



A Study on extent of Adoption of Bt Cotton Production Technologies by the Bt cotton growers of Andhra Pradesh

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ABSTRACT

The study on Adoption of Bt cotton production technology in Andhra Pradesh was studied in Adilabad, Guntur and Kurnool districts of Andhra Pradesh. The results revealed that there was significant difference among the small, medium and large groups of farmers in respect of adoption of Bt cotton production technologies. Majority of the respondents had medium level of adoption category followed by high and low. The results also indicated that majority of the respondents adopted the use of Bt cotton hybrids (100%), top dressing of nitrogen and potash fertilizers (86.36%), use of recommended insecticides against sucking pests (84.09%). The least adoption was for basal application of phosphate fertilizers (12.5%), crop rotation (6.81%), growing of inter crops (5.68%), keeping yellow sticky traps for management of white flies (3.40%), stem application of monochrotophos (3.40%), topping of branches in cotton at 18-20 sympodial braches stage (2.27%), Regarding application of bio fertilizers, maintenance of refuge crop cent per cent of the small farmers did not adopt.

Key words : Critical difference, Content analysis, Refuge crop, Biofertilisers, Stem application

Commercial cultivation of Bt cotton was started in India during 2002. The new production technologies recommended for Bt cotton cultivation should be transmitted from the sources where it is generated to the farms where it is adopted. So the present study has been undertaken to analyse the extent of adoption of Bt cotton production technologies by the farmers of Andhra Pradesh. Identifying the Bt cotton cultivation practices followed by farmers not only have the way for improving their present management practices but also it may through some light to the researcher to evolve economically feasible technologies.

MATERIAL AND METHODS

Three districts namely Guntur, Adilabad and Kurnool representing Andhra, Telangana and Rayalaseema regions of Andhra Pradesh respectively were selected for the study. Guntur, Adilabad and Kurnool districts were purposively selected based on highest area under Bt cotton cultivation in their respective regions. Two mandals from each district were selected by using random sampling technique. Thus, a total of 6 mandals were

selected from all the three districts for the study. 18 villages at the rate of three villages from each mandal were selected randomly. From each village ten farmers comprising small (88), medium (49) and Large farmers (43) were selected by following proportionate stratified random sampling method. Thus, a total number of 180 respondents were selected from 18 villages. For the present study, a schedule consisted of 20 items which represents the entire package of practices of Bt cotton cultivation was prepared duly considering the literates for knowledge inventory. Each practice adopted within the range by a farmer was given a score of one. The score summated for all the adopted practices formed the total score of the individual. Further the item response analysis of adoption of recommended practice was done with the help of percentages. Based on the total score obtained by the respondents on the adoption level, they were grouped in to three categories on the basis of mean and standard deviation. In this study the farmers who had followed the practices as recommended were considered as adopters and those who had not followed were non-adopters for that practice.

RESULTS AND DISCUSSION

The Findings and discussions are presented in the following sub sections.

1. Distribution of respondents based on their adoption of technologies of Bt cotton cultivation.
2. Difference in Adoption of farmers with respect to Bt cotton cultivation technologies

1. Distribution of respondents based on their adoption of technologies of Bt cotton cultivation.

To find out the extent of adoption of recommended Bt cotton cultivation technologies, 20 practices were identified. The response of the farmers was obtained on adoption and non adoption of Bt cotton cultivation technologies. The results of the table 1 indicated that, in the case of small farmers 54.54 per cent of the respondents had medium level of adoption followed by high (23.86%) and low (21.60%). Regarding medium farmers majority (53.06%) of the respondents had medium level of adoption followed by high (26.54%) and low (20.40%). With respect to large farmers 60.46 per cent of the farmers had medium level of adoption followed by high (25.58%) and low (13.95%).

Further the data pertaining to all the farmers put together it was found that 55.56 per cent of the respondents had medium level of adoption followed by high (25.00%) and low (19.44%) level of adoption of Bt cotton technologies.

2. Differences in adoption of farmers with respect to Bt cotton cultivation technologies.

The data regarding to the adoption of different categories of farmers were analysed by applying analysis of variance test to find out the differences in their adoption scores. The results were presented in table 2.

Null hypothesis:

There is no significant difference among the mean adoption score of farmers in three groups.

Empirical hypothesis:

There is significant difference among the mean adoption score of farmers in three groups.

