

**STUDY ON
SOCIO-ECONOMIC IMPACT ASSESSMENT OF
BT-COTTON IN INDIA
BY
COUNCIL OF SOCIAL DEVELOPMENT**



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EXECUTIVE SUMMARY

Context

Bt cotton is the first genetically modified crop to be used in India. Cotton cultivation in India is mainly dominated by Bt cotton hybrids, approved for commercial cultivation in the year 2002. Currently above 90 per cent of the Cotton area is under hybrid Bt cotton.

While several studies have shown that farmers have benefitted from adopting the technology, other studies have expressed concerns about benefits over time. Hence, this study aims to assess the socio-economic impact of Bt cotton cultivation in various regions of India.

Objectives

1. To undertake a spatial and temporal analysis of World Cotton production and trade.
2. To analyse trends in area, production, yields and farm input use of Cotton in India.
3. To undertake a cost of cultivation and net return analysis of Bt cotton in different states.
4. To analyse the agronomic factors accounting for Bt cotton yields.
5. To analyse the effect of incomes of Bt cotton on the health and sanitation, education, infrastructural and other livelihood status of farmers across various farm sizes.
6. To analyse the impact of Bt cotton on labour employment and income of landless labourers.

Methodology and Data Sources

A primary survey was conducted in selected districts of 9 major Cotton growing states for the agricultural year 2010-11. The study was based on a total sample size of 1050 farmers and 300 agricultural labourers across the country. The present study is a cross-sectional analysis of farming population for a single year and hence the information received has been compared with secondary data received from Government sources. Since it was difficult to compare a single year study with previous years using the same population dataset, hence, farmers' recall method was used during the interview. Further, a lot of information was based on farmers' perception regarding various issues.

Secondary data sources include Ministry of Agriculture, Economic Survey, GOI, USDA, UNCTAD and FAOSTAT.

Commercial cultivation of Bt cotton in India had started from 2002-03 only in the states of the central and southern regions. In the northern region comprising the states of Punjab, Haryana and Rajasthan, cultivation began from 2005-06 onwards. Hence, in this study the Post-Bt cotton period for the central and southern states have been taken from 2002-03 onwards, while for the northern states, it has been taken from 2005-06 onwards.

KEY FINDINGS:

Pesticide Use

It was found that **pesticide consumption in the country declined by 54.54 per cent** in the Post-Bt cotton period (2002 to 2009) when compared to the Pre-Bt cotton period (1996 to 2001). Farmers reported that with the introduction of Bt cotton, though Bollworm damage had declined, there was an increased damage of sucking pests not supposed to be controlled by Bt Cotton technology. In the last 2 years the rate of decline in consumption of pesticide has also reduced. Hence, the decline in Cotton yields in recent years, can to some extent, be attributed to increased attacks by sucking pests.

Exports

In terms of exports it was seen that, India's share in the value of exports increased from 0.75 per cent in the TE¹ 2000 to 10.53 per cent in TE 2009. Further, it was observed that the trend growth rate of Cotton exports in quantity terms was -24.6 per cent and in value terms it was -21.3 per cent in the Pre-Bt cotton period (1990 to 2001). However these export trends increased significantly to above 75 per cent between the Post-Bt cotton period (2002 to 2009). **Thus, the advent of Bt cotton has changed India from a net importer into a net exporter of Cotton.**

Area under Cotton, Production & Yield

Ever since the cultivation of Bt cotton in India in 2002-03, the growth rate of Cotton area, production and yield between 2002 and 2011 increased by 4.91, 9.25, and 4.95 per cent, respectively. This quantum leap in growth rates especially in the last decade suggests the huge influence of Bt cotton on farming choices in India. However, the Post-Bt cotton period also registered a marked increase in instability, measured through the coefficient of variation. The average Cotton yields also showed some decline since 2008-09 onwards, presumably under the impact of

- marginal lands (shallow soils in rain-fed areas) that were being brought under Cotton cultivation
- erratic weather conditions especially rainfall
- increased attacks by sucking pests not controlled by the current Bt technologies.

In the course of research it was found that from 2009-10 onwards, the average area under

Cotton was highest in the states of Maharashtra (38 Lakh hectares), Gujarat (27.6 Lakh hectares) and Andhra Pradesh (17.07 Lakh hectares). However, these states, especially Maharashtra, did not show commensurate increase in productivity of Cotton during the last 3 years due to cotton being grown in marginal lands.

