



Extent of Adoption of Recommended Practices of Cotton Cultivation by the Farmers

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Authors' contributions

This work was carried out in collaboration between both authors. Author BS designed the study, performed the statistical analysis, wrote the protocol and wrote the manuscript. Author GR managed the data collection. Both authors read and approved the final manuscript.

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ABSTRACT

An attempt was made to assess the adoption behaviour of the cotton growers about the recommended practices and in-situ incorporation of cotton stalks by the respondent farmers. The study was conducted in four villages of Sadashivpet mandal of Medak district of Telangana purposively and a total of 120 farmers at the rate of 30 from each village were selected by following the simple random sampling technique. An interview schedule was prepared for collection data pertaining to the adoption of recommended practices and in-situ incorporation of stalks by the respondents. From the study, it could be concluded that, with respect to the adoption, majority of the farmers (70.00%) fell under medium category of adoption followed by low (17.50%) and high (12.50%) categories. With regard to the practice wise adoption, seeds and sowing, plant protection measures, land preparation and inter cultivation operations were adopted by more than eighty percent of the respondents. Among the socioeconomic characteristics of the respondents except age all other factors posed significant positive association with the extent of adoption of the recommended practices of cotton. The study also revealed that, only 35.83 per cent of the farmers were aware about the in-situ incorporation of cotton stalks in to the soil and cent percent of the farmers were aware of using the stalks as fuel/fire wood for cooking purpose.

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1. INTRODUCTION

Indian farmers have been cultivating cotton for hundreds of years. The world famous cotton in those days is Indian Cotton Fabric, Calico & Dhaka Muslin. The country is blessed with ideal climate, suitable soil and toiling farmers to cultivate cotton. The country cultivates around 12 million hectares of cotton every year as it is one of the most important fibre & cash crop and plays a dominant role in agricultural and industrial economy of the nation [1].

Cotton crop provides direct livelihood to farmers and provides employment in trade and processing activities of the cotton. The major cotton growing states which are divided into three zones, viz. north zone, central zone and south zone. North zone consists of Punjab, Haryana, and Rajasthan. Central zone includes Madhya Pradesh, Maharashtra and Gujarat. South zone comprises Andhra Pradesh, Telangana, Karnataka and Tamil Nadu.

In India, Cotton satisfies half of the domestic needs of clothing and also earns considerable amount of foreign exchange. During the Financial Year 2020 (till November 2019), exports of cotton yarn, cotton fabrics and cotton made-ups reached to US\$1.74 billion, US\$3.99 billion and US\$5.58 billion, respectively. (Source: Office of the Textile Commissioner). The country has well-established research and extension network both at public and private sectors and also has the vast experience of cultivating traditional *desi* cotton, improved varieties, hybrid cotton and transgenic cotton [1]. Introduction of Bt. cotton hybrids resulted in excellent control of American Bollworm and reduced the use of insecticides, besides reduced production cost and increasing profit, Bt cotton lowered farming risk and improved farmer's perspective in cultivating cotton crop [2].

Presently, almost 95% of the cotton area is covered with Bt cotton hybrids. Around 40% of the Indian cotton is under irrigated condition predominantly in states like Punjab, Haryana, Rajasthan, Gujarat and Tamil Nadu [1]. During 2019-20, 27 lakh bales of cotton was exported by India to China, Vietnam, Bangladesh, Pakistan and other countries and 12.50 lakh bales of cotton was imported from USA, Brazil, Egypt and other countries. Ending stocks are expected to be around 98.60 lakh bales, which is much

higher than the ending stocks of previous season. Maharashtra occupies first place in cotton cultivation with an area of 44.05 lakh ha followed by Gujarat 26.66 lakh ha, Telangana 21.26 lakh ha (52.55 lakh acres), Haryana 7.01 lakh ha and Rajasthan 6.44 lakh ha (Source: AMIC, PJTSAU [3].