As could be seen from the table 2 reveals that calculated F value was more than the table value. Therefore, the null hypothesis was rejected and empirical hypothesis was accepted and concluded that there was significant difference among the three groups of farmers in respect of adoption of Bt cotton cultivation technologies. To determine significant differences among three categories of farmers the critical difference were calculated and presented in Table 3

In order to find out whether there is any significant difference among the groups the data was subjected to ANOVA and the results indicated a significant difference. In order to probe more deeply into which of the groups are differing, critical difference (CD) value was computed.

It can seen from table 3 that there was significant difference in adoption of small and medium and medium and large farmers as it is evident from the mean values of small and medium farmers (0.94), medium and large farmers (0.7) and small and large (1.64) farmers with greater than C.D value. An observation of the results of the table reveal that there is a significant difference in adoption levels of small, medium and large farmers which could be due to the differences in their level of education, mass media exposure and economic motivation.

It was quite interesting to note from the table 4 that highest extent of adoption of recommended technologies by the small, medium, large and pooled farmers belonged to medium category followed by high and low. This clearly shows that farmers might have been convinced of the merits of the use of Bt cotton hybrids which helped in building favourable attitude, thereby resulted in adoption of Bt cotton cultivation practices. High returns from Bt cotton cultivation and better bollworm control might have contributed for the adoption of Bt cotton cultivation. In addition to that, majority of the Bt cotton growers had medium economic motivation and knowledge. These could be the other reasons for majority of them with medium adoption level.

However efforts should be directed by the extension functionaries to see that all the farmers should adopt recommended technologies of Bt cotton by organizing on farm trials on location

Table 1. Distribution of the respondents according to their adoption.

Category	Small farmers (88)		Medium farmers (49)		Large farmers (43)		Total (180)	
	F	%	F	%	F	%	F	%
Low	19	21.60	10	20.40	6	13.95	35	19.44
Medium	48	54.54	26	53.06	26	60.46	100	55.56
High	21	23.86	13	26.54	11	25.58	45	25.00
Mean	7.75		2.37		8.69			
SD	2.59		9.39		2.48			

Table 2. Difference in Adoption scores of farmers in respect of Bt cotton cultivations technologies.

Source of variations	D.F	Sum of scores	Mean sum of scores	F.cal val	F. tab value
Between samples	2	84.01277	42.00638	6.928**	3.4
Within samples	177	1073.18723	6.06320		
Total	179	1157.2			

*significant at 0.01 level of probability

Table 3. Critical difference between the groups of respondents in respect of adoption scores.

S.No	Categories of farmers	Mean	Difference in mean	CD value (cal)	Significance
1	Small	7.75	0.94	0.5087	Significant
2	Medium	8.69			
3	Small	7.75	1.64	0.5087	Significant
4	Large	9.39			
5	Medium	8.69	0.7	0.5087	Significant
6	Large	9.39			

specific problems of Bt cotton, large scale demonstrations on proven technologies derived through on farm trials and method demonstrations on stem application, yellow sticky traps, use of naphthalic acidic acid, application of herbicides and bio-fertilizers. the results were in conformity with the findings of Sriram (1999), Reddy and Venkata

ramaiah (2003), Shashidhara and Manjunath(2008), Prasad *et.al.*, (2010) and Naik *et.al.*, (2010).

The result in table 4 reveals the item analysis of Bt cotton cultivation technologies. Twenty items related to Bt cotton cultivation technologies were selected for the item analysis of adoption of Bt cotton cultivation technologies. The detailed discussion is given under.

1 Use of Bt cotton hybrids

The data in the table 4 shows that all the respondents are using Bt cotton hybrids for sowing. The apparent reasons were that farmers were getting more net income when compared with Non-Bt cotton. However there is need to conduct assessment and refinement by KVKs, DAATTCs on the performance of available Bt cotton hybrids to different plant density levels under different farming situations. Extension functionaries including agricultural scientists are facing problems when farmers are asking about recommended Bt cotton hybrids for a particular area or a particular farming situation.

2 Maintenance of refuge crop

Regarding maintenance of refuge crop only 9.30 per cent of the large farmers and 2.04 per cent of the medium farmers have grown refuge crop. They felt that maintenance of refuge crop needs extra spraying of insecticide for the control of boll worms on refuge crop. It has been found that farmers are not properly trained in adopting bio safety measures such as growing of refuge crop so as to avoid building up of the resistance by boll worms against the Bt toxin. Therefore growing of refuge crop should be given adequate attention in the farmers trainings, front line demonstrations and mass media coverage.

