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Adoption of Bt Cotton Production Technologies by the Cotton Farmers of Vizianagaram District of Andhra Pradesh

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ABSTRACT: The study on Adoption of Bt cotton production technology in Vizianagaram district of Andhra Pradesh was studied. The results revealed that there was significant difference among the small, medium and large groups of farmers in 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 o fN and K fertilsiers (75.56%) spray of urea/ potassium nitrate (66.67%).The least adoption was for maintenance of refuge crop (4.44%), stem application of monochrotophos (11.11%), topping of branches in cotton at 8- 12 sympodial braches stage(15.56%), keeping yellow sticky traps for management of white flies (17.78%), basal application of phosphate fertilizers (18.89%), and use of NAA (18.89%).
Keywords: Cotton hybrids, Content analysis, Refuge crop, Stem application

1. Introduction

Cotton is the oldest among all fibres, king of textiles, used by human beings and forms as one of the most important commercial crops playing a key role in the economy of the world. It is grown in more than 80 countries in the world as a major commercial crop with an average area of 33–34 million hectares every year. The five largest cotton producing countries in the world are China, USA, India, Pakistan and Uzbekistan, which together account for about 70 per cent of world area and production. (www.motilaloswal.com). India is the third largest cotton producer in the world behind China and the United States, accounting for 25 per cent of the world acreage but only 14 per cent of world production (USDA 200l). Cotton is grown on nine million hectares of land across India and occupies around 5 to 6 per cent of the total cultivated area distributed over 12 states in the country. Andhra Pradesh occupies a prominent position among the principal cotton producing states in India, as it accounts for around 11 per cent of the nation's cotton production and occupies third place in terms of area and production of cotton in the country. Cotton is mostly raised as a karif crop in the state. In Vizianagaram district Cotton is cultivated in 14,000ha mostly on sandy loam to clay loam soils during kharif season (Anonymous, 2012). Although, Bt cotton is grown in the district, the productivity is quite low due to low adoption of Bt cotton technologies.

The new production technologies recommended for Bt cotton cultivation should be transmitted from the sources they have generated to the farms they are adopted. The present study has been undertaken to analyse the extent of adoption of Bt cotton production technologies by the farmers of Vizianagarm district of Andhra Pradesh. Identifying the Bt cotton cultivation practices followed by farmers not only have the way for improving but also it may focus some light to the researchers to evolve economically and technically feasible technologies.

2. Material and Methods

Three predominantly cotton cultiviating mandals from Vizianagaram district viz., Saluru, Pachipenta and Komarada were selected by using random sampling technique. 9 villages at the rate of three villages from each mandal were selected randomly. From each village ten farmers comprising small (40), medium (30) and Large farmers (20) were selected by following proportionate stratified random sampling method. Thus, a total number of 90 respondents were selected from 9 villages. For the present study, a schedule consisted of 15 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. 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 into which of the groups are differing significantly, critical difference (CD) value was computed as per the procedure outlined by Panse and Sukhatme (1978).

3. Results and Discussion

Distribution of respondent farmers based on their adoption of Bt cotton technologies.

To find out the extent of adoption of recommended Bt cotton cultivation technologies, 90 practices were identified. The response of the farmers was obtained on adoption and non adoption of Bt cotton technologies. The results in the **table 1** indicated that, in the case of small farmers 55 per cent of the respondents had medium level of adoption followed by low (25%) and high (20%). Regarding medium farmers' majority (53.33%) of the respondents had medium level of adoption followed by low (30%) and high (16.66%).With respect of large farmers 50 per cent of the farmers had medium level of adoption followed by high (30%) and low (20%). Further the data pertaining to all the farmers put together it was found that 53.33 per cent of the respondents had medium level of adoption followed by low (25.55%) and high (21.11%) level of adoption of Bt cotton technologies.

Adoption levels of farmers with respect to Bt cotton cultivation technologies.

The data regarding to the adoption of different categories of farmers were analyzed by applying analysis of variance test to find out the differences in their adoption scores. The results were presented in **table 2**. It revealed 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.** 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 (0.70) and small

and large (1.64) farmers with higher C.D value. The difference in adoption levels of small, medium and large farmers could be due to the differences in their level of education, mass media exposure and economic motivation.

Among small, medium, large farmers, the highest extent of adoption of recommended technologies by the farmers belonged to medium category followed by large and small. 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. Better bollworm control and high returns from Bt cotton cultivation might have contributed for the adoption of Bt cotton technologies.

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 demonstrations on location specific problems of Bt cotton, 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 Reddy and Venkataramaiah (2003), Shashidhara and Manjunath(2008), Prasad *et.al.,* (2010) and Naik *et.al.,* (2010).

