

An overview of Bt Cotton experience in Karnataka: 2002 to 2009

Bt Cotton (insect-resistant transgenic cotton) is often portrayed as that technological revolution in Indian cotton cultivation which has changed the cotton scenario in India and pushed it to higher yields to make India the second largest producer of Cotton in the world. This brief report seeks to analyse the major developments with regard to Bt Cotton cultivation in the state of Karnataka in South India. Karnataka's cotton area was 4.16% of all-India cotton cultivation area in 2006-07, while the production was 2.70%. 14.7% of the total cotton cultivation was under irrigated conditions in 2005-06.

Bt Cotton was officially allowed for commercial cultivation in Karnataka in 2002 when the regulatory body in the Government of India – Genetic Engineering Approval Committee (GEAC) allowed three Bt Cotton hybrids belonging to Mahyco-Monsanto to be commercialised in the South and Central zones of cotton cultivation in India. Way before this official regulatory approval, it was documented that biosafety norms were being violated in the field trials of Bt Cotton¹. Trial farmers were shown to be selling produce from the trial plots in the open market whereas biosafety norms clearly require for all the material in the plot to be destroyed by burning.

The following pages try to present a picture of cotton and specifically Bt Cotton in India, with particular emphasis placed on official records obtained from the Department of Agriculture, Government of Karnataka which addresses the usual contention of bias in NGO or industry studies on the subject.

The following is the picture of Bt Cotton expansion in India over the years (in million hectares).

State	2002	2003	2004	2005	2006	2007	2008
Punjab	0.000	0.000	0.000	0.0704	0.2810	0.5750	0.4760
Haryana	0.000	0.000	0.000	0.0107	0.0420	0.2790	0.3800
Rajasthan	0.000	0.000	0.000	0.0023	0.0050	0.0380	0.1210
Gujarat	0.0091	0.0417	0.1259	0.1493	0.4070	1.3000	1.4500
Maharashtra	0.0120	0.0218	0.1615	0.5088	1.6550	2.5620	2.5720
Madhya Pradesh	0.0014	0.0133	0.0861	0.1362	0.3020	0.4710	0.5140
Andhra Pradesh	0.0038	0.0054	0.0712	0.0904	0.6570	1.0000	1.1430
Karnataka	0.0021	0.0030	0.0343	0.0293	0.0800	0.1460	0.1720
Tamil Nadu	0.0003	0.0076	0.0120	0.0170	0.0320	0.0600	0.0720
%age to total cotton	0.388	1.187	5.552	11.083	37.792	66.290	73.616

Source: Khadi, Santy & Yadav, "Cotton: An introduction" in Biotechnology in Agriculture & Forestry, 2010, Volume 65, 1-14, Springer-Verlag

In terms of percentage increase of Bt Cotton in the total cotton area of Karnataka, the picture is the following (area in million hectares, with total cotton extent obtained from CCI data):

¹ Indira M et al, *Agricultural Biotechnology & Biosafety in India: Expectations, Outcomes & Lessons*, Stockholm Environment Institute & Centre for Budget and Policy Studies, April 2005

%age area of Bt Cotton in the total cotton area of Karnataka – 2002 onwards

	2002	2003	2004	2005	2006	2007	2008
Total Cotton extent	0.393	0.313	0.521	0.413	0.378	0.388	0.335
Bt Cotton extent	0.0021	0.003	0.0343	0.0293	0.08	0.146	0.172
%age	0.53	0.96	6.58	7.09	21.16	37.63	51.34

Source: Compiled from <http://www.cotcorp.gov.in/statistics.asp#areal> and *ibid*

The very first year of Bt Cotton cultivation in Karnataka showed up various problems that official monitoring records have captured. According to Commissioner for Agriculture, Karnataka, 5478 packets were cultivated by 4952 farmers across the districts of Belgaum, Bellary, Chitradurga, Bijapur, Davanagere, Dharwad, Haveri, Gadag, Gulbarga, Koppal and Raichur in the first year of Bt Cotton's official entry. There was a mixed picture with regard to yields with Bt Cotton, as per the monitoring report of the state government across different districts. In Bellary and Raichur, non-Bt Cotton yields were supposed to be higher while in Mysore, Davanagere and Haveri, Bt Cotton yields were reported to be higher. The variability of yields was considerable. It was observed that even in places where the yields were higher, the high cost of seeds had offset this profit (the cost of Bt Cotton was higher by 4.5 times than the non-Bt Cotton hybrids at that time). It was also reported that the market price for Bt Cotton was lower in almost all the districts (the Bt Cotton seeds supplied were of medium staple).

In a study of 100 early adopters of Bt cotton carried out in two districts of Karnataka during 2002, Orphal (2005) found that in irrigated cotton farmers using Bt had higher gross margins while the opposite was found under rainfed conditions². The economic analysis showed that the economic advantage of Bt cotton depends on the agronomic conditions. While the gross margin for Bt was higher although not statistically significant if farmers had good access to irrigation, the opposite was true for cotton production under rain fed conditions. This study reports that pesticide costs were not the major cost item and the difference in seed cost between Bt and non-Bt was higher than the difference in pesticide cost. Hence, during years with low bollworm attack planting of Bt varieties can be a costly prophylactic pest control treatment that can reduce farmer's ability to cope with different pests later in the season.