3 Recommended spacing

It was also revealed from the table 4 that nearly fifty per cent of small and medium farmers, 30.23 per cent of large farmers were maintaining recommended inter and intra row spacing for Bt cotton. Respondents opined that the recommended spacing for red soils holds good. But for black cotton soils, the recommended spacing of 90cmx45cm was not feasible during excess rainfall situation.

4 Application of farm yard manure

Regarding application of farm yard manure, 13.64 per cent of the small farmers, 16.33 per cent of the medium farmers and 9.30 per cent of the large farmers adopted for Bt cotton. The poor economic condition of the small farmers, high cost of farm yard manure, insufficient stock of FYM

for application, consumption of more labour for transport and application and manure reserved for chilli crop were the major constraints expressed by the respondents for non application of farm yard manure. Some of the medium farmers were able to apply farm yard manure once in two years. Hence, farmers should be motivated by the extension functionaries to go for other alternatives like green manuring, vermiculture and bio-fertilisers for maintenance of soil health.

5 Application of bio-fertilisers

Regarding application of Bio-fertilisers cent per cent of the small and medium farmers did not adopt and 16.28 per cent of the large farmers were applying bio-fertilisers supplied by the Department of Agriculture under Farmers Field Schools (FFS). Further the data pertaining to all the farmers put together only 3.88 per cent of the farmers were adopting bio-fertilizers. Farmers were not convinced about the importance of bio-fertilizers possible due to the absence of a visible effect. Lack of proper knowledge about the utility of the bio fertilizers, non availability of bio fertilizers in local market at proper time, lack of proper demonstrations could be the other reasons for non adoption of bio fertilizers. Further, farmers were not fully aware of the subsidies given by the Department of Agriculture for bio fertilizers. The same results were reported by Sriram and Palaniswamy (1999).

6 Application of phosphate fertilizer as basal dose

Regarding application of phosphate fertilizers as basal, only 12.5, 16.33, 9.30 per cent of the small, medium and large farmers respectively were adopting. As all the farmers taken together it was 12.78 per cent. Phosphate fertilizers were recommended as basal application only. But majority of the farmers were applying phosphate fertilizers as top dressing in two to three split dosages. They felt that frequent application of nitrogenous fertilizers without phosphate fertilizer causes susceptibility to pests and diseases. Hence, it is required to make aware of such practice by conducting method demonstrations, seasonal long training programmes.

7 Application of micronutrients

Micronutrients were applied by 15.91 per cent of small farmers, 16.33 per cent of medium farmers and 30.23 per cent of large farmers. In the case of all the farmers put together 19.44 per cent of farmers were applying micro nutrients. The reason for adopting micronutrients on Bt cotton were attributed to result of effective extension effort to protect the crop from micronutrient deficiencies. Anyhow, it is necessary to intensify extension programmes particularly for marginal farmers to increase their adoption level on use of micronutrients, which would help in increasing the yield of Bt cotton.

8 Top dressing of N and K fertilizers

Regarding top dressing of N and K fertilizers 86.36, 89.80, 88.37 per cent of the small, medium and large farmers respectively were applying nitrogen and potash fertilizers. With the case of all the farmers it was 87.80 per cent. But during interaction with the respondents they opined that the recommended dosage is not sufficient for getting higher yields. So they were applying more quantity of N and K fertilizers than the recommended. So the research wing should refine the fertilizers dosage and schedules. Balance nutrient management is one of the important components of sustainable farming. So farmers are to be educated on balanced nutrient management through trainings and demonstrations.

9 Spraying of urea or potassium nitrate

Spraying of urea or potassium nitrate was followed by 72.73 per cent of small farmers, 93.88 per cent of medium farmers, 79.07 per cent of large farmers, and when all the farmers are taken together it was 80.00 per cent. The reason for high adoption of spraying of urea or potassium nitrate might be due to the reason that it involved low cost and simple nature of the technique to adopt the practice. In addition to that urea has compatibility with most of the insecticides and fungicides.

10 Spraying of naphthalic acetic acid

Spraying of naphthalic acetic acid was followed by 31.82, 12.24, 41.86 per cent of the small, medium and large farmers respectively and when

all the farmers are taken together it was 47.20 per cent. Nearly half of the respondents did not apply Naphthalic Acetic Acid (NAA) to control flower drop. Lack of knowledge about the advantages and lack of technical guidance were the major reasons for non adoption of Naphthalic acetic acid.

11 Irrigation at critical stages

Irrigation at critical stages was followed by 22.73 per cent of small farmers, 10.20 per cent of medium farmers, 18.60 per cent of large farmers and when all the farmers are taken together, it was only 18.33 per cent. Majority of the farmers were not able to irrigate their cotton fields due to non availability of source for irrigation. So efforts are directed to popularize less water using Bt cotton production technologies like drip irrigation and alternate furrow irrigation for achieving maximum water use efficiency and thereby high productivity of Bt cotton.

