Extension Journal

International Journal of Agriculture Extension and Social Development

Improved cotton production practices by farmers in Haryana: Knowledge and adoption status

¹Pawan Kumar, ²Saroj Devi, ³Mujahid Khan and ⁴Rati Mukteswar

¹Krishi Vigyan Kendra, Jind, Haryana, India

²Agricultural Research Station (SKNAU, Jobner), Fatehpur-Shekhawati, Sikar, Rajasthan, India

³Department of Extension Education, CCS HAU, Hisar, Haryana, India

DOI: https://doi.org/10.33545/26180723.2024.v7.i7d.807

Corresponding Author: Pawan Kumar

Abstract
One of the most important commercial and fiber crops in the world is cotton. It provides around 60% of the raw materials required by Indian textile mills and significantly adds to the community of cotton farmers in to support their way of life. The present study was accompanied in Jind district of Haryana state in 2022 and the derived data of 120 farmers was analyzed with different statistical tools such as frequency, mean score, percentage, knowledge index, adoption index and rank order etc. The study revealed that farmers have full knowledge (100 percent) and high level (100 percent) of adoption about sowing methods and irrigation requirement by cotton crop. Majority of farmers (63.33 percent) had medium knowledge level and 16.67 percent farmers had high knowledge level about different improved cotton production practices. The findings also indicated that about 76.66 percent of the farmers had medium to low level of adoption of cotton cultivation practices.

Introduction
Agriculture has a significant potential to boost exports and generate much-needed foreign money while also directly employing and paying the societal segments that make up the majority of the population and are most vulnerable. The country's growth is still dependent on agriculture. Due to the fact that it provides the industries with raw materials, agriculture is very important. Agriculture is a key component of several of the largest businesses, including those that use cotton, jute, and sugar as raw materials.

From an economic standpoint, it is possible to ascertain the significance of the agricultural system since, as in any other industry, agriculture's efficiency is attained via the best possible use of available resources. Resources include things like land, manpower, money, and irrigation systems. What crops to grow, how much area to dedicate to each crop activity, and what other resources should be used to achieve the best possible allocation of land and other resources utilizing the best technique and combination of inputs for each crop will maximize agricultural profits. Cotton is one of the major fiber crops of the world and is used about 3/4th of world's population for textile purposes. The cotton plant's fiber is a key component of the world's textile industry and contributes significantly to the nation's foreign exchange profits. (Deepika *et al.*, 2020) [6].

In India, cotton is an important commercial crop valued for its oil and fiber. By giving millions of people jobs, it has a big impact on the economy of the country. Thus, it significantly contributes to the community of Indian cotton farmers' ability to maintain a sustainable way of life by meeting about 60% of the raw material needs of Indian textile mills. (Annual report, Ministry of textile, 2020-2021, Kranthi and Stone, 2020) [10]. Due to its high importance in agricultural and industrial sectors this is considered as "White Gold" (Ahmed *et al.*, 2018, Prasad *et al.*, 2018, Sun *et al.*, 2019; Khan *et al.*, 2020) [1, 18, 23].

All four domesticated cotton species, as well as their intra- and inter-specific hybrids, are only farmed in India (Chockalingam, 2016) [5]. In India, cotton has been utilized as a natural fabric from the beginning of time. Evidence suggests that India has been growing cotton since the Indus Valley time period. India is renowned for having extraordinary weaving and spinning abilities. (Ramesh *et al.*, 2020) [19].

Cotton is mainly produced in Gujarat (90 lakh bales), Maharashtra (84 lakh bales), Telangana (51 lakh bales), Rajasthan (32 lakh bales), Haryana (22.5 lakh bales), Karnataka (22 lakh bales), Madhya Pradesh (18 lakh bales), Andhra Pradesh (17 lakh bales), Punjab (11 lakh bales) and Tamil Nadu (6 lakh bales) (Indiastat.com 2020) [7].

In addition to the pink bollworm infestation in Bt cotton that has been observed by farmers over the past few years and the heavy pesticide use that has accompanied it, many additional difficulties have also been mentioned by cotton growers. As a result, the current study's goal was to examine farmers' understanding of various cultivating techniques and their level of adoption of these techniques.

