Agricultural Economics Research Review
Vol. 19 July-December 2006 pp 293-300

A Comparative Analysis of Production and Marketing of Bt Cotton and Hybrid Cotton in Saurashtra Region of Gujarat State

H.R. Visawadia[1], A.M. Fadadu[2] and V.D. Tarpara[3]

Abstract

The study has revealed that the total cost per hectare is higher in Bt cotton than hybrid cotton. The cost of seeds has been found higher in Bt cotton, whereas hybrid cotton growers incur more cost on insecticides/ pesticides. This shows the effectiveness of the new technology (Bt cotton) for insect resistance. The average total cost of production as well as the bulk line cost have been found lower in Bt cotton. This depicts a reduction in the unit cost of Bt cotton, which is the distinct advantage of the new technology. A higher yield of 29 per cent has been obtained by the Bt cotton farmers over the hybrid cotton growers. The study has identified the constraints in production, and marketing of Bt cotton in the area. Bt cotton has been found a superior technology to hybrid cotton, as it gives higher yield and has low cost of production.

Introduction

India has the largest area in the world (~9 million ha) under cotton and is the third largest cotton producer (~2.7 million tonnes). Gujarat is the largest cotton-producing state in India, accounting for about 27 per cent (~714,000 tonnes) of the India's total production with only 18 per cent (~1.6 million ha) of India's total area under cotton cultivation. In Gujarat, the major cotton producing districts, viz. Rajkot, Bhavnagar, Vadodara, Amreli, Mehsana,

[1] Department of Agricultural Economics, Junagadh Agricultural University, Junagadh – 362 001; E-mail:Visawadia@yahoo.co.in
[2] At & Post Ivnagar, via. Junagadh, Dist. Junagadh
[3] Office of the Director of Research, Junagadh Agricultural University, Junagadh-362 001; E-mail:vaju_tarpara@yahoo.com

This paper has been drawn from the M.Sc. thesis, "Comparative Economics of Bt Cotton and Hybrid Cotton in Saurashtra Region of Gujarat State", submitted to Junagadh Agricultural University, Junagadh in 2004 by Alpesh Mohanbhai Fadadu.

Authors are grateful to the referee for his fruitful suggestions.

Bharuch and Surendranagar, produce about 85 per cent of the total cotton-production in the state (Anonymous, 2002a). Rajkot has the largest area under the irrigated cotton, (132 thousand ha) with the production of 153 thousand tonnes (Anonymous, 2002b).

The developments in biotechnology have enabled the seed companies to develop Bt as a toxin to protect the cotton crop against tobacco budworm, cotton bollworm and pink bollworm. The Genetic Engineering Approval Committee (GEAC) under the Federal Ministry of Environment and Forests (MoEF), New Delhi, had cleared Mahyco's three transgenic hybrid cotton varieties for commercial application in India, viz. Mech-12, Mech-162 and Mech-184. The Government of India, on the basis of approval given by the GEAC, approved these varieties in India for commercial cultivations (Sen, 2003).

The adoption of transgenic crops like Bt cotton could help in protecting the crop against the potentially most damaging pest and thus could reduce the risk of crop failure. Effective transfer and implementation of this new Bt cotton technology demands a thorough understanding of the constraints confronting the farmers in its adoption, although before releasing the Bt cotton to farmers, sample tests were conducted under different agro-climatic conditions in various research stations and through trials and demonstrations. However, yield levels realized by the farmers tended to be considerably lower than those recorded at the research stations and demonstration plots, leaving a considerable untapped yield potential. Once the constraints are identified, attempts could be made to overcome them. The present study was, therefore, undertaken to study the comparative economics of Bt cotton and hybrid cotton and to identify the constraints confronting them.

Methodology

The Saurashtra region of Gujarat was selected purposively for this study as 52 per cent of cotton in the state is grown in this region. Kotda Sangani and Gondal talukas of the Rajkot district were selected purposively for their highest share in Bt cotton crop in this district. From these two talukas, eight villages (four from each talukas) were selected at random for the study. The primary data were collected from 128 (64 Bt cotton growers + 64 hybrid cotton growers) cotton farmers by the survey method through pre-tested questionnaires. Simple tabular analysis was used for estimating the costs and returns structures of Bt cotton and hybrid cotton and evaluating them. Various farm management cost concepts were also followed.