Further, a survey in 2004 with the 100 early adopters supplemented by 50 non-adopters showed that about 90% of the early adopters had stopped growing Bt cotton, while continuing to cultivate cotton. An important factor was lack of irrigation facilities³. Most reasons given by the farmers relate to a lack of economic attractiveness. The category labeled 'other reasons' includes a number of farmers who stated that Bt is not used as it reduces soil health, is not suited for the prevailing soil conditions or due to deficits in knowledge and information on Bt cotton, amongst others, as per this study.

It has to be noted in this context that even in 2005-06, the percentage coverage under irrigation in total cotton area in Karnataka was just 14.7%, 14% in 2007-08 and was 13.8% in 1999-2000⁴.

In 2005, an official monitoring report of Bt Cotton in Karnataka recorded that yields of Bt Cotton in irrigated plots are better than rainfed crops. Further, the general trend that has been observed is that Bt Cotton varieties are highly sensitive to water logging and heavy rainfall.

² ORPHAL, J. (2005). Comparative analysis of the economics of Bt and non-Bt cotton production. Pesticide Policy Project Publication Series Special Issue No. 8, Institute of Economics in Horticulture, University of Hannover in cooperation with FAO

³ Ashok Malkarnekar et al (2005): Why some Indian cotton farmers do not adopt Bt cotton, University of Hannover <http://www.tropentag.de/2005/abstracts/posters/298.pdf>

⁴ <http://agricoop.nic.in/statistics2003/chap4c.htm>, http://dacnet.nic.in/eands/latest_2006.htm

In an analytical piece based on data from various sources, Keya Acharya pointed out that in Karnataka, farmers reported middling yields and lesser revenue earnings from Bt than from non-Bt varieties till 2004⁵. In 2005, the State has shown good yields in both traditional and non-traditional cotton-growing belts but has earned lesser revenue from Bt than non-Bt varieties like DCH-32 and DHH-11. This was in spite of reduced use of pesticides in Bt fields and happened more due to demand of the long-stapled varieties existing within non-Bt varieties. But in 2005, at least one Bt long-stapled variety, MECH 6918 was introduced which has reported good results in Karnataka, making the economics of long-stapled Bt comparable to long-stapled non-Bt, she reported. Bt Cotton appears to favour 'rich' farmers, who have access to water, better resources and alternative support, says Acharya.

By the end of 2008, Bt. cotton had expanded to more than half of the total cotton area (this however indicates less rapid expansion in this state compared to some other cotton-growing states of the country). Cotton yields in Karnataka increased from 302 kg/ha to 567 kg/ha. By the end of 2009, around 66% of Karnataka's cotton was estimated to be Bt Cotton.

However, yield figures from the five largest cotton-growing districts of Karnataka, with their erratic pattern with regard to yields in the recent years, put a question mark on the claims of Bt Cotton proponents about yield increases due to Bt Cotton. Further, the state government's yield figures, which differ from the Cotton Corporation of India's (CCI) data, show that there has been a fluctuating trend with regard to yields in the state.

Yields of Cotton crop in Karnataka as per two different sources

	CCI records	State govt records
2002-03	216	NA
2003-04	228	177
2004-05	261	236
2005-06	268	253
2006-07	270	290
2007-08	351	250
2008-09	507	357

Source: compiled from CCI records and data obtained from the Directorate of Agriculture, Govt of Karnataka

What is also interesting to note with the top five cotton-growing districts in the state is the fluctuating yield figures, across the years from 2003 onwards after the entry of Bt Cotton. The variability of yields (kgs per hectare) across districts is also apparent from the table below.

Yields of cotton crop in five top-cotton-growing districts of Karnataka

	Dharwad	Haveri	Mysore	Gadag	Raichur
2003-04	115	140	164	59	241
2004-05	160	292	239	154	180
2005-06	166	289	302	144	256
2006-07	197	375	208	85	425
2007-08	136	290	568	38	59
2008-09	154	310	641	43	64

Source: Data obtained from the Directorate of Agriculture, Govt of Karnataka

PESTICIDE/INSECTICIDE USAGE IN THE PAST FEW YEARS

The National Level Monitoring Team's (NALMOT) latest report also shows a pattern of increasing pesticide usage in Karnataka. This puts to question the very basis on which Bt Cotton was brought in.

