one farmer going in for the mandatory non-GM cotton/pigeonpea refuge for insect resistance management as laid down by the regulators during the time of Bt cotton approval.

YIELD, EXPENDITURE AND INCOME

The following are the findings with regard to yield (in quintals), expenditure and income in relation to the two years surveyed.

Particular	2005 survey	2012 survey
Yield in quintals, per acre	5.86	4.87
Expenditure (paid-out for inputs), in Rupees per acre	Rs. 5832/-	Rs. 7320.42/-
Gross Income @ Rs. 1596/qtl on an average at the end of 2004 season	Rs. 9352.56	Rs. 7772.52 Rs. 19181.53 (at current prevailing prices)
Net Returns per acre (without including any equipment hire or labour costs)	Rs. 3520.56/-	Rs. 452.10/- at 2005 prices; Rs. 11861.11 at current prices.

The above findings with regard to declining yields (compared to 2004 Kharif, average yields per acre in Kharif 2011 were lower by 17%) and increasing expenditure (26% higher in 2011 compared to 2004) are a matter of serious concern. The farmers have been left with some margins in each acre of Bt cotton cultivation only because of the current market prices touching nearly Rs. 4000/quintal, as opposed to just around sixteen hundred rupees seven years ago. These net returns have been calculated without including the costs of equipment hiring costs or labour costs incidentally.

The primary survey conducted at the end of Kharif 2011 only reinforces the trends noticed at the macro level, of declining yields and increasing costs for Bt cotton farmers.

TO SUM UP…..

1. The annual average yield figure between 1995-96 and 2002-03 in Madhya Pradesh, as per Government of India's data is: 588.36 kgs/ha while the corresponding figure between 2003-04 and 2010-11 (eight year annual average yield after Bt cotton's entry) is 495.31 kgs/ha. This is nearly a 15% decline in yield.

2. A record average yield figure of 739.85 kilos per hectare was achieved in 1997-98, years before the advent of Bt cotton into the picture, not reached subsequently.

3. When it comes to adoption of Bt cotton seeds and expansion within the cotton area of the state, it can be seen that in 2006, a substantial jump in Bt cotton adoption can be seen (25% more) in addition to a jump in 2007 also, by another 31% approximately. However, yield figures in 2006 Kharif and 2007 Kharif offer no such increases, despite the greater spread of Bt cotton.

4. A fluctuating trend in pesticide consumption exists in the state, with or without Bt cotton and the low quantum of pesticide consumption in 2003-04 when Bt cotton

area was just 2.2% of cotton cultivation area, has been further reduced to 645 only in the last year of reporting in all these years, even though the trend is now towards low volume-high value pesticides! In the interim, during the Bt cotton expansion phase, consumption of pesticides touched 957 MTs also in 2006-07.

5. During the years of Bt cotton expansion there have been no dramatic decreases in cost of cultivation per hectare or of fertilizer or insecticide costs, as projected by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

6. A primary survey was undertaken in 2012, to compare Bt cotton performance in Kharif 2011, with performance in Kharif 2004. 18 farmers surveyed in 2005 were re-visited, in addition to data from 21 new farmers enumerated from 12 villages in all of Petlawad block of Jhabua district in Madhya Pradesh. 8 of the farmers studied in 2005 had opted out of cotton cultivation this year. Amongst the ones who went in for cotton cultivation, more percentage of their land has been brought under Bt cotton in 2011.

7. Even though the seed rate per acre (quantity sown per unit of land) has been increased by the farmers in the region (24% increase), the seed cost was lower by nearly 12.5% in 2011, compared to 2004. This was mainly because of regulatory restrictions placed on Bt cotton seed price.

8. While a marginal increase in the quantity of fertilizers used is being reported from Kharif 2011 (7.64 bags of 50 kilos each were used per acre compared to 7.42 bags in Kharif 2004), in terms of cost, a substantial increase is being borne by the farmers (56% higher).

9. The average number of pesticide sprays per acre, in the 7 years between the two surveys, has gone up by 119.5%. Another finding that raises serious concern is that 43.5% of the sample farmers in the 2012 survey have sprayed between 7-9 times on their Bt cotton crop, while in 2005, 50% of the farmers surveyed had sprayed less than 4 times.

10. Additionally, the cost of chemical pesticide usage has gone up by Rs. 921.81/- per acre, which is an increase of nearly 70%, compared to 2005 cost.

11. Despite good rains reported in 2011, farmers provided more irrigation in 2011 than in 2004. There was an increase of 22% in the number of times the crop was irrigated.

12. Neither in 2004 Kharif nor in 2011 Kharif did the surveys find even one farmer going in for the mandatory non-GM cotton/pigeonpea refuge for insect resistance management as laid down by the regulators during the time of Bt cotton approval.

13. Findings with regard to declining yields (compared to 2004 Kharif, average yields per acre in Kharif 2011 were lower by 17%) and increasing expenditure (26% higher in 2011 compared to 2004) are a matter of serious concern. The farmers have been left with some margins in each acre of Bt cotton cultivation in Kharif 2011 only because of the current market prices touching nearly Rs. 4000/quintal, as opposed to just around sixteen hundred rupees seven years ago. These net returns have incidentally been calculated without including the costs of equipment hiring costs or labour costs.

CONCLUSION

Our analysis of official data on yields, pesticide consumption, cost of cultivation including fertilizer and pesticides costs etc., clearly points out that in Madhya Pradesh, there have been no gains made as per claims of Bt cotton proponents. In fact, there were better yields in the state before the advent of Bt cotton.

Further, our primary survey that compares performance of Bt cotton in Kharif 2011 with Kharif 2004 also points to increased use of inputs including irrigation water, increased pesticide consumption on Bt cotton, higher costs and declined yields. This is clearly unsustainable.

WE also look with alarm and concern at Madhya Pradesh, which has a declared organic farming policy for the state, losing its advantage when it comes to organic cotton production, since this is being threatened by the takeover of the seed market with Bt cotton seeds and cotton lands and processing facilities with Bt cotton production.

There is no dearth of proven alternatives on the ground and all such farmer-controlled, safe, sustainable and affordable alternatives have to be promoted with greater investment, effort and appropriate institutional mechanisms by the government with all farmers.

There is also an urgent need to learn lessons from this decade of false hype around Bt cotton in particular and GM crops in general and ensure that the true picture of failed promises is brought into the public domain clearly.

In this context, the Madhya Pradesh government is urged to pro-actively educate farmers on the hazards of GM cotton cultivation, encourage organic cotton cultivation with appropriate incentives and support systems put in place and strictly regulate the Bt cotton seed industry to make Madhya Pradesh a truly organic state.