A large list of constraints in Bt cotton production was collected by reviewing the literature related to its production and marketing. Moreover, cotton growers and experts in the field of production and marketing of cotton

of different institutions/organizations were also contacted through open-ended questionnaires. This constraint schedule was used for recording the responses of 128 sample cotton growers. The respondents were asked to give their responses on a three-point continuum, viz. Often (3), Sometimes (2) and Never (1). After recording the responses from all the Bt cotton growers, the total score of each constraint was summed up and divided by the total number of respondents to find out the mean score of each constraint. On the basis of mean score of each constraint, ranks were assigned to all the constraints to ascertain their importance.

Results and Discussion

Comparative Economics of Bt Cotton and Hybrid Cotton in Saurashtra Region

The cost structure of Bt cotton and hybrid cotton is presented in Tables 1 and 2, respectively. The average total cost (Cost C_2) per hectare amounted to Rs 44553/- for Bt cotton and Rs 39816/- for hybrid cotton. In the case of hybrid cotton, the plant protection cost was higher as compared to that in Bt cotton, while the seed cost was meagre. The other cost components remained almost the same for both the groups.

Regarding the use of pesticides, the farmers opined that there was a reduction in the overall pesticide-use on the Bt cotton than hybrid cotton. A remarkable difference was observed in the use of pesticides on both sucking pests and bollworms; it was Rs 3407 in Bt cotton and Rs 4486 in hybrid cotton. The use of pesticides was more for the control of bollworms on the hybrid cotton crop, and consequently, the expenditure on pesticides was higher on control of bollworms than sucking pest (see Tables 1 and 2). Bt cotton had higher order of pest attack in the form of sucking pests as compared to bollworms but the difference in the cost of plant protection was meagre.

The average total cost C_2 per quintal was estimated to be Rs 2381 in Bt cotton and Rs 2746 in hybrid cotton. This implied that reduction in the unit cost of cotton production was an added advantage for Bt cotton farmers. The bulk line cost per quintal of cotton ranged from Rs 2300 to Rs 2651 in Bt cotton and Rs 2550 to Rs 3201 in hybrid cotton. This showed a higher cost of production per quintal in hybrid cotton. The bulk line cost covered more than 85 per cent of the total production, more than 80 per cent of the total area and more than 76 per cent of the total farmers.

Crop Yields and Returns

Timely sowing and using the recommended rate of quality seeds helped in augmenting crop productivity as well as income of farmers. A comparative

Table 1. Cost on cultivation of Bt cotton in Gujarat

Items	Bt cotton		
	Physical unit	Value in Rs	Percentage of total cost
Human labour			
Family (mandays)	88.7	5204	11.68
Hired (mandays)	110.1	6451	14.50
Bullock labour (pair days)	25.3	3501	7.86
Seeds (kg)	0.9	3409	7.65
Chemical fertilizers (kg)			
N	129.1		
P	81.1	2868	6.44
K	25.1		
Insecticides/Pesticides			
Sucking pest		1101	2.47
Bollworm		2306	5.18
Irrigation (hours)	153.8	3425	7.69
Other paid out cost		3298	7.40
Depreciation cost		128	0.29
Interest on working capital		1590	3.57
Interest on fixed capital		64	0.14
Rental value of owned land		7150	16.05
Management costs		4051	9.09
Cost A		28084	63.04
Cost B		35298	79.23
Cost C_1		40502	90.91
Cost C_2		44553	100.00
Cost of production per quintal			
Cost A		1501	
Cost B		1887	
Cost C_1		2165	
Cost C_2		2381	

study on these aspects will have a greater bearing in formulating appropriate policy. The impact of Bt cotton and hybrid cotton is discussed below.