Materials and Methods

The present study was performed in 2022-23 with the objective to analyze the knowledge and adoption level of the farmers. The study was implemented in Jind district of Haryana state. Two blocks *i.e.* Uchana and Narwana from Jind district were selected purposively, as these blocks have the highest production of cotton in the district. To select the ultimate sample of the farmers practicing cotton cultivation, simple random sampling design was adopted. The 60 farmers from each block were selected randomly. Thus, a total 120 farmers were selected randomly for this study. These farmers were questioned based on three point continuum *i.e.* High, Medium and Low level of knowledge and adoption. Depending on the type and amount of data that was available, several analytical tools and techniques were used to analyze the data in order to meet the specific goals of the study. The raw score was converted into the knowledge index and adoption index by using following formula:

$$\text{Knowledge Index} = \frac{\text{Actual obtained knowledge score}}{\text{Maximum obtainable knowledge score}} \times 100$$

$$\text{Adoption Index} = \frac{\text{Actual obtained adoption score}}{\text{Maximum obtainable adoption score}} \times 100$$

The respondents were categorized into low, medium and high level of knowledge and adoption on the basis of knowledge and adoption index.

Results and Discussion

Farmers' knowledge level regarding improved cotton production practices

The existing knowledge of cotton growers has been presented in Table 1 and practice wise knowledge level of the respondents was worked out for interpretation. The results indicated that the greater part of the cotton growers (56.66 percent) had high level of knowledge and 43.33 percent had medium level of knowledge regarding seed rate. In case of sowing method and irrigation, 100 percent farmers had high level of knowledge. As regards with manure and fertilizer, it was observed that 60.00 percent of the respondents possessed high level of knowledge and 40.00 percent had medium level of knowledge.

Table 1 also reveals that 40.00 percent farmers possessed high, 38.33 percent medium while only 21.66 percent had low level of knowledge about intercultural operations. It is reveals from the table that majority of the respondents (66.66 percent) had low whereas 33.33 percent of the respondents had medium level of knowledge about use of hormones in production of cotton. Not even a single respondent was found to have high level of knowledge of it. The table also shows that 51.66 percent of the respondents had medium, 30.00 percent had low and 8.33 percent had high level of knowledge regarding insect-pests and their control. Similar findings were obtained by Sharma *et al.* (2021) [20] in their research.

In case of diseases and their control, it was observed that 53.33 percent of the respondents had medium, 35.00 percent had low and only 11.66 percent had high level of knowledge. In case of nematodes control, 73.33 percent farmers had high level of knowledge and 26.66 percent

farmers had medium level of knowledge. The study gets support from Singh (2004) [22] and Kumar *et al.* (2016) [12].

Knowledge index of cotton growers (Rank ordering)

The major technological practices of cotton cultivation were given ranks based on their knowledge index (Table 1). It is evident from the table that knowledge of cotton growers for sowing methods and irrigation was 100 percent and these two practices were ranked 1st, followed by nematodes control (91.11 percent), manure & fertilizer (86.66 percent) and seed rate (85.55 percent) were ranked 2nd, 3rd and 4th, respectively. Intercultural operations (72.77 percent), diseases & their control (58.88 percent), insect-pests & control (52.77 percent) and use of hormones (44.44 percent) were ranked 5th, 6th, 7th and 8th, respectively.

Overall knowledge status of cotton growers

To study the knowledge status of recommended package of practices, a schedule was developed which contained appropriate questions related to cotton cultivation. It was measured on a three-point continuum i.e. high knowledge, medium knowledge and low knowledge. Accordingly, based on their overall knowledge, score of the farmers were divided into low, medium and high categories. The results are presented in Table 2. The data indicated that 20.00 percent of the respondents had low level of knowledge, while 63.33 percent of them had medium level of knowledge and remaining 16.67 percent of respondents possessed high knowledge level. These findings are supported by Kumari *et al.* (2022) [13], Pedhekar (2015) [17] and Bishnoi *et al.* (2016) [3]. The further analysis of data presented in Table 2 shows that most of the respondents (83.33 percent) had low to medium level of knowledge. These results are in line with Deepika (2020) [6], Jeya (2020) [8], Parkash and Peshin (2020) [15] and Kumar *et al.* (2021) [11].

Association between personality traits of the cotton growers and their knowledge level

The findings of the correlation coefficient between personality traits of cotton growers and their knowledge level clearly demonstrated that the chosen independent variables like education, mass media exposure (MME) and socio-economic status (SES) had positive and highly significant relationship at 0.01 level of significance with dependent variable knowledge level of respondents towards improved cotton production practices (Table 3). This means that cotton growers having higher education, mass media exposure and socio-economic status possessed higher level of knowledge regarding improved cotton production practices. The selected personality traits of cotton growers were fitted in the multiple regression equation for determining the type and magnitude of variation caused by these traits and results are also given in Table 3. The results clearly showed that the independent variables education, landholding and SES were significant at 0.05 level of significance. The findings showed that an increase of one unit in each of the age, education, land holding, MME, extension contact and SES would result in a corresponding increase of 1.78, 5.92, -3.62, 0.95, 1.27 and 4.81 units in knowledge. The results showed that these independent variables contributed 46.40 percent in knowledge level of

farmers. This means that only 46.40 percent of variation in the dependent variable was due to these independent variables and the remaining 53.60 percent is due to unexplained variables. These findings are partially in line with Kumar *et al*. (2021) [11] and Jeya (2020) [8].