The highest average yields of Cotton lint over the last 3 years were seen in Tamil Nadu (943.67 Kg/Hec) whose average area under Cotton was only 1.19 Lakh hectares. Tamil Nadu was followed by Gujarat (659.33 Kg/Hec) and Andhra Pradesh (564.33 Kg/Hec), that showed relatively higher Cotton area (above 20 Lakh hectares). These states were followed by Haryana (553 Kg/Hec), Punjab (538.67 Kg/Hec) and Rajasthan (506.33 Kg/Hec), where Cotton area was around 5 Lakh hectares.

¹ TE – Triennium Ending

The yield in Maharashtra the highest ranking state in terms of Cotton area was the lowest (336 Kg/Hec). The Cotton area in Madhya Pradesh was 6.53 Lakh hectares but its corresponding yield was just 437.33 Kg/Hec. Some pockets in the states like Maharashtra and Madhya Pradesh are mainly rainfed having shallow soils and erratic rainfall patterns. Hence, they can be termed 'marginal lands' compared to other traditional cotton growing areas in the states. Further the yields in these states have also shown a decline despite high area. Hence, it can be safely said that overall Cotton yields in India have declined due to increase in Cotton area in marginal lands.

Fertilizer Consumption

As regards fertilizer consumption in Cotton, it was seen that, per hectare fertilizer consumption showed increasing trends especially since 2007-08. **The average consumption of fertilizers increased from 95 Kg/Hec in the Pre-Bt cotton period (1996-2001) to 120 Kg/Hec in the Post Bt-cotton period (2002-2008).** The proportion of fertilizer cost to total cost showed increasing trends in the Post-Bt cotton period, also due to increase in fertilizer prices as well as increased purchasing power of farmers due to higher returns from Bt cotton.

Seed Usage

Secondary sources say the total seed usage of Cotton declined from 9.23 Kg/Hec in the Pre-Bt cotton period (1996-2001) to 4 Kg/Hec in the Post Bt-cotton period (2007-2008). The field survey found that the average seed usage in Bt cotton was around 2 Kg/Hec. In spite of using relatively less seed, **farmers are realizing higher yields and hence higher net returns.**

Seed Sources

As regards the proportion of farmers using Bt cotton seeds from different seed companies in the surveyed regions, it was found that a high proportion of farmers (25.14 per cent) used seeds of Nuziveedu Seeds Pvt Ltd followed by Shriram Bioseeds Genetics (20.57 per cent), Rasi Seeds Pvt. Ltd (19.24 per cent), Ankur Seeds Pvt Ltd (17.24%), Bayer Biosciences Pvt Ltd (14.95 per cent), Mahyco Ltd (13.62 per cent) and Monsanto Holdings Pvt. Ltd (6.29 per cent).

Irrigation

The average irrigation costs per hectare increased from Rs.355/Hec in the Pre-Bt cotton period (1996-2001) to Rs.813/Hec in the Post-Bt cotton period (2002-2008), in response to increased diesel costs. However, the proportion of irrigation costs to total costs showed declining trends in the Post-Bt cotton period.

Labour

The proportion of human labour cost to total cost of Cotton was the highest in the cultivation of Cotton crop over the years. It ranged between 25 and 50 per cent in various states. The human labour use increased positively from 96 man-days/Hec in the Pre-Bt cotton period (1996-2001) to 104 man-days/Hec in the Post-Bt cotton period (2002-2008) mostly for the harvesting activities on account of higher yield. It was observed during the field survey that, **the average daily wages of landless labourers increased by more than 80 per cent** from the Pre – Bt cotton to the Post - Bt cotton period, for all kinds of farm operations, in

all the surveyed regions. The percentage increase in female labour wages was around 10 times more than their male counterparts. It was seen that at the all India level labour wages were highest for post harvesting operations followed by picking.

Machine Labour

The average per hectare costs of machine labour increased from Rs.732.06/Hec in the Pre-Bt cotton period (1996-2001) to Rs.1408.07/Hec in the Post-Bt cotton period (2002-2008). **Growth rates of machine labour costs showed substantial increase in the Post-Bt cotton period in the major cultivating states.** The cost of machine labour as a proportion of total costs showed increasing trends in the Post-Bt cotton period.

Demographics

From the field survey it was observed that, most Bt cotton growers surveyed across the country were small farmers (53.71 per cent) followed by medium (36.76 per cent) and then large farmers (9.52 per cent). Further, it was seen that all farmers (100 per cent) surveyed in the major Cotton growing states cultivated Bt cotton. Farmers mainly learnt of Bt cotton from co-farmers (72 per cent) followed by seed dealers (22 per cent), extension workers (3 per cent) and social media (3 per cent).