The details of yields, returns and input-output ratios of both the cotton crops have been given in Table 3. Bt cotton gave 29 per cent higher yield than that of hybrid cotton in the study area. Though the difference in prices of Bt cotton and hybrid cotton was negligible, the net income and other incomes were appreciably higher in Bt cotton due to its higher yield. The net income from the Bt cotton crop was Rs 134/ha, whereas a loss of Rs 5316/ha was incurred for hybrid cotton, which obviously resulted in unfavourable input-output ratios over cost C_1 and cost C_2.

Table 2. Cost on cultivation of hybrid cotton in Gujarat

Items	Hybrid cotton		
	Physical unit	Value in Rs	Percentage of total cost
Human labour			
Family (mandays)	81.5	4902	12.31
Hired (mandays)	83.0	4972	12.49
Bullock labour (pair days)	22.0	3261	8.19
Seeds (kg)	1.6	866	2.17
Chemical fertilizers (kg)			
N	129.7		
P	81.4	2880	7.23
K	25.2		
Insecticides/Pesticides			
Sucking pest		954	2.40
Bollworm		3532	8.87
Irrigation (hours)	133.8	3200	8.04
Other paid out cost		3827	9.61
Depreciation cost		256	0.64
Interest on working capital		1900	4.77
Interest on fixed capital		128	0.32
Rental value of owned land		5518	13.86
Management costs		3620	9.09
Cost A		25647	64.42
Cost B		31294	78.60
Cost C_1		36196	90.91
Cost C_2		39816	100.00
Cost of production per quintal			
Cost A		1768	
Cost B		2158	
Cost C_1		2496	
Cost C_2		2745	

The results indicated that Bt cotton and hybrid cotton seeds had a pronounced effect on cotton production. Bt cotton had depicted more potential in harvesting higher yields than that of hybrid cotton. The results suggested that Bt cotton was more effective in reducing the yield loss through damage by bollworms.

Production and Marketing Constraints Confronting Bt Cotton

There have been some constraints in the adoption of Bt cotton technology. A wide gap existed between the performance of the new Bt cotton and the old hybrid cotton on the farmers' fields. Though some farmers were able to

Table 3. Details of yields, returns and input-output ratio of Bt cotton and hybrid cotton

Items	Bt cotton	Hybrid cotton
Yields		
(a) Main product, q	18.71	14.46
(b) By product, q	27.71	17.80
Farm harvest price		
(a) Price of main product, Rs/q	2353	2386
(b) Income from by-product, Rs	664	425
Gross returns, Rs	44686	34500
Farm business income, Rs	16602	8853
Family labour income, Rs	9388	3206
Net income over cost C_1, Rs	4184	(-)1696
Net income over cost C_1,Rs	134	(-)5316
Input output ratio over		
Cost A_2	1.59	1.34
Cost B	1.27	1.10
Cost C_1	1.10	0.95
Cost C_2	1.00	0.87

achieve high yields with the help of new technology (Bt cotton), they seldom reached the levels attained at the experimental station due to certain constraints. The constraints confronting production and marketing of Bt cotton were also studied. The lack of availability of quality seeds of Bt cotton with a mean score of 2.88 was the main constraint among the physical constraints [Table 4(A-1)], followed by the lack of knowledge about the recommended package of practices by agencies (2.84), shortage of agricultural labour during peak seasons (2.63), inadequate supply and high price of genuine fertilizers (1.45) and lack of availability of micro-nutrient fertilizer (1.14).

The inadequate irrigation facilities with a mean score of 2.14 ranked first among the irrigation constraints [Table 4(A-2)], followed by low availability of irrigation power (2.08), underground water not fit for irrigation (1.99), and high cost of power (1.83). With regards to plant protection constraints [Table 4(A-3)], the high incidence of sucking pest in Bt cotton ranked first, followed by high incidence of diseases, and other insects and lack of availability of genuine plant protection chemicals.

Regarding credit constraints [Table 4(A-4)], the lack of capital resources with the mean score of 1.67 ranked first, followed by lack of credit availability from institutional sources (1.40) and high cost of credit (1.26).