In India, Telangana ranks 3rd in area and production with 52.55 lakh acres and 68.58 lakh bales accounting for 16.65 percent and 19.02 percent of all India cotton area and production respectively. Among the districts in Telangana, Nalgonda stood first with 2.73 lakh ha (6.84 lakh acres) followed by Nagarkurnool 1.42 lakh ha (3.55 lakh acres), Adilabad 1.40 lakh ha (3.50 lakh acres), Sangareddy 1.40 lakh ha (3.50 lakh acres) and Komaram Bheem 1.24 lakh ha (3.12 lakh acres) (Source: AMIC, PJTSAU).

A Tamil proverb goes like this "*Aal Pathi Aadai Pathi*" (meaning the distinction of a person is decided half by his natural appearance and half by his dress) stating the importance of clothing in our life [4,5]. The increasing population, mounting need for food and fibre, industrialisation of agriculture, globalisation demands and budding Informatics compel the modern agricultural research to introduce novel technologies that maximise the yield [6].

During the last decade, cost of cultivation was increased by three folds, consumption of fertilizer by 250% and the usage of insecticides was doubled. Further, for producing a kilogram of cotton lint, 2000 litres of water is consumed by the cotton crop, which is one of the highest in the world.

In the present situation, the Indian cotton is at cross roads. The resistance development by Pink Boll Worm, leaf curl virus and whitefly infestation yet again forcing farmers on to pesticide trade mill. It is imperative to shift towards more 'input use efficient' and 'sustainable yield enhancement techniques' in order to lower production costs and improve profits [7].

In India, around 30 million tonnes of cotton stalks are produced annually, and less than 10% of the stalks are put to commercial use and about 2.5 tonnes of stalk is produced in one ha of cotton field which will give about Rs. 5000 additional income if this is utilized for briquettes and pellets making. Cotton stalks can be utilized for bio-

enriched compost preparation and oyster mushroom cultivation [8].

Stubbles of cotton crop contain more than 1.11% of Nitrogen, 0.1% of Phosphorous, and 3.98% Potash. This indicates that, the grown crop can supplement 1.5 tons of Carbon, 20-25 kg of Nitrogen, 72 kg of Potash from the cotton stubbles collected from one hectare of cotton cultivated area. The stubbles can be chopped and incorporated with the help of a rotavator, as it can till the soil up to 6 inches. The microbial cultures can also be used to hasten the decomposition process. This operation should be taken up well before the rainy season so as to permit faster decomposition of the chopped stubbles and also improves the soil porosity and productivity [9,10]. Another way of utilizing the cotton stubbles is briquettes. Cotton stubbles inherently have substantial energy content, which varies from 17 MJ/kg to 18 MJ/kg. The stubbles can be chopped and then processed mechanically in a briquetter to form briquettes. These briquettes can be used as a renewable source of energy in substitution to fossil fuel [11].

In view of the aforementioned, this present study was undertaken to assess extent of adoption of recommended practices of cotton production and factors influencing the adoption of in-situ incorporation of cotton stalks into the soil by the respondents.

2. MATERIALS AND METHODS

2.1 Selection of Area and Respondents

Sangareddy district of Telangana state was selected purposively as the district ranks 3rd in the state with an area of 1.4 lakh hectares under cotton cultivation (Source: Department of Agriculture, Sangareddy District) and various demonstrations, capacity building programmes were organized by the extension centres of the University on recommended practices and insitu incorporation of cotton stalks. Out of 25 mandals of the district Sadashivpet mandal stands first with an area of 41, 562 acres under cotton and four villages namely, Veltur, Sadashivpet, Nizampur and Nandikandi were selected purposively as they are having highest area under cotton. A total of 120 respondents at the rate of 30 from each village were selected by using simple random sampling technique.

2.2 Data Collection Tools and Procedures

The data were collected from the respondents through personal interview with the help of

interview schedule. Necessary precautions were taken to ensure that the questions in the schedule were unambiguous, clear, concise, complete, and comprehensive. The respondents were contacted in person mostly at the common place in the village.

2.3 Statistical Analysis

The data collected for the study was tabulated, processed and analyzed using simple statistical tools like frequency and percentage, class interval, rank order and co-efficient of correlation.

