Original Research Article

A Comparative Study on Socio Economic Impact of Bt cotton and Non-Bt cotton Farm Households in Warangal District of Telangana State, India

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A B S T R A C T

A comparative study of socio economic impact on Bt cotton and Non-Bt cotton was carried out in Warangal district of Telangana State during the year 2016. The study was conducted with the objective to evaluate the socio economic characteristics of both Bt cotton and Non-Bt cotton farm households. Jangoan block was purposively selected for the study as it was recorded as highest area under Non-Bt and Bt cotton cultivation. Total 120 farm households were surveyed for the study in which 60 farmers were selected from Bt cotton cultivars and another 60 from Non-Bt cotton. Among all crops which were cultivated in the Study area on an average Bt cotton has occupied 0.76 ha and Non Bt cotton occupied 0.72 ha. The cropping intensity is in Bt cotton farm households was 203.7 per cent and in case of Non-Bt cotton farm households it was 196.03 per cent. The average size of farm families are four to five members were common in both Bt and Non-Bt cotton households but it was slightly higher in Bt-cotton than Non-Bt cotton. The total literacy was seems to be high in Bt cotton than Non-Bt cotton households. The literacy rate increasing from small to large both in case of Bt and Non-Bt. Cotton. The sample average of Primary occupation was highest in Non-Bt cotton farm households as against to the Bt cotton households

Introduction

Cotton (*Gossypium sps*) the "white gold" and "king of fibers", is cultivated in tropical and subtropical regions of more than seventy countries across the world and enjoys a predominant position amongst all cash crops in India. The major producers of cotton are USA, China, India, Pakistan, Uzbekistan, China, Australia, Greece, Brazil, Egypt and Turkey contributing about 85 per cent of the Global cotton production. Cotton is a major cash crop of India and is the largest producer of cotton in the world accounting for about 26% of the world cotton production. It has the distinction of having the largest area under cotton cultivation in the world constituting about 38% to 41% of the world area under cotton cultivation.

Cotton is grown under rainfed as well as irrigated conditions and the major cotton producing states include Punjab, Haryana, Rajasthan, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Telangana and Tamil Nadu. The pest problem

in cotton is one of the worst among all crops (http://cotcorp.gov.in).

Bt cotton adoption in India

In India, 162 species of insect pests attack different stages of cotton. The bollworms are most important tissue feeders and highly damaging. Three types of bollworms viz. American bollworm (*Helicoverpa armigera*), Pink bollworm (*Pectionphora gossypiella*) and spotted bollworm (*Earias vitella*), normally referred as bollworm complex are by far the most damaging and loss inducing pests of cotton. Amongst them, *Helicoverpa* emerged as a key pest all over the country causing as high as 80% losses in cotton. Lot of efforts have been made for alternative strategies of bollworm management and various non-pesticidal (NPM), restricted pesticidal (IRM) and IPM techniques have been formulated, tested and demonstrated. These are slowly gaining acceptance but so far successes have been restricted and dissemination is slow. Transgenic Bt cotton, which evokes inbuilt resistance in the host, is gaining wider adaptability as a means of avoidance of losses due to bollworm because the technology operates at seed level dissemination and finds quick favour among the users.

Therefore, Bt cotton has already proved useful in countries where it has been introduced earlier. In Indian context also, it is expected to give a wider base to all other protection strategies in cotton. The Bt is a short form of ubiquitous soil bacterium *Bacillus thuringiensis*. This bacterium is gram positive and spore forming that forms parasporal crystals during stationary phase of its growth cycle. The synthesized crystalline proteins called 'endotoxins' are highly toxic to certain insects. The decision of the Genetic Engineering Approval committee (GEAC) of Government of India clearing the release of Bt cotton for commercial cultivation during 2002-2003 crop season, is considered as one

of the major milestones in the history of cotton improvement in India.

Bt cotton adoption in India show that the technology leads to significant pesticide reductions, yield gains, and income increases on average. Bt technology might not be suitable for all farmers because pest pressure and access to effective alternatives vary from case to case (Qaim *et al.,* 2005). The non-Bt cotton farmers use chemical fertilizers, organic manures and bullock labour excessively which result in a lower net returns. Technology has been found the major contributor to the total productivity difference between Bt and non- Bt cottons. Seed cost, yield of Bt cotton and cost of plant protection have been found to greatly influence the probability of adoption of Bt cotton (Kiresur *et al.,* 2011). Farmers that used cotton engineered to produce the *Bacillus thuringiensis* (Bt) substantially reduced the use of pesticide without reducing the output/ha. or quality of cotton. This resulted in substantial economic benefits for small farmers (pray *et al.,* 2001). Bt variety generally resulted in a per hectare increase in yields, value of output and reduction of pesticide costs which outweighed the increase in seed costs to give a substantial increase in gross margins (Ismael *et al.,* 2001). To evaluate and propose interventions in cropping pattern of any area a comprehensive study and understanding of socio economic conditions of farming livelihoods is essential. In Warangal district of Telangana state a case study was taken up to evaluate the socio economic impact of Bt cotton and Non-Bt cotton on Different size farm households.

