

In an earlier study based on extensive field trials, *Bt* cotton contributed Rs 4,678 (US\$96) more per acre from yield increases, which is about 78% of the average net return from non-*Bt* counterpart. Reduction in pesticide cost contributed an additional Rs 870 (US\$18) per acre equivalent to 14% of the net return from using non-*Bt* lines. Considering current farmers practices in controlling bollworm, an additional total net benefit by as much as Rs 6,529 (US\$134) could be generated, or an equivalent 110% increase over the net return from using non-*Bt* cotton.

The adoption of *Bt* cotton will play a key role in developing the competitiveness of India in cotton production. Very encouraging results have been attained in the field trials of *Bt* cotton conducted over the years. Significant benefits derived include yield increases, reduction in pesticide use, and increased profitability.

### Suggested Readings

- Qaim, M. and D. Zilberman. 2003. Yield effects of genetically modified crops in developing countries. *Science*, 299:900-902. 7 February 2003.
- James, C. 2002. Global review of commercialized transgenic crops: 2001 Feature: Bt cotton. *ISAAA Briefs* No. 26, ISAAA: Ithaca, NY.
- Indian Council for Agricultural Research (ICAR). 2002. Report on 2001 IPM trial cost benefit analysis. ICAR: New Delhi, India.
- Naik, G. 2001. An analysis of socio-economic impact of *Bt* technology on Indian cotton farmers. Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad, India, April 2001.

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# Bt Cotton in India





## Background

Cotton is a major crop of India grown in about 9.3 million hectares, the largest cotton area in the world. More than four million farmers with small- and medium-holdings cultivate cotton in the country. Yields are low compared to world average, partly because of heavy losses from insect pests, particularly cotton bollworm complex. Yield losses due to insect pests are estimated to be around 10-14% every year. As a result of low yields, cotton production in India represents only 13% of the total world production.

India is addressing the need for increased cotton production with the deployment of genetically modified cotton cultivars. These insect protected cotton varieties contain a naturally occurring substance, a *Bacillus thuringiensis* (*Bt*) protein, which has been used as an active ingredient in safe and effective biological sprays for more than 50 years. *Bt* trait has been successfully transferred into 40 Indian cotton lines. Extensive and fully replicated field trials of *Bt* cotton were conducted from 1998 to 2001 cropping seasons, meeting government requirements for commercialization. Three *Bt* cotton cultivars have recently been approved for planting in India.

## Economic Benefits to Farmers

Information from the cost benefit analysis study on *Bt* cotton published by the Indian Council for Agricultural Research (ICAR) are presented in the table below.

### Yield Advantage

*Bt* cotton hybrids have yield advantage of 60% to 90% over conventional hybrids. Yield advantage of up to 92% was recorded for Mech 184, up to 87% for Mech 162, and up to 60% for Mech 12.

### Pesticide Use Reduction

With *Bt* cotton, there is significant reduction in pesticide use. *Bt* hybrids required only one spray, even on heavy infestation, to control bollworm as compared to an average of 4 sprays for non-*Bt* cultivars and popular checks. In the field, farmers normally spray 5-9 times per season to control bollworm. Thus, pesticide use could be reduced by more than 70% using *Bt* cultivars.

**Agronomic and economic performance of *Bt* cotton and conventional cotton, ICAR field trials, 2001.**

Cotton hybrids	Yield (q/ha)	Gross income (Rs/ha)	Pesticide control (Rs/ha)	Additional cost of <i>Bt</i> seed per ha	Net income (Rs/ha)	Difference between <i>Bt</i> and checks (Rs/ha)
	(1)	(2)	(3)	(4)	(5) = 2-(3+4)	(6)
Mech 184 <i>Bt</i>	14.00	25,200 (\$520)	1,413 (\$29)	2,425 (\$50)	21,362 (\$440)	
Local check	8.37	15,006 (\$310)	2,845 (\$59)		12,221 (\$252)	9,141 (\$188)
National check	7.31	13,158 (\$270)	2,001 (\$41)		11,157 (\$230)	10,205 (\$210)
Mech 162 <i>Bt</i>	13.67	24,606 (\$507)	1,413 (\$29)	2,425 (\$50)	20,768 (\$428)	
Local check	8.37	15,006 (\$310)	2,845 (\$59)		12,221 (\$252)	8,547 (\$176)
National check	7.31	13,158 (\$270)	2,001 (\$41)		11,157 (\$230)	9,611 (\$198)
Mech 12 <i>Bt</i>	11.67	21,006 (\$433)	1,727 (\$35)	2,425 (\$50)	16,854 (\$347)	
Local check	8.37	15,006 (\$310)	2,845 (\$59)		12,221 (\$252)	4,633 (\$96)
National check	7.31	13,158 (\$270)	2,001 (\$41)		11,157 (\$230)	5,697 (\$117)

Exchange rate: Rs48.5 = US\$1.00

Source: Adapted from James, 2002

### Increase in Net Return

Significant economic benefit arises from increased yield and reduction in pesticide cost. Substantial increases in yield provide a major contribution to increases in gross income generated by *Bt* hybrids.

Gross income for the three *Bt* cotton hybrids averaged 23,604 Rs/hectare (US\$487) compared with 14,050 Rs/hectare (US\$290) for the local and national check hybrids. This shows a 68% gross income advantage of *Bt* cotton hybrids over conventional hybrids. Significant reduction in pesticide cost translates to increases in net income for the use of *Bt* hybrids.