The result in **table 4** reveals the item wise analysis of Bt cotton cultivation technologies. Fifteen items related to Bt cotton cultivation technologies were selected for the item analysis of adoption of Bt cotton technologies.

Use of Bt cotton hybrids

The date in the **table 4** shows that all the respondents are using Bt cotton hybrids. 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. Awareness on recommended Bt cotton hybrids for a particular area or a particular farming situation is to be created among farmers.

Maintenance of refuge crop

Regarding maintenance of refuge crop only 15 per cent of the large farmers and 3.33 per cent of the medium farmers were adopted refuge crop. Therefore growing of refuge crop should be given adequate attention in the farmers' trainings, front line demonstrations and mass media coverage.

Recommended spacing

About 55 percent of small and 45 percent of medium and 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 in clay soils, the recommended spacing of 90cmx45cm was not feasible.

Application of farm yard manure (FYM)

The total adoption of FYM application was only mere 30 percent. Insufficient stock of FYM and high cost of farm yard manure and consumption of more labour for transport and application were the major constraints expressed by the respondents for non application of farm yard manure. Hence, farmers should be motivated by the extension functionaries to go for other alternatives like green manuring, vermicomposting for maintenance of soil physical condition and soil health.

Basal application of phosphate fertilizer

Application of phosphate fertilizers as basal, only, 12.5, 26.67, 20.0 per cent of the small, medium and large farmers respectively were adopting. As all the farmers taken together it was 18.89 per cent. Phosphate fertilizers were recommended as basal application only. But majority of the farmers were applying phosphate fertilizers (DAP) as top dressing in two to three split dosages. Hence, farmers must be make aware of such practice by conducting method demonstrations and training programmes.

Application of micronutrients

Micronutrients were applied by 20 per cent of small farmers, 26.67 per cent of medium farmers and 35 per cent of large farmers. In the case of total farmers 25.56 per cent of farmers were applying micro nutrients. Keeping the importance of micronutrient application to Bt cotton for increasing yield and quality, it is necessary to intensify extension programmes increase their adoption level.

Top dressing of N and K fertilizers

Regarding top dressing of N and K fertilizers 72.5, 80.0, 75.0 per cent of the small, medium and large farmers respectively were adopting the practice. In the case of all the farmers it was 75.56 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 in various soils for Bt cotton. Soil test based fertilizer management is one of the key components of sustainable farming. Hence farmers are to be educated on soil test based fertilizer management through trainings and demonstrations.

Spraying of urea or potassium nitrate at boll development stage

Spraying of urea or potassium nitrate at boll development stage of Bt cotton was followed by 52.5 per cent of small farmers, 83.33 per cent of medium farmers, 70.0 per cent of large farmers, and when all the farmers are taken together it was 66.67 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 and high marginal returns.

Irrigation at critical stages

Irrigation at critical stages was followed by 32.5 per cent of small farmers, 33.33 per cent of medium farmers, 20.0 per cent of large farmers and when all the farmers are taken together, it was only 30.00 per cent. Majority of the farmers were not able to irrigate their cotton fields due to non availability of source for irrigation. therefore 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.

Spraying of naphthalene acetic acid (NAA)

Spraying of naphthalene acetic acid (NAA) was followed by 15.0, 16.66, 30.0 per cent of the small, medium and large farmers respectively and when all the farmers are taken together it was 18.88 per cent. Nearly 80 percent of the respondents did not apply naphthalene acetic acid (NAA) to control flower drop. Lack of knowledge about the advantages of NAA spry and lack of technical guidance were the major reasons for non adoption of naphthalene acetic acid by the respondents.

Use of recommended herbicides

The recommended herbicides were applied by 12.5.20.0 and 35.0 per cent of the small, medium and large farmers. When all the farmers taken together it was 20.0 per cent. Lack of awareness and finance problems were reasons for not adopting the technology.

Topping of branches at 8-12 sympodial branch stage

A few adopted technology of topping of branches at 8- 12 sympodial branch stage.only 15.0 per cent of the small farmers, 16.66 per cent of the medium farmers and 15.0 per cent of the large farmers were practicing. When all the farmers are taken together it was only 15.56 per cent. Topping of branches in cotton at 8- 12 sympodial branch stage is one of the component Bt cotton technologies. But 94.44 per cent of the respondents did not adopt. Due to high escalating labour costs, and lack of awareness farmers could not be able to adopt the method.