Materials and Methods

A detailed survey on Socio Economic profile of Bt cotton and Non-Bt cotton Farm Households in Warangal District of Telangana State was carried out in Jangoan block during the year 2016. A purposive sampling

technique was adopted for the survey. As a result Jangoan block was selected purposively based on highest area under Non-Bt and Bt cotton cultivation. The survey was conducted in six villages of Jangoan block. In each of these six villages 10 Bt cotton and 10 Non-Bt cotton households were selected as a result 60 Bt and 60 Non Bt cotton growing households selected for the study. Total 120 farm households were surveyed for the study. In each village farmers were selected in ascending order on the basis of area under Bt. cotton and Non-Bt cotton cultivation and these farmers were again classified in three different size groups on the basis of area under Bt. and non Bt. cotton cultivation viz.,

First group: Small households – less than 1 ha;

Second group: Medium households – 1 ha to less than 2 ha and

Third group: Large households – More than 2 ha

Cropping intensity formula

Cropping intensity = (Gross cropped area / Net sown area) x 100

A combination of descriptive statistics, mathematical and statistical techniques was used to achieve the objectives. Descriptive statistics like sum, average, percentage and ratio were calculated to examine the socio economic characteristics

Results and Discussion

Cropping pattern followed by farmers

Out of 60 Bt cotton Farm households which 34 farm households were categorized as small, 18 medium and 08 large households respectively. Similarly in case of the Non-Bt cotton 28 farm households were categorized as small, 19 medium and 13 were large,

respectively. Altogether 120 respondents were selected for study. Sample average of the total cultivated holdings for Bt cotton farm households was 1.31 ha. and it for Non-Bt cotton recorded as 1.39 ha. It could also be seen that land utilization pattern in different crops. The crops sown in Kharif season in this area were cotton, Paddy and Maize.

Among all these crops on an average Bt cotton has occupied 0.76 ha and Non Bt cotton occupied 0.72 ha. The area allocated to Both Bt and Non-Bt cotton was seems to be higher than the area allocated other crops due to low rainfall in the study area in particular season influencing the farmers to grow cotton crop under rain fed condition. The average total sown area for Bt cotton farm households was 2.58 ha. and for Non-Bt cotton farm households it was 2.63/ha. The cropping intensity is an indicator of the efficient use of land. The sample average Cropping intensity in Bt cotton farm households was 203.7 per cent and in case of Non-Bt cotton farm households it was 196.03 per cent (Table 1).

Family composition of different size farm groups

The average family size of all households did not vary much but 4 to 5 members were common among small, medium and large farm households in both Bt and Non-Bt cotton farm groups. The composition of an average size of the farm families according to sex and age composition is indicated in Table 2.

The sample average of male population in Bt and Non-Bt cotton farm households was 55.07 and 58.50 percent respectively. The sample average of female population in Bt and Non-Bt cotton farm households was 44.93 and 41.50 per cent respectively. The average size of farm families are four to five members were common in both Bt and Non-Bt cotton households but it was slightly higher in Bt-cotton than Non-Bt cotton.

Table.1 Detail description of cultivated holdings of farm in different size farm groups in 2016
(Area in hectares)