12 Adoption of crop rotation

Crop rotation was adopted by 6.81 per cent of small farmers, 2.04 per cent of medium farmers 37.21 per cent of large farmers and when all the farmers are taken together, it was only 12.78 per cent. Respondents were adopting crop rotation with chilli or soybean. The reason for low adoption may be due to non remuneration of the recommended crops for crop rotation.

13 Adoption of inter cropping

Inter cropping was adopted by 5.68, 2.04, 13.95 per cent of the small, medium and large farmers respectively. When all the farmers taken together it was 6.66 per cent. Majority of the respondents did not adopt inter cropping with pulses. Farmers expressed that 'inter crops compete with cotton crop for nutrient' and 'increased pest and disease incidence' as the major reasons for not growing intercrops. In addition to that they opined that intercrops in Bt cotton were not remunerative and there was possibility for reduction in Bt cotton yields.

14 Use of recommended herbicides

The recommended herbicides were applied by 13.64, 12.24 and 32.56 per cent of the small, medium and large farmers. When all the farmers taken together it was 17.78 per cent. Interestingly,

Table 4. Content analysis of adoption of Bt cotton cultivation technologies.

S.No	Statement	Respondents															
		Small farmers (88)				Medium farmers (49)				Large farmers (43)				Total (n = 180)			
		Adoption		Non adoption		Adoption		Non adoption		Adoption		Non adoption		Adoption		Non adoption	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Use of Bt cotton hybrids	88	100	0	0	49	100	0	0	43	100	0	0	180	100	0	0
2	Maintenance of refuge crop	0	0	88	100	1	2.04	48	97.96	4	9.302	39	90.7	5	2.778	175	97.22
3	Maintenance of recommended spacing	52	59.09	36	40.91	20	40.82	29	59.18	13	30.23	30	69.77	85	47.22	95	52.78
4	Application of FYM	12	13.64	76	86.36	8	16.33	41	83.67	4	9.302	39	90.7	24	13.33	156	86.67
5	Application of Bio fertilizers	0	0	88	100	0	0	49	100	7	16.28	36	83.72	7	3.889	173	96.11
6	Basal application of P fertilizer	11	12.5	77	87.5	8	16.33	41	83.67	4	9.302	39	90.7	23	12.78	157	87.22
7	Application of micronutrients	14	15.91	74	84.09	8	16.33	41	83.67	13	30.23	30	69.77	35	19.44	145	80.56
8	Top dressing of N and K fertilizers	76	86.36	12	13.64	44	89.8	5	10.2	38	88.37	5	11.63	158	87.78	22	12.22
9	Spraying of urea / DAP/ Potassium nitrate	64	72.73	24	27.27	46	93.88	3	6.122	34	79.07	9	20.93	144	80	36	20.00
10	Irrigation at critical stages	20	22.73	68	77.27	5	10.2	44	89.8	8	18.6	35	81.4	33	18.33	147	81.67
11	Use of NAA to induce flowering	28	31.82	60	68.18	6	12.24	43	87.76	18	41.86	25	58.14	52	28.89	128	71.11
12	Crop rotation	6	6.818	82	93.18	1	2.04	48	97.96	16	37.21	27	62.79	23	12.78	157	87.22
13	Growing of intercrops	5	5.682	83	94.32	1	2.04	48	97.96	6	13.95	37	86.05	12	6.667	168	93.33
14	Use of recommended herbicides	12	13.64	76	86.36	6	12.24	43	87.76	14	32.56	29	67.44	32	17.78	148	82.22
15	Topping of branches in Bt cotton at 18-20 symphydial branch stage	2	2.273	86	97.73	3	6.122	46	93.88	3	6.977	40	93.02	8	4.444	172	95.56
16	Keeping of yellow sticky traps for the management of white flies	3	3.409	85	96.59	3	6.122	46	93.88	4	9.302	39	90.7	10	5.556	170	94.44
17	Use of neem products	70	79.55	18	20.45	21	42.86	28	57.14	28	65.12	15	34.88	119	66.11	61	33.89
18	Stem application of Monochrotophos or imidacloprid for control of sucking pests	3	3.409	85	96.59	1	2.04	48	97.96	0	0	43	100	4	2.222	176	97.78
19	Use of recommended insecticides against sucking pests	74	84.09	14	15.91	38	77.55	11	22.45	27	62.79	16	37.21	139	77.22	41	22.78
20	Application of recommended chemicals against bacterial leaf spot	17	19.32	71	80.68	22	44.9	27	55.1	16	37.21	27	62.79	55	30.56	125	69.44

cent per cent of small farmers were not adopting herbicides. Due to high cost of labourers nearly half of the big farmers opted for herbicides. Respondents opined that inter cultivation is highly useful not only for control of weeds but also for better growth of the plant. Lack of awareness and finance problems may be the other reasons for not applying herbicides.