3. RESULTS AND DISCUSSION

3.1 Adoption of Recommended Cotton Cultivation Practices

One of the objectives of the investigation is to study the extent of adoption of recommended cotton cultivation practices; an interview schedule with 26 statements comprising important practices was developed after through reviewing of the literature and consultation with the experts. The developed extent of adoption schedule was administered and responses on each item was measured on three point continuum that is fully adopted, partially adopted and not adopted with the scoring of 3, 2 and 1, respectively. The maximum and minimum possible scores were 78 and 26 respectively, whereas the maximum and minimum obtained scores were 61 and 34 respectively. Based on adoption scores obtained, the respondents were classified into following three categories by using exclusive class interval method. The results were expressed in the form of frequencies and percentages.

It was observed from the Table 1 that, majority of the farmers (70.00%) fell under medium category of adoption followed by high (17.50%) and low (12.50%) categories. The same results were reported by Mali [12], Rajput et al. [13] and Kumar and Dhorey [2]. The probable reason for the above result, the farmers are adopting the recommended practices but there is a need to stress up on the timely of adoption of the practices and it was also found that high cost of inputs like fertilizers and pesticides, non availability of labour and financial constraints were the factors leading to the non adoption of some of the recommended practices by the farmers.

Chart 1. Classification of respondents into three groups by using inclusive class interval technique

S. no.	Category	Score range
1	Low	34-43
2	Medium	43-52
3	High	52-61

Table 1. Distribution of the respondents according to their extent of adoption of recommended practices of cotton cultivation

(n=120)			
S. no.	Adoption level	Frequency	Percentage
1	High	21.00	17.50
2	Medium	84.00	70.00
3	Low	15.00	12.50

Table 2. Recommended package of practice wise adoption by respondents

(n =120)					
S. no.	Practices	Adopted		Not adopted	
		F	%	F	%
1	Land preparation	89.00	74.16	31.00	25.83
2	Seeds and sowing	95.00	79.16	25.00	20.84
3	Water management	44.00	36.67	76.00	63.33
4	Manure & Fertilizer management	56.00	46.67	64.00	53.33
5	Intercultural operations	80.00	66.67	40.00	33.33
6	Plant protection measures	61.00	50.83	59.00	49.17
7	Harvesting & post –harvest technology	72.00	60.00	48.00	40.00

3.2 Recommended Practices Wise Adoption

Practice wise adoption of cotton cultivation practices was presented in the Table 2. Total twenty six practices were taken for the present study and adoption was seen for each practice.

From the above table it could be observed that, among the recommended practices, seeds and sowing, plant protection measures, land preparation and inter cultivation operations were adopted by more than eighty percent of the respondents. The similar results were also reported by Mahmood et al. [14] where he reported that, on overall basis 80% of the cotton growers sowed their crop in time and about 67.5% of the farmers applied seed rate as per the recommendations.

Roy et al. [15] also reported that, 94.16 per cent and 100.00 per cent of the Bt.cotton growers completely adopted the suitable soil for Bt. cotton cultivation and major land preparation practices like tillage, harrowing or hoeing respectively. The probable reason for the above results was regular training programmes and field visits organized by the District Agricultural Advisory and Transfer of technology centre of the district and department officials facilitated them in clear

understanding critical inputs and stages of the crops, and timely adoption of recommended practices helped them in better management of the crops.

3.3 Socioeconomic Characteristics of Selected Farmers

From the study, it was evident that, above half of the (52.50%) farmers were middle aged, had medium level of income, farming experience and with intermediate level of education (25.83%). A study on factors influencing adoption of paddy straw management revealed that on the overall, an average age of respondents was 42 years with an average farming experience of family was 10.70 years and the average area under paddy was 7.45 acres [16].

From the Table 3, it can be observed that, the majority of the respondents were cultivated the cotton in an area of 2.5 to 5.00 acres and had medium level of extension contact, training undergone with medium level of mass media exposure. It could be concluded from the above results that, respondents were of middle aged with higher level of education and have undergone training programmes related to the recommended practices of cotton cultivation.