On the basis of data presented in Table 4(B), it could be inferred that the lack of marketing facilities at the village level with a mean score of 2.93

Table 4. Constraints confronting cultivation of Bt cotton in the study area

Sl No.	Particulars	Total score	Mean score	Rank
	(A) Production constraints			
	(1) Physical constraints of seed, labour and fertilizers			
•	Lack of pure and quality seeds of Bt cotton	369	2.88	I
•	Lack of agricultural labour during peak seasons	337	2.63	III
•	Lack of availability and high price of genuine fertilizers	185	1.45	IV
•	Lack of availability of micro-nutrient fertilizers	146	1.14	V
•	Lack of knowledge about recommended package of practices (by agencies)	364	2.84	II
	(2) Irrigation constraints			
•	Underground water not fit for irrigation of Bt cotton	255	1.99	III
•	Inadequate irrigation facilities	274	2.14	I
•	Low availability of irrigation power	266	2.08	II
•	High cost of irrigation power	234	1.83	IV
	(3) Plant protection constraints			
•	High incidence of diseases	304	2.38	II
•	High incidence of sucking insect in Bt cotton	379	2.96	I
•	High incidence of other insect pest in Bt cotton	263	2.05	III
•	Lack of availability of genuine plant protection chemicals	228	1.78	IV
	(4) Credit constraints			
•	Lack of capital resources	214	1.67	I
•	Lack of credit availability from institutional sources	179	1.40	II
•	High cost of credit	161	1.26	III
	(B) Marketing constraints			
•	Lack of timely availability of good quality Bt seeds	367	2.87	II
•	High prices of quality Bt seeds	272	2.13	IV
•	Lack of timely availability of genuine fertilizers	221	1.73	V
•	Lack of timely availability of plant protection appliances	150	1.17	X
•	Lack of marketing facilities at village level	375	2.93	I
•	Low price of farm produce at the time of harvesting	317	2.48	III
•	Lack of storage facilities	216	1.69	VI
•	Lack of grading and standardization	175	1.37	IX
•	Lack of cheap and efficient transport	177	1.38	VII
•	Delay in payment by the marketing agencies	176	1.38	VIII
•	Less payment by the marketing agencies	147	1.15	XI

ranked first, followed by low prices for farm produce at the time of harvesting (2.48), lack of storage facilities (1.69), lack of cheap and efficient transportation (1.38), delay in payment by marketing agencies (1.38), lack of grading (1.37) and less payment by the marketing agencies (1.15).

Conclusions

The study has revealed the total cost per hectare to be higher in Bt cotton than hybrid cotton. The cost of seeds has been found much higher in Bt cotton, whereas in respect of insecticides/pesticides hybrid cotton growers have incurred higher cost as the cost on plant protection for bollworms has been higher in hybrid cotton.

The average total cost of production as well as the bulk line cost have been found lower in Bt cotton. Thus, a reduction in the unit cost of cotton has been the distinct advantage of the Bt cotton. But, there are production and marketing constraints in growing Bt cotton in the study area. The study has showed that Bt cotton technology is superior to hybrid cotton in terms of higher yields and lower cost of production.

References

Anonymous, (2002a) Report rubbished*, Down to Earth*, **11**(4): 13.

Anonymous, (2002b) *District-wise Area, Production and Yield per Hectare of Important Food and Non-food Crops in Gujarat State*, Directorate of Agriculture, Govt. of Gujarat, Gandhinagar.

Kalaitzandonakes, N. and R. Maltsbarger, (1998) *Biotechnology and Identity-preserved Supply Chains*, Choices (fourth quarter), pp. 15-18.

Kalaitzandonakes, N. and M. Hayenga, (1999) Structural change in the biotechnology and seed industrial complex: Theory and evidence. Paper presented at the *Transitions in Agbiotech: Economics of Strategy and Policy Conference,* Washington, DC.

Sen, A., (2003) *Cotton Scenario in India: Current Cotton Scenario*, Navi Mumbai. Cotton Corporation of India.

Sharma, D., (2001) The introduction of transgenic cotton in India, *Biotechnology and Development Monitor*, **44**: 10-13.

Sudarshan, I. and N. Lalitha, (2002) Bt cotton in India: Controversy visited, *Indian Journal of Agricultural Economics,* **57**(3): 463.