15 Topping of branches at 18-20 sympodial branch stage

A few adopted technology of topping of branches at 18-20 sympodial branch stage. only 2.27 per cent of the small farmers, 6.12 per cent of the medium farmers and 6.97 per cent of the large farmers were practising. When all the farmers are taken together it was only 11.70 per cent. Topping of branches in cotton at 18-20 sympodial branch stage is the practice recommended as one of the component of IPM. But 95.56 per cent of the respondents did not adopt. Due to high escalating labour costs, farmers could not be able to practice the above method.

16 Use of yellow sticky traps

A small per cent of the small (3.40%), medium (6.12%) and large farmers (9.30%) were installing yellow sticky traps to control whitefly attack in cotton. When all the farmers are taken together it was only 5.55 per cent. Yellow sticky traps were used to control whitefly attack in cotton. 94.44 per cent of the respondents did not use yellow sticky traps. This suggests that extension agency should motivate the Bt cotton growers to keep yellow sticky traps against white flies. The farmers need to be educated on the integrated control measures of white fly; otherwise the yields are going to be reduced putting the farmers in a very disadvantaged position.

17 Use of neem products

Neem products were utilized by 79.55, 42.86 and 65.12 per cent of the small, medium and large farmers respectively. When all the farmers taken together it was 66.11 per cent. With the implementation of Farmers Field Schools, Majority of the farmers are getting neem products on subsidy from the Department of Agriculture. In addition to that sincere efforts by the extension functionaries

regarding popularization of neem products for the management of sucking pests made the farmers to adopt neem products.

18 Stem application of monochrotophos

A non-significant adoption was found in stem application of monochrotophos by small (3.40%), medium (2.04%) and zero per cent of large farmers respectively. When all the farmers taken together it was only 2.22 per cent. Stem application was recommended to control the sucking pests attack in cotton. Farmers were of the view that its application was labour intensive. They were also view that frequent spraying of chemicals would effectively control the sucking pests. But indiscriminate use of insecticides leads to development of resistance in sucking pests and ecological imbalance beside environmental pollution costing too much to the farmers. There is an urgent need to educate the farmers by the farm scientists, extension functionaries on stem application technique.

19 Application of recommended insecticides against sucking pests

Application of recommended insecticides against sucking pests was followed by 84.09, 77.55, and 22.45 per cent of the small, medium and large farmers respectively. When all the farmers taken together it was 77.22 per cent. Usually, the farmers resorted to spraying of pesticides even when they sighted few insects (below ETL), which was not at all warranted. Lack of technical guidance and non availability of recommended insecticides in the local market, dependence on input dealers for guidance were the dominant reasons for non-adoption of recommended dosage of insecticides. Therefore, it is necessary to develop strategy for providing technical guidance by the extension agency through mass media, demonstrations and training programmes. The finding was in line with Sriram and Palaniswamy (1999) Prasad et.al (2010).

20 Application of recommended chemicals against bacterial leaf spot

A significant adoption was found in application of recommended chemicals against bacterial leaf spot by small (19.32%), medium

(44.90%) and large farmers (37.27%). When all the farmers taken together it was 30.56 per cent.

The reason behind this was if bacterial leaf blight affects Bt cotton plant, it severally reduces the yield of cotton lint. As a result nearly half of the respondents adopted the recommended plant protection chemicals.

CONCLUSION

From the study it can be concluded that majority of the respondents had medium level of adoption and there was significant difference among small, medium and large farmers in adoption level of Bt cotton production technologies. A non-significant adoption was found in eco-friendly recommended technologies like application of bio-fertilisers, maintenance of refuge crop, intercropping, application of phosphate fertilizers as basal. So extension efforts should be directed for increasing the adoption rate on the recommended eco-friendly technologies of Bt cotton by organization of demonstrations on farmers fields, training programmes and creation of awareness among farming community through mass media. Every effort should be focused on reduction of cost of cultivation and more net income from Bt cotton cultivation.

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