



## Research Article

# ADOPTION OF FARMERS ABOUT Bt COTTON PRODUCTION TECHNOLOGY IN BHILWARA DISTRICT OF RAJASTHAN

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Received: November 29, 2016; Revised: December 01, 2016; Accepted: December 02, 2016; Published: December 12, 2016

**Abstract-** Cotton is grown chiefly for its fiber use in the manufacture of clothes and for the purpose like making threads for mixing in other fiber and extraction of oils from the cotton seeds. The present study was conducted in the purposely selected Bhilwara district of Rajasthan. There are total twelve tehsils in Bhilwara district of Rajasthan, out of which, two tehsil namely Mandalgarh and Asind have been selected on the basis of maximum area under cultivation of Bt cotton. Four villages selected from each tehsil were taken on the basis of maximum area under Bt cotton cultivation. The list so prepared, 5 marginal, 5 small and 5 large Bt growers were selected randomly from each identified village. Thus, in all 120 farmers (40 marginal, 40 small and 40 large farmers) were included in the sample of the study. The Study indicated that 43.33 per cent of the total respondents were in the medium level of adoption group, whereas 37.50 per cent respondents were in high adoption group and remaining 19.17 per cent Bt cotton growers were observed in the category of low level of adoption about Bt cotton production technology and there was significant difference among marginal, small and large farmers with respect to adoption of improved cotton production technology.

**Keywords-** Bt-Cotton, Adoption, Production and Technology

**Citation:** Bishnoi Manmeet, et al., (2016) Adoption of Farmers about Bt Cotton Production Technology in Bhilwara District of Rajasthan. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 8, Issue 60, pp.-3353-3356.

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**Academic Editor / Reviewer:** D. Jacob

## Introduction

Cotton (*Gossypium spp.*) the "white Gold", is a very important commercial crop of India. It sustains the country's cotton textile industry which is perhaps the largest organized industry in the country. Cotton is grown chiefly for its fiber use in the manufacture of clothes and for the purpose like making threads for mixing in other fiber and extraction of oils from the cotton seeds. The oil content in the cotton seed ranges from 15-25 per cent depending on the variety. American cotton contains more per cent of oil. Cotton seed cake after extraction of oil is good organic manure and contains about 6 per cent nitrogen, 3 per cent phosphorus and 2 per cent potash. Cotton linters, seeds and pulp obtained during oil extraction and cotton meal are good concentrate feed for cattle [1].

In India, the annual area under this crop is 76.6 lakh hectares with annual production of 136.0 lakh bales and average productivity of 301.5 kg per hectare. It is cultivated on a large scale in Maharashtra, Gujarat, Karnataka, Madhya Pradesh, Punjab, Rajasthan, Haryana, Tamil Nadu and Uttar Pradesh. Maharashtra is the largest producer of cotton in India followed by Gujarat and Andhra Pradesh. In India the total area under Bt cotton cultivation was 7.0 Lakh hectares in the year 2008, which is 80 per cent of the total cotton growing area. In Rajasthan Bt cotton grown in an area of 4.5-5.0 lakh hectares which is 68 per cent of the total cotton growing area. The major cotton growing districts are Bhilwara, Chittorgarh, Rajsamand, Banswara, Shri-Ganganagar, Bikaner and Nagaur [2].

## Materials and Methods

The present study was conducted in the purposely selected Bhilwara district of Rajasthan. There are total twelve tehsils in Bhilwara district of Rajasthan, out of which, two tehsils namely Mandalgarh and Asind were selected on the basis of

maximum area under cultivation of Bt cotton. Further, a comprehensive list of all the major Bt cotton growing villages was prepared in consultation with the personnel of revenue and agriculture department from the identified tehsil. Four villages selected from each tehsil were taken on the basis of maximum area under Bt cotton cultivation. Thus, total eight villages were selected for the present investigation. For selection of respondents, a comprehensive list of Bt cotton growers was prepared with the help of village patwari and agriculture supervisor of respective villages. The list so prepared, 5 marginal, 5 small and 5 large Bt growers were selected randomly from each identified village. Thus, in all 120 farmers (40 marginal, 40 small and 40 large farmers) were included in the sample of the study. Data were collected by personnel interview method through structured schedule. Thereafter, data were tabulated, analysed and conclusion were drawn in light of the objective. [3] [4]

## Statistics

In order to answer the research questions mentioned under hypothesis and to achieve the object of the study, investigator undertook appropriate and most pertinent statistical analysis. The following statistical methods were used in the present study:

### Percentage and frequency:

The percentage and frequency of each studied item was calculated and a comparison was made in interpreting the results.