S.no	Particulars		Bt cotton Farm House Hold				Non-Bt cotton Farm House Hold			
			Small	Medium	Large	Sample Average	Small	Medium	Large	Sample Average
1	Size of farms group (in numbers)		34	18	8	**60**	28	19	13	**60**
2	Average size of cultivated holdings in Hectare		0.92	1.36	2.87	**1.31**	0.82	1.4	2.63	**1.39**
3	Land utilization in different crops (sown area in ha)									
	Kharif									
i	1	Cotton	0.52	0.81	1.67	**0.76**	0.45	0.64	1.58	**0.72**
	2	Paddy	0.21	0.25	0.52	**0.26**	0.19	0.26	0.37	**0.25**
	3	Maize	0.12	0.16	0.26	**0.15**	0.12	0.31	0.45	**0.25**
	4	others	0.07	0.14	0.42	**0.14**	0.06	0.19	0.23	**0.14**
ii	Rabi									
	1	cotton	0	0	0	**0**	0	0	0	**0**
	2	Chilli	0.21	0.27	0.64	**0.29**	0.18	0.25	0.64	**0.3**
	3	Maize	0.15	0.13	0.37	**0.17**	0.11	0.36	0.28	**0.23**
	4	Others	0.04	0.1	0.19	**0.08**	0.08	0.15	0.13	**0.11**
iii	Summer									
	1	Paddy	0.25	0.31	0.42	**0.29**	0.16	0.24	0.26	**0.21**
	2	Pulses	0.21	0.18	0.27	**0.21**	0.22	0.21	0.18	**0.21**
	3	Maize	0.09	0.14	0.11	**0.11**	0.12	0.06	0.21	**0.12**
	4	Others	0.12	0.12	0.04	**0.11**	0.04	0.08	0.06	**0.06**
4	Total sown area		1.99	2.66	4.91	**2.58**	1.73	2.75	4.39	**2.63**
5	Cropping intensity		216	195	171	**203.7**	210	196	166	**196.03**

Table.2 Detail description of male and female ratio sample size of farm families in 2016

Sl. No	Particulars	Bt cotton Farm House Hold				Non-Bt cotton Farm House Hold			
		Small	Medium	Large	Sample Average	Small	Medium	Large	Sample Average
1	Male	2.55 (58)	2.77 (56.82)	2.75 (59.46)	**2.53 (55.07)**	2.82 (57.25)	2.89 (57.9)	2.9 (62.3)	**2.86 (58.5)**
2	Female	1.88 (42)	2.11 (43.18)	1.87 (40.54)	**2.06 (44.93)**	2.1 (42.75)	2.1 (42.1)	1.76 (37.7)	**2.03 (41.5)**
	Average size of farm families	4.44 (100%)	4.88 (100%)	4.62 (100%)	**4.6 (100%)**	4.92 (100%)	5 (100%)	4.69 (100%)	**4.9 (100%)**

Note: Figures in parentheses are percentage to the respective column totals.

Table.3 Educational status of different size of farm households

S. no	Particulars	Bt cotton farm household				Non-Bt cotton farm household			
		Small	Medium	Large	Sample Average	Small	Medium	Large	Sample Average
1	Average size of farm families	4.44	4.88	4.62	**4.6**	4.92	5	4.62	**4.9**
2		Educational status							
		0.7	1	0.87	**0.81**	1.14	0.63	0.46	**0.83**
i	Primary	(15.9)	(20.45)	(18.92)	**(17.75)**	(23.19)	12.63	9.81	**17**
ii	Middle High school	0.94	1.22	1	**1.03**	0.96	1.47	0.61	**1.05**
		(21.19)	(25.00)	(21.62)	**(22.46)**	(19.56)	29.48	13.1	**21.42**
iii	Intermediate	1.41	1.5	1.25	**1.41**	0.92	0.94	1.07	**0.96**
		(31.78)	(30.68)	(27.02)	**(30.80)**	(18.84)	18.95	23	**19.72**
iv	Graduation and Above	0.7	0.66	1.12	**0.75**	0.78	1.36	1.92	**1.21**
		(15.9)	(13.63)	(24.33)	**(16.31)**	(15.95)	27.36	40.98	**24.82**
3	Total literacy	3.76	4.38	4.25	**4.01**	3.82	4.42	4.07	**4.07**
		(84.77)	(89.76)	(91.89)	**(87.31)**	(77.54)	88.42	86.89	**83.30**
		0.67	0.5	0.37	**0.56**	1.1	0.57	0.53	**0.81**
4	Total illiteracy	(15.23)	(10.29)	(8.11)	**(12.69)**	(22.46)	11.58	13.11	**16.70**

Note: Figures in parentheses are percentage to the respective column total

Table.4 Detail Description of occupational distribution of farm families

S .No	Particulars	Bt cotton Farm House Hold				Non-Bt cotton Farm House Hold			
		Small	Medium	Large	Sample Average	Small	Medium	Large	Sample Average
1	Size of farms group (in numbers)	34 (100)	18 (100)	8 (100)	60 (100)	28 (100)	19 (100)	13 (100)	60 (100)
2	One occupation (Primary occupation)	9 (26.47)	6 (36.36)	7 (33.33)	17 (28.34)	12 (42.85)	8 (42.10)	6 (46.15)	26 (43.34)
3	Two occupation (Secondary occupation)	12 (35.30)	8 (36.36)	7 (38.88)	23 (38.33)	7 (25.00)	6 (31.59)	4 (30.78)	17 (28.33)
4	Three occupation (Tertiary occupation)	13 (38.23)	6 (27.27)	5 (27.77)	20 (33.33)	9 (32.15)	5 (26.31)	3 (23.07)	17 (28.33)