Table 1: Knowledge level of farmers regarding improved cotton production practices

Sr. No.	Practices	Knowledge level	Score range	No. of growers	Percentage	Mean score	Kn. Index	Rank order
1.	Seed Rate	Low	1	0	00.00	2.56	85.55	IV
		Medium	2	52	43.33			
		High	3	68	56.66			
2.	Sowing Method	Low	3-5	0	00.00	3.00	100	I
		Medium	6-7	0	00.00			
		High	8-9	120	100.0			
3.	Manure & Fertilizer	Low	1	0	00.00	2.60	86.66	III
		Medium	2	48	40.00			
		High	3	72	60.00			
4.	Intercultural Operations	Low	2-3	26	21.66	2.18	72.77	V
		Medium	4-5	46	38.33			
		High	>5	48	40.00			
5.	Irrigation	Low	1-3	0	00.00	3.00	100	I
		Medium	4-6	0	00.00			
		High	>6	120	100.0			
6.	Use of Hormones	Low	2-3	80	66.66	1.33	44.44	VIII
		Medium	4-5	40	33.33			
		High	>5	0	00.00			
7.	Insect-Pests & control	Low	5-8	36	30.00	1.58	52.77	VII
		Medium	9-12	62	51.66			
		High	> 12	10	08.33			
8.	Diseases & their control	Low	1	42	35.00	1.76	58.88	VI
		Medium	2	64	53.33			
		High	3	14	11.66			
9.	Nematodes control	Low	1	0	00.00	2.73	91.11	II
		Medium	2	32	26.66			
		High	3	88	73.33			

Table 2: Cotton growers' overall knowledge status

S. No.	Knowledge status	Knowledge score	No. of growers	Percentage
1.	Low	32-39	24	20.00
2.	Medium	40-47	76	63.33
3.	High	48-54	20	16.67

Table 3: Correlation and regression coefficients with knowledge level of farmers

Sr. No.	Particulars	Correlation coefficient	Regression coefficient	t-value
1.	Age	-0.09	0.06	1.78
2.	Education	0.51**	1.15	5.92*
3.	Land holding	0.08	-1.33	-3.62*
4.	MME	0.34**	0.17	0.95
5.	Extension contact	0.12	0.15	1.27
6.	SES	0.42**	1.08	4.81*

Constant value in regression equation = 12.03
R^2= 0.464

Farmers' adoption level regarding improved cotton production practices
The Table 4 shows that majority of cotton growers (51.66 percent) had high level of adoption while 48.33 percent had medium level of adoption regarding seed rate. The data contained in table reveals that 100 percent of growers possessed high level of adoption about sowing methods. Regarding manure and fertilizer, it was observed that majority of respondents (50.00 percent) had high and 38.33 had medium level of adoption. As intercultural operations is concerned, it was observed that 40.00 percent of the respondents had high level of adoption, 38.33 percent had medium and only 21.66 percent had low adoption level. Majority of cotton growers (91.66 percent) had high level while 8.33 percent had medium level of adoption for recommended irrigation.

In case of use of hormones, it was found that 66.66 percent of respondents had low and 33.33 percent had medium level of adoption. It was also observed from Table 4 that 8.33 percent of the respondents had high, 48.33 percent had medium and 43.33 percent had low level of adoption regarding diseases and their control. The study has brought out that high percentage of respondents (51.66 percent) were in medium to high levels of adoption for insect-pests and their control. Regarding nematodes control, it was observed that 26.66 percent of the respondents had medium and 73.33 percent of respondents had high level of adoption. The results of the study partially get support from Sharma *et al*. (2021) [21].