The total hybrid Bt-cotton area as a proportion of total Cotton area was over 90 per cent. **The all India average yields of hybrid Bt Cotton were reported slightly higher than those of Non-Bt (Desi) cotton. Bt cotton area and yields were scale neutral.**

Cost of Cultivation V/S Income

As regards Cotton prices it was seen that average minimum support prices (MSP) of Cotton showed an increase from Rs.1363/Quintal in the Pre-Bt cotton period (1992-2001) to Rs.2242.50/QtI in the Post-Bt cotton period (2002-2011). The farm harvest prices (FHP) of Cotton also showed an increase across all states in the Post-Bt cotton period. However, both the MSP and FHP showed high fluctuations indicating instability in Cotton prices over the years in all states. Further, the MSP of long staple length Cotton in the country in 2010-11 was Rs.3000/QtI. The field survey showed that farmers in all the states sold Cotton above the MSP, the all India average being Rs.4377.43/QtI.

The ensuing net returns per hectare derived from the cost of cultivation analysis (total working capital) of Cotton was found to be positive in all the regions indicating good profits to farmers from cultivation of Bt cotton. The average net returns from Bt cotton at the all India level was Rs.65307.82/Hec. The per hectare net returns were scale neutral across farm size classes. Further, it was also found that the total income or net returns from Bt cotton was much higher than income from other non-farm sources.

It was noticed from data received from the Ministry of Agriculture that the average per hectare cost of cultivation increased by 67.68 per cent in the Post-Bt cotton period (2002-2009) from the Pre-Bt cotton period (1996-2001). As observed from the field survey, high costs in Bt cotton were mainly due to human labour (52.69 per cent of total cost) for planting, weeding and harvesting followed by cost of fertilizers (10.84 per cent), seed (9.61 per cent) and mechanization (8.86 per cent). Secondary data on per hectare value of production also increased in the Post-Bt cotton period from the Pre-Bt cotton period by 94.06 per

cent. The average net returns per hectare also increased significantly from the Pre to the Post-Bt cotton period by 375 per cent. This change was much greater than the increased costs of Bt cotton cultivation. The percentage change in value of production and net returns per hectare from the Pre-Bt cotton to the Post Bt-cotton period were high enough to offset the increase in per hectare cost of cultivation of Bt cotton in the major cultivating states in India. **This showed that despite high cost of cultivation farmers were deriving greater benefits from Bt cotton cultivation.**

Farmer Suicides

On the issue of farmers' suicides, a very small proportion of farmers (between 1- 4 per cent) in states like Maharashtra and Andhra Pradesh reported farm related suicides within their families. Farmers in the central Indian region blamed the suicides mainly on low and erratic nature of rainfall as this was a rainfed region, unavailability of timely credit and fluctuating Cotton prices over the years that made production risky in certain years. As timely availability of institutional credit was a challenge, farmers depended more on non-institutional sources of credit such as money lenders, arhatiyas (middle men), relatives and friends. Non-institutional credit was easily accessible but had a higher rate of interest.

Farmer Perception

As regards perception of farmers on various issues of Bt cotton, it was seen that 94 per cent farmers said that Bt cotton yields were higher than Non-Bt cotton and 87 per cent said that returns were also higher. 84 per cent farmers said that the quantity of seed usage per hectare on Bt cotton was less than that used in Non-Bt cotton. However, 92 per cent farmers said that the expenditure on Bt cotton seeds was more than Non-Bt cotton.

A very small proportion of farmers (2 per cent) said that they had faced problems of spurious seeds. All proportions were very similar across all the surveyed districts and across different farm size categories. 84 per cent farmers said they did not plant 'refuge crops' alongside their Bt cotton plots. This was because farmers looked at getting higher yields and earn higher income on maximum areas. The total fertilizer usage on Bt cotton was reported to be slightly higher (54 per cent) than Non Bt-cotton (46 per cent).

At the all India level, 76 per cent farmers reported that the quantity of pesticide usage on Bt cotton had reduced over the years, and 71 per cent said that the expenditure on pesticide use for Bt cotton had also reduced. As regards the role of Bt cotton in minimizing the attack of Bollworms, 90 per cent farmers claimed that Bt cotton had reduced the attack of Bollworms. As regards irrigation expenditure, a relatively higher proportion of farmers (59 per cent) said that irrigation expenditure on Bt cotton was higher than Non-Bt cotton.

Socio-Economic Impact

The field survey also documented the effect of increased returns from Bt cotton on the livelihood status of farmers and landless labourers. **On an average 85 per cent farmers and landless labourers invested in better quality education for their children, 77 per cent reported intake of high value and nutritious food, 70 per cent in recreation and social functions, 75 per cent on health of their family members and 64 per cent on health of livestock.**