Table 3. Distribution of the respondents according to their socio-economic characteristics

Variable	Categories	Frequency (n=120)	Percentage
Age	Young age (up to 34)	42	35.00
	Middle age (34-55)	63	52.50
	Old age >55	15	12.50
Education	Illiterate	5	4.16
	Functionally literate	10	8.33
	Primary school	14	11.67
	Middle school	16	13.33
	High school	27	22.50
	Intermediate	31	25.83
	Graduation and above	17	14.17
Annual Income	Low annual income	38	31.67
	Medium annual income	68	56.67
	High annual income	14	11.66
Farming Experience	Low farming experience	38	31.67
	Medium farming experience	64	53.33
	High farming experience	18	15.00
Area under cotton cultivation	1.0 to 2.5 acres	13	10.83
	2.5 to 5.0 acres	63	52.50
	Above 5.0 acres	44	36.67
Extension contact	Low	25	20.83
	Medium	68	56.67
	High	27	22.50
Training undergone	Low	15	12.50
	Medium	60	50.00
	High	45	37.50
Mass media exposure	Low	38	31.67
	Medium	42	35.00
	High	40	33.33

3.4 Awareness about *In-situ* Incorporation and Management of Cotton Stalks

An attempt was made to assess the extent of awareness among the respondents about the management of cotton stalks and in-situ incorporation of the same for improving the soil fertility status.

From the Table 4, it could be observed that, only 35.83 per cent of the farmers were aware about the in-situ incorporation of cotton stalks in to the soil and whereas only meagre percent of the farmers (10.00%) were aware about the use of the cotton stalks as boiler fuels by preparing briquette & pellets. It is also evident from the table that, cent percent of the farmers were aware of using the stalks as fuel/fire wood for cooking purpose and use of stalks for preparation of bio enriched compost (20.83%).

Further, from the table it can be concluded that, majority of the respondents were aware of

benefits of cotton stalks incorporation i.e., about 2.5 tonnes of stalk is produced in one ha of cotton field (65.83%) followed by Incorporation of stalks/stubbles into soil helps in addition of organic matter to the soil (53.33%), Incorporation facilitates in less weed & insect pests infestation in the next crop (49.17%), Incorporation of stalks into soil helps to maintain soil quality and fertility (29.16%), Incorporation requires less investment than removal and burning (27.50%) and in-situ incorporation of cotton stalks in soil reduces the quantity of fertilizers for next crop (19.16%).

It was also evident from the table that, greater majority (80.83%) of the farmers were aware of environmental pollution of stalks burning and farmers also felt that, management of cotton stalks requires more labour and investment (74.16%). It can be concluded that, Shortage of labour, non availability of suitable technologies for hastening up the decomposition of stalks were also some of the constraints expressed by the farmers in adoption of the in-situ incorporation. Further, the burden of collection

and logistics of cotton stalks from the field limits its uses in Industrial application. These can be taken as an entrepreneurial activity by the farmers to fetch additional income from cotton cultivation.

3.5 Relationship between the Socio-economic Characteristics and Extent of Adoption of Recommended Practices by the Respondents

Efforts were made to find out the relationship of the selected personal, socio-economic, communication, situational and psychological characteristics of growers with their extent of adoption of improved cultivation practices of cotton. The coefficients of correlation were worked out and have been presented in Table 5.

From the Table 5, it could be revealed that, there was a significant negative relationship between age and extent of adoption. The reason might be that, majority of the respondents were middle aged. This age farmers are less innovative as compared to young age. The same result was reported by Kumar & Dhorey [2], Roy et al. [15] and Soumya et al. [17]. Further, it was also observed from the above table that, all other socio economic characteristics viz., education, annual income, farming experience, area under cotton cultivation, extension contact, training undergone and mass media exposure were

found to had positive and significant relationship with the extent of adoption of the respondents. The possible reasons for the above trend might be due to the fact that, literate farmers would be able to locate, understand, interpret, evaluate, and use information recommended practices effectively and efficiently. The reason might be that the respondents who had more annual income they had good farm machinery, use good quality seed, and they apply fertilizers and pesticides in appropriate time and due to frequent extension contacts there will be definitely knowledge transfer from extension agent to farmer. Logically, a farmer with more extension contacts will have more adoption of agricultural innovations. The results were in conformity with Rajput and Umesh [13], Kumar & Dhorey [2] and Chendrashekhar et al. [16].