Table 4: Adoption level of farmers regarding improved cotton production practices

Sr. No.	Practices	Adoption level	Score range	No. of growers	Percentage (%)	Mean score	Adoption Index	Rank order
1.	Seed rate	Low	1	00	00.00	2.51	83.88	IV
		Medium	2	58	48.33			
		High	3	62	51.66			
2.	Sowing method	Low	3-5	00	00.00	3.00	100	I
		Medium	6-7	00	00.00			
		High	8-9	120	100.00			
3.	Manure & fertilizer	Low	1	14	00.00	2.38	79.44	V
		Medium	2	46	38.33			
		High	3	60	50.00			
4.	Intercultural operations	Low	2-3	26	21.66	2.18	72.77	VI
		Medium	4-5	46	38.33			
		High	>5	48	40.00			
5.	Irrigation	Low	1-3	00	00.00	2.91	97.22	II
		Medium	4-6	10	08.33			
		High	>6	110	91.66			
6.	Use of hormones	Low	2-3	80	66.66	1.33	44.44	IX
		Medium	4-5	40	33.33			
		High	>5	00	00.00			
7.	Insect-pests & control	Low	5-8	58	48.33	1.55	51.66	VIII
		Medium	9-12	58	48.33			
		High	> 12	04	03.33			
8.	Diseases & their control	Low	1	52	43.33	1.65	55.00	VII
		Medium	2	58	48.33			
		High	3	10	08.33			
9.	Nematodes control	Low	1	00	00.00	2.73	91.11	III
		Medium	2	32	26.66			
		High	3	88	73.33			

Adoption index of cotton growers (Rank ordering)
The major scientific practices of cotton cultivation were accorded ranks based on adoption index score (Table 4). It is evident from table that the adoption index of sowing methods was highest (100 percent) and accorded first rank. It implies that the adoption of sowing methods by respondents was highest. It is followed by irrigation (97.22 percent), nematodes control (91.11 percent), seed rate (83.88 percent) and manure & fertilizer (79.44 percent) and these were ranked 2nd, 3rd, 4th and 5th, respectively. The adoption index of inter cultural operations (72.77 percent) and diseases & their control (55.00 percent) were ranked 6th

and 7th, respectively. Insect-pests and their control (51.66 percent) was least adopted practice by the respondents.

Overall adoption status of cotton growers
According to Table 5, 18.33 percent respondents fell into the low adopter category, followed by 58.33 percent of those in the medium adopter category and 23.33 percent of those in the high adopter category. It shows that low to medium levels of cotton growing practices were used by roughly 76.66 percent of the farmers. These results were supported by Landge (2001) [14], Bodake (2003) [4] and Bhajipale *et al.* (2021) [2].

Table 5: Cotton growers' overall adoption status

S. No.	Adoption status	Adoption score	No. of growers	Percentage
1	Low	32-38	22	18.33
2	Medium	39-45	70	58.33
3	high	46-51	28	23.33

Association between personality traits of the cotton growers and their adoption level
The results of the correlation coefficient between adoption level of farmers for improved cotton production practices and their socio-economic traits clearly show that selected independent variables like education, MME and SES had positive and highly significant relationships with the dependent variable at a 0.01 level of significance (Table 6). The results of regression analysis clearly depicted that the independent variables education, landholding and SES were significant at 0.05 level of significance.

The outcomes indicated that an increase of one unit in each of the age, education, land holding, MME, extension contact and SES would result in a corresponding increase of 1.83, 4.98, -3.47, 0.30, 0.77 and 4.98 units in adoption. The results showed that these independent variables contributed 41.20 percent in adoption level of cotton growers. This means that only 41.20 percent of variation in the dependent variable was due to these independent variables and the remaining 58.80 percent is due to unexplained variables. These findings are partially in line with Patel *et al.* (2008) [16].

Table 6: Correlation and regression coefficients with adoption level of farmers

Sr. No.	Particulars	Correlation coefficient	Regression coefficient	t-value
1	Age	-0.07	0.06	1.83
2	Education	0.47**	0.94	4.98*
3	Land holding	0.09	-1.23	-3.47*
4	MME	0.29**	0.05	0.30
5	Extension contact	0.09	0.09	0.77
6	SES	0.42**	1.08	4.98*

Constant value in regression equation = 13.68
R^2 = 0.412

Conclusion

The majority of farmers had medium to high knowledge level (80 percent) and adoption level (81.66 percent) about different cotton cultivation practices. But, still there is a scope to improve the knowledge and adoption levels of farmers. The knowledge level of cotton cultivating farmers can be improved by integrating the knowledge of different innovative groups of the farmers. The farmers can be motivated to adopt improved production practices by providing effective information from sources like authorized agencies, organizations and SAUs. Enhancement of knowledge level is positively related to adoption of different cotton production practices. By providing training and motivating the local leaders, people's participation can be enhanced because they rely on them easily.