Table.5 Details value of asset position of farmers

S.No	Particulars	Bt cotton Farm Households				Non-Bt cotton Farm Households			
		Small	**Medium**	**Large**	**Sample Average**	**Small**	**Medium**	**Large**	**Sample Average**
1	Land	16,824	29,289	35,637	27,250	15,630	38,970	62,570	39,057
		(34.70)	(32.67)	(19.12)	(28.83)	(32.38)	(34.88)	(32.08)	(33.11)
2	Farm buildings	9,567	22,560	26,795	19,641	9,850	28,127	37,961	25,313
		(19.74)	(25.18)	(14.38)	(19.77)	(20.40)	(25.16)	(19.47)	(21.17)
3	Farm machinery &equipments	8,261	19,561	98,261	42,028	8,550	16,327	68,734	31,204
		(17.04)	(21.82)	(52.75)	(30.54)	(17.72)	(14.62)	(35.24)	(22.53)
4	Live stock	13,821	18,221	25,633	19,225	14,234	28,329	25,776	22,780
		(28.52)	(20.33)	(13.75)	(20.87)	(29.50)	(25.34)	(13.21)	(23.00)
	Total value	48,473	89,631	1,86,326	1,08,143	48,264	1,11,753	1,95,401	97,208
		(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

Detail description of literacy of farm families

The analysis has indicated that among different size farm groups on an average 17.75 percent of farm families had primary education, 22.46 percent middle high school, 30.8 percent intermediate and 16.3 percent graduates in Bt cotton households. The total literacy and illiteracy rate of Bt cotton households was recorded as 87.31 and 12.69 percent respectively. However as the size of the farm increases literacy rate also increasing from small to large households in Bt cotton. As regards to the Non- Bt cotton households in different size farm groups on an average 17 percent of farm families had primary education, 21.42 percent middle high school, 19.72 percent intermediate education, 24.82 percent having education up to graduation. The total literacy and illiteracy rate of Bt cotton households was recorded as 83.30 and 16.7 percent respectively. The total literacy was seems to be high in Bt cotton than Non-Bt cotton households. The literacy rate increasing from small to large both in case of Bt and Non-Bt. Cotton (Table 3).

Occupation details

The size of the farms group in numbers for Bt cotton farm households in small, medium, large size of farms were 34, 18 and 8 respondents respectively. The size of farms group numbers for Non-Bt cotton farm household in small, medium, large size of farms were 28, 19 and 13 respondents respectively. The sample average of Primary occupation was highest in Non-Bt cotton farm households (43.34 per cent) and 28.34per cent of Bt cotton farm households were engaged with primary occupation. The sample average of Secondary occupation for Bt cotton and Non-Bt cotton farm households was 38.33 and 28.33 percent respectively. The sample average of Tertiary occupation for Bt cotton and Non-Bt cotton farm households was 33.33 per cent and 28.33 per cent respectively

Asset position of farmers

Farm assets include land, farm buildings, farm machinery and equipment, livestock, depreciation on farm buildings and depreciation on farm machinery and

equipment per year. Sample average value for land, farm buildings, farm machinery and equipment and the livestock was Rs.27,250, Rs.19,641, Rs.42,368 and Rs.19,225 respectively. In Non-Bt cotton farm households Sample average value for land, farm buildings, farm machinery and equipment and the livestock was Rs.39,057, Rs25,313, Rs 31,204 and Rs22, 780 respectively.

The results of socio economic characteristics show impact on adoption of any new interventions in crop production and technology. According to the results the area under Bt cotton was slightly higher than the area under Non-Bt cotton. But totally area allocated to cotton was higher than the other crops cultivated in the study area. The average family size of all households did not vary much 4 to 5 members were common in both Bt and Non-Bt cotton households. It was also found that illiteracy is higher in Non-Bt cotton(16.70 percent) households as compared to the Bt cotton households(12.69 percent) indicating that these less illiteracy of Non-Bt cotton households making them pay less attention on adoption of new interventions in agriculture as like Bt cotton. Primary occupation was highest in Non-Bt cotton farm households as against to the Bt cotton households indicating that Non-Bt

cotton farmers concentration was directed only on one occupation (primary occupation). The total average value of assets was found to be higher at Bt-Cotton households as compared to the Non-Bt cotton households.

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