⁵ <http://www.indiatogether.org/2006/aug/agr-btnomics.htm> "Bt, flaky results and pre-determined consensus": Keya Acharya, India Together, August 2006

Pesticides used in Cotton in Karnataka (Unit in million tonnes)

Sl. No.	Item	2005-06	2006-07	2007-08	2008-09	2009-10
1	Insecticides	1216	1008	1240	1406	1444
2	Fungicides	324	272	337	380	370
3	Others	998	82	108	114	8
	Total	1638	1362	1685	1900	1900*

*Projected demand during 2009-10

Source: NALMOT report, 2008, obtained from the Directorate of Agriculture, Govt of Karnataka

Further, studies show that the cotton mirid bug *Creontiades biseratense* (Distant) is an emerging insect pest on Bt cotton in Karnataka, India causing heavy shedding of squares and bolls which lead to significant reduction in seed cotton yield⁶. The new insect pest cotton mirid bug (*C. biseratense*) said to be rampant through out Karnataka. Results of a systemic study undertaken during 2008-09 on the population level of the bug covering 7 districts, 22 taluks and 88 villages as well as other reports showed that the mirid bug, *C. biseratense* could be considered as an emerging threat to cotton cultivation in the state which is appearing regularly and damaging squares/bolls heavily.

As per a question asked in the Rajya Sabha on 12/11/2007, the government presented data on cost of production of cotton in the recent past (weighted average A2+FL cost, namely all expenses in cash and kind including rent paid for leased-in land and imputed value of wages of family labour). The response is presented in the table below:

Year	2005-06	2006-07	2007-08
Cost of production of cotton for all-India	1538.93	1528.11	1549.01
MSP per quintal for medium staple	1760	1770	1800

This table shows that there have been no dramatic decreases in cost of production, while in fact, there is a fluctuating trend on this front. The cost of production per quintal of hybrid cotton in irrigated and rainfed cotton in the state of Karnataka shows that trends are fluctuating, as they were before the advent of Bt Cotton and that there have been no dramatic changes in costs as claimed by Bt Cotton proponents.

Cost of production per quintal of hybrid cotton (in Rs.)

Year	Irrigated	Rainfed
1998-99	1373.82	2189.76
1999-00	964.88	1634.62
2000-01	1301.91	1502.63
2001-02	2006.6	2305.31
2002-03	1576.28	2458.4
2003-04	2239.71	1951.61
2004-05	1603	1762
2005-06	NA	2018

Source: Data obtained from Directorate of Agriculture, Govt of Karnataka

⁶ Rohini RS, Mallapur CP & Udikeri SS, Incidence of mirid bug, *Creontiades biseratense* (Distant) on Bt cotton in Karnataka, *Karnataka J. Agric. Sci.*, 22(3-Spl. Issue) : (680-681) 2009

Meanwhile, a 2-year survey of performance of Bt Cotton hybrids in South India by Central Institute of Cotton Research ("Evaluation of Bt Cotton hybrids in South India" - Note sent by Mr Anupam Barik, Director, Kapas Vikas Nideshalaya, Directorate of Cotton Development, Govt of India, F. NO. D-3-14/09TMC/719, to Directors of Agriculture in Tamil Nadu, Andhra Pradesh and Karnataka on CICR's 2-year evaluation study on Bt Cotton hybrids on the basis of their yield performances in the South Zone) which brought out ground level data from Dharwad, Guntur and Coimbatore had the following results to share about Dharwad:

- the average lint yield (kgs per hectare) of 52 Bt Cotton hybrids in the zone was 526.79 kilos per hectare.
- The average lint yield of non-Bt cotton hybrids like DHH 11, Bunny etc., was 622 kilos per hectare.

44 of the Bt Cotton hybrids (out of 52) had lower yields than the average yield of non-Bt Cotton hybrids as per the findings here.

CONCLUSIONS:

1. Claims made in support of Bt Cotton either in terms of pesticide usage or yields or economics do not hold as the data presented in this brief review shows.
2. Insecticide usage in Karnataka in cotton crop has actually increased as per the official NALMOT data presented in this review. This belies the rationale for bringing in Bt Cotton.
3. Secondary data shows that Bt Cotton was working well only in irrigated conditions whereas a majority of cotton cultivation in Karnataka is in unirrigated conditions.
4. Cost of cultivation per quintal of cotton in Karnataka show fluctuating trends as was the case even before the advent of Bt Cotton. In fact, lower costs were present before Bt Cotton entered the scene, as official data from the recent past shows.
5. Other data on various Bt Cotton hybrids right now in the market from CICR shows that non-Bt Cotton's average lint yield is higher than the average of the Bt Cotton hybrids studied.
6. In the top five cotton growing districts of Karnataka, the picture with yields is that of dramatic fluctuations and variability across years and districts.

We conclude that Bt Cotton has not delivered on its claims and promises and it is important that the Government of Karnataka takes up an official review to look at the situation, given that field visits are pointing out to lack of supply of any other seeds, leaving very little choices for the farmers of the state.

** This is a brief review of Bt Cotton in Karnataka taken up by Sahaja Samruddha, with the help of Karthik Karthikeyan, an independent researcher trained in journalism, based mostly on official data collected and compiled for the purpose (October 2010)*