Use of yellow sticky traps

A meager per cent of the small (17.5%), medium (23.33%) and large farmers (10.0%) were installing yellow sticky traps to control whitefly attack in cotton .When all the farmers are taken together it was only 17.78 per cent. Yellow sticky traps is a important component of integrated pest control in cotton. 82.22 per cent of the respondents did not use yellow sticky traps. This suggests that the farmers need to be educated on the integrated control measures of white fly. Similar findings were reported by Sriram and Palaniswamy (1999)

Stem application of monochrotophos

A non-significant adoption was found in stem application of monochrotophos by small (17.5%), medium (10.0%) and zero per cent of large farmers respectively. When all the farmers taken together it was only 11.11 per cent. Stem application was recommended to control the sucking pests in cotton. Farmers were of the view that its application was labour intensive. Hence, there is an urgent need to educate the farmers on stem application technique.

Application of recommended chemicals against bacterial leaf spot

A meager adoption was found in application of recommended chemicals against bactrerial leaf spot by small (7.5%), medium (20.0%) and large farmers (25.0%). When all the farmers taken together it was 15.56 per cent. The if bacterial leaf blight affects Bt cotton plant, it severally reduces the yield of cotton lint. Hence more awareness campaigns are need to be conducted on this technology.

4. Conclusion

Based on the present study it is 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 maintenance of refuge crop, use of recommended herbicides, application of phosphate fertilizers as basal. therefore extension efforts should be directed for increasing the adoption rate on the recommended Bt cotton technologies by extension units through demonstrations on farmers fields, training programmes and creation of awareness among farming community through mass media. The efforts should be focused on reduction of cost of cultivation and more net income from Bt cotton practices.

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Table 1. Distribution of the respondents according to their adoption of Bt cotton technologies.

Category	Small farmers (40)		Medium farmers (30)		Large farmers (20)		Total (90)	
	F	%	F	%	F	%	F	%
Low	10	25.00	9	30.00	4	20.00	23	25.55
Medium	22	55.00	16	53.33	10	50.00	48	53.33
High	8	20.00	5	16.66	6	30.00	19	21.11
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 variance	D.F.	Sum of scores	Mean sum of scores	F.cal val	F. tab value
Between samples	2	48.01	23.00638	5.93*	3.4
Within samples	87	573.18	4.06320		
Total	89	527.2			

*significant at 0.05 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 mean
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			

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Table 4. Content analysis of adoption of Bt cotton cultivation technologies in Vizianagaram district

		Respondents															
S. No	Statement	Small farmers (40)				Medium farmers (30)				Large farmers (20)				Total (90)			
		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	40	100.00	0	0.00	30	100.00	0	0.00	20	100.00	0	0.00	90	100.00	0	0.00
2	Maintenance of refuge crop	0	0	40	100	1	3.33	29	96.67	3	15.00	17	85.00	4	4.44	86	95.56
3	Maintenance of recommended spacing	22	55.00	18	45.00	13	43.33	17	56.67	8	40.00	12	60.00	43	47.78	47	52.22
4	Application of FYM	16	40.00	24	60.00	9	30.00	21	70.00	2	10.00	18	90.00	27	30.00	63	70.00
5	Basal application of P fertilizer	5	12.5	35	87.5	8	26.67	22	73.33	4	20.00	16	80.00	17	18.89	73	81.11
6	Application of micronutrients	8	20.00	32	80.00	8	26.67	22	73.33	7	35.00	13	65.00	23	25.56	67	74.44
7	Top dressing of N and K fertilizers	29	72.50	11	27.50	24	80.00	6	20.00	15	75.00	5	25.00	68	75.56	22	24.44
8	Spraying of urea / DAP/ Potassium nitrate	21	52.50	19	47.50	25	83.33	5	16.67	14	70.00	6	30.00	60	66.67	30	33.33
9	Irrigation at critical stages	13	32.50	27	67.50	10	33.33	20	66.67	4	20.00	16	80.00	27	30.00	63	70.00
10	Use of NAA to induce flowering	6	15.00	34	85.00	5	16.66	25	83.33	6	30.00	14	70.0	17	18.89	73	81.11
11	Use of recommended herbicides	5	12.50	35	87.50	6	20.00	24	80.00	7	35.00	13	65.00	18	20.00	72	80.00
12	Topping of branches in Bt cotton at 8-12 sympodial branch stage	6	15.00	44	85.00	5	16.66	25	83.33	3	15.00	17	85.00	14	15.56	86	95.56
13	Keeping of yellow sticky traps for the management of white flies	7	17.50	33	82.50	7	23.33	23	76.67	2	10.00	18	90.00	16	17.78	74	82.22
14	Stem application of Monochrotophos or imidacloprid for control of sucking pests	7	17.50	33	82.50	3	10.00	27	90.00	0	0.00	20	100.00	10	11.11	80	88.89
15	Application of recommended chemicals against bacterial leaf spot	3	7.50	37	92.50	6	20.00	24	80.00	5	25.00	15	75.00	14	15.56	76	84.44

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