References

1. Ahmed M, Shahid AA, Din SU, Akhtar S, Ahad A, Rao AQ, Husnain T. An overview of genetic and hormonal control of cotton fiber development. Pak J Bot. 2018;50(1):433-443.
2. Bhajipale D, Kharde P, Karangami R. Extent of Adoption of Improved Cultivation Practices of Watermelon. Indian J Ext Educ. 2021;55(2):20-24. Available from: https://epubs.icar.org.in/index.php/IJEE/article/view/109191
3. Bishnoi M, Sisodia S, Ranawat Y. Knowledge of Farmers about Improved Bt Cotton Production Technology. J Prog Agri. 2016;7:64-66.
4. Bodake HD. Awareness and adoption of biofertilizers by the farmers. M.Sc (Agri.) Thesis. Dr. PDKV, Akola; 2003.
5. Chockalingam MM. A Profile of Indian Cotton: At A Glance. The Cotton Corporation of India Limited, Mumbai; 2016. p. 1-6.
6. Deepika M, Asokhan V, Rani S. Knowledge level of ELS cotton growers in Vellore district – An analysis. J Cotton Res Dev. 2020;34(1):129-134.
7. Indiastat. Agricultural Production. 2020. Available from: https://www.indiastat.com/data/agriculture
8. Jeya R. Knowledge level of hybrid cotton growers on cotton cultivation practices. Plan Archives. 2020;20(1):503-505.
9. Khan MA, Wahid A, Ahmad M, Tahir MT, Ahmed M, Ahmad S. World cotton production and consumption: An overview. In: Cotton production and uses. 2020. p. 1-7.
10. Kranthi KR, Stone GD. Long-term impacts of Bt cotton in India. Nat Plants. 2020;6(3):188-196.
11. Kumar KU, Bose DK, Jahanara. Knowledge of Farmers on Improved Cotton Production Practices in Yadadri Bhuvanagiri District of Telangana. Int J Adv Agric Sci Technol. 2021;8(10):29-38.
12. Kumar P, Shehrawat PS, Rohila AK, Ghanghas BS, Ansul. Knowledge Status of Masumbi (Citrus sinensis) Cultivating Farmers of Haryana (India): A Sustainable Fruit Crop. Indian J Ecol. 2016;43(2):599-601.
13. Kumari V, Chander S, Malik K, Kaur B. Assessment of Knowledge and Adoption of Drip Irrigation in Cotton Crop among Farmers of Haryana. Indian J Ext Educ. 2022;58(4):149-154. Available from: https://epubs.icar.org.in/index.php/IJEE/article/view/128456
14. Landge TP. Knowledge and adoption of cultivation practices recommended for PKV Rajat cotton. M.Sc (Agri.) Thesis. Dr. PDKV, Akola; 2001.
15. Parkash S, Peshin R. Growers Knowledge of Improved Maize Production Technologies in Jammu Region of J&K. Indian J Ext Educ. 2020;56(3):41-47. Available from: https://epubs.icar.org.in/index.php/IJEE/article/view/106966
16. Patel JB, Patel SR, Patel BD. Factors influencing adoption level of cotton growers about IPM technology. Gujarat J Ext Educ. 2008;XVIII-XIX:87-89.
17. Pedhekar RD. Knowledge and Adoption of Ratoon Management Practices by the Sugarcane Growers. MPKV, University Library Rahuri; c2015.
18. Prasad BMVS, Bhattiprolu SL, Kumari VP, Kumar PA. *In vitro* evaluation of fungicides against Alternaria macrospora causing leaf spot in cotton. Int J Curr Microbiol Appl Sci. 2018;7(1):2551-2557.
19. Ramesh, Krishnamurthy KN, Naveenkumar GS, Samma N, Avinash G. Growth in Area, Production and Productivity of Cotton Crop in Selected Districts of Karnataka, India. Int J Curr Microbiol Appl Sci. 2020;9(2):689-694.
20. Sharma T, Kathpalia J, Kumari V, Tyagi R. Cropping Pattern and Adoption of Bt. Cotton among Bt. Cotton Growing Farmers in Haryana-A Sociological Study. J Global Commun. 2021;14(1):53-59.
21. Sharma K, Dhaliwal NS, Bishnoi C. Adoption Status of Improved Crop Production Practices in Bt-cotton in Sri Muktsar Sahib, Punjab. Indian J Ext Educ. 2021;57(2):63-68. Available from: https://epubs.icar.org.in/index.php/IJEE/article/view/111677
22. Singh M. Adoption and constraints in mango cultivation. M.Sc Thesis (unpublished). Department of Extension Education, CCSHAU, Hisar; 2004.
23. Sun W, Gao Z, Wang J, Huang Y, Chen Y, Li J, *et al*. Cotton fiber elongation requires the transcription factor GhMYB212 to regulate sucrose transportation into expanding fibers. New Phytol. 2019;222(2):864-881.