Similar results were reported in South East Asia by Cheryll et al. [18], farming experience, farm implements and training programmes had positive and significant influence on incorporation of loose straw and stubbles method of practicing [19]. Pongchompu et al. [19] also reported that, the farmers' education, number of paddy straw compost trainings in which the farmer participated, lack of knowledge about technology, insufficient labour and difficulty in making rice straw compost had a significant impact on the farmer's decision to use paddy straw compost.

Table 4. Distribution of respondents according to their awareness about the management of cotton stalks (n=120)

S. no.	Statements	Frequency	Percent
1	Are you aware of in-situ incorporation of cotton stalks?	43.00	35.83
2	Are you aware that, cotton stalks can be used for briquette & pellet preparation and are used as boiler fuels in many industries, brick kilns, and gasification	12.00	10.00
3	In-situ incorporation of cotton stalks in soil reduces the quantity of fertilizers for next crop	23.00	19.16
4	About 2.5 tonnes of stalk is produced in one ha of cotton field	79.00	65.83
5	Incorporation of stalks into soil helps to maintain soil quality and fertility	35.00	29.16
6	Burning of stalks results in environmental pollution	97.00	80.83
7	Incorporation of stalks/stubbles into soil helps in addition of organic matter to the soil	64.00	53.33
8	Incorporation requires less investment than removal and burning	33.00	27.50
9	Incorporation facilitates in less weed & insect pests infestation in the next crop	59.00	49.17
10	Cotton stalks can be utilized for bio-enriched compost preparation	25.00	20.83
11	Management of cotton stalks requires more labour and investment	89.00	74.16
12	Use of stalks as fire wood in kitchen	120.00	100.00

Table 5. Relationship between the profile characteristics of the respondents and extent of adoption of recommended practices

S. No.	Independent Variables	r
1.	Age	-0.396**
2.	Education	0.369**
3.	Annual income	0.219*
4.	Farming experience	0.192
5.	Area under cotton crop	0.528163**
6.	Extension contact	0.193*
7.	Training undergone	0.398**
8.	Mass media exposure	0.216*

*Significant at 5 per cent level of probability (0.17934); **Significant at 1 per cent level of probability (0.23430)

Roy et al. [15] also reported that land holding, area under Bt.cotton cultivation and risk preference of the respondents were found positively and significantly correlated with adoption at 0.05 level of probability. This indicates that the farmers who had wide range of cultivated land area, along with higher proportion of area under Bt.cotton cultivation and those who took more chances in using new technologies had more adoption level. Other variables like education, farming experience in Bt.cotton cultivation, annual income, source of information, innovativeness, knowledge, irrigation facility had positively-significant relation with extent of adoption at 0.01 level of probability.

4. CONCLUSION

Majority of the cotton growers had medium level adoption of recommended practices. Higher adoption level was observed in seeds & sowing, plant protection and land preparation related practices; whereas lower adoption was observed in water, manure and fertilizer management related practices. The socio economic factors viz. education, farming experience, annual income, area under cotton cultivation, extension contact and mass media exposure were found positively correlated with the extent of adoption, while age was found negatively correlated. In view of the above findings, the study recommends that efforts should be made by extension agencies through their various programmes to highlight the economic benefits of recommended cotton cultivation practices to promote awareness among the cotton growers.

Appropriate technologies and strategies are needed either to increase yields or reduce production costs. To remain competitive in the global market, we need to take care of contamination and mixtures. Massive efforts are needed to create awareness among the cotton

farmers and to motivate them to follow the 'Best Cotton Management Practices' for improving quality and reducing the level of contamination. To achieve the targeted income by the year 2022, it is necessary to limit the growth in production costs as well as increase the productivity by utilizing all possible means. It is also very important to keep the prices at a level where farmers will get profits.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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