### Mean per cent score:

It was calculated by multiplying total obtained score of the respondent by 100 and divided by the maximum obtainable score.

$$\text{Mean per cent score} = \frac{\text{Total score obtained}}{\text{Maximum obtainable score}} \times 100$$

**Rank:**

Ranks were accorded in the descending order according to the mean per cent score obtained.

**Standard deviation:**

The standard deviation was used for categorization of respondents in three group on the basis of observed age, education, income, knowledge, adoption and constraints of farmers about Bt cotton cultivation practices. The formula for standard deviation is as follows:

$$S.D. = \sqrt{\frac{\sum X_i^2}{n} - \frac{(\sum X_i)^2}{(n)^2}}$$

Where,

S.D. = Standard deviation  
 $\sum X_i^2$  = Sum of square of the observations  
 $\sum X_i$  = Sum of value of the observations  
 n = Number of respondents

**Analysis of Variance**

Analysis of variance in this study used to test the significance of difference in the knowledge, adoption and constraints of different categories of respondents. The following formula was used for calculating 'F' value,

$$F = \frac{A}{B} = \frac{\text{Mean Sum of Square "between villages"}}{\text{Mean Sum of Square "within villages"}}$$

$$\text{Correction Factor (C.F.)} = \frac{(\sum x_i)^2}{N}$$

Where,

$\sum x_i$  = Grand total of all observations  
 N = Total number of respondents

$$\text{Total Sum of Squares (T.S.S.)} = (\sum x_i)^2 - C.F.$$

Where,

$(\sum x_i)^2$  = Sum of square of all observations

**Sum of Square between groups (G.S.S.)**

$$G.S.S. = \frac{(\sum x_1)^2}{N_1} + \frac{(\sum x_2)^2}{N_2} + \frac{(\sum x_{ni})^2}{N_3} - C.F.$$

$\sum x_i$  = Sum of square of all observations

$N_1$  = Total number of respondents in each group

**Sum of square within group (error):** = T.S.S.-S.S. between groups

**Degree of freedom: between groups** = k-1

Total = N-1

Within group = N-K

**Mean Sum of square for the groups & error:**

$$M.S.S. = \frac{\text{Sum of squares}}{\text{Respective degree of freedom}} \times 100$$

The level of significance at 5 per cent & 1 per cent were used

**Results and Discussion**

In the modern era new ideas are being invented by agricultural scientists and put to use by farming communities but all the innovations are not being adopted by many of the members of a social system. The results are presented in the subsequent tables.

**Distribution of respondents on the basis of their level of adoption**

To get an overview of adoption level, the respondents were divided into three groups viz., (i) low level of adoption (< 18) (ii) medium level of adoption (18 to 34) and high level of adoption (>34). The groups were formulated on the basis of calculated mean and standard deviation of the adoption scores obtained by the respondents. The results are presented in the [Table-1].

**Table-1** Distribution of respondents on the basis of level of adoption of Bt cotton production technology n=120

| S. No. | Adoption level         | Marginal farmers |        | Small farmers |        | Large farmers |        | Total |        |
|--------|------------------------|------------------|--------|---------------|--------|---------------|--------|-------|--------|
|        |                        | f                | %      | f             | %      | f             | %      | f     | %      |
| 1      | Low (< 18 score)       | 11               | 27.50  | 8             | 20.00  | 4             | 10.00  | 23    | 19.17  |
| 2      | Mediu (18 to 34 score) | 22               | 55.00  | 16            | 40.00  | 14            | 35.00  | 52    | 43.33  |
| 3      | High (>34 score)       | 7                | 17.50  | 16            | 40.00  | 22            | 55.00  | 45    | 37.50  |
|        | Total                  | 40               | 100.00 | 40            | 100.00 | 40            | 100.00 | 120   | 100.00 |

f = frequency, % = per cent

The data show in [Table-1] indicate that 43.33 per cent of the total respondents were in the medium level of adoption group, whereas 37.50 per cent respondents were in high adoption group and remaining 19.17 per cent Bt cotton growers were observed in the category of low level of adoption about Bt cotton production technology.[5]

Further, among the various categories of Bt cotton growers, it was observed that 55.00 per cent marginal farmers, 40.00 per cent small farmers and 35.00 per cent large farmers were in the medium adoption category. Whereas, 17.50 per cent marginal, 40.00 percent small farmers and 55.00 per cent large farmers were reported in high adoption group. Likewise, 27.50, 20.00 and 10.00 per cent marginal, small and large farmers possessed low level of adoption respectively about Bt cotton production technology.

**Aspect-wise level of adoption of Bt cotton production technology**

Individual aspect wise level of adoption of Bt cotton growers was worked out. For this mean percent score of each practice was calculated. The results are presented in [Table-2] reveals that adoption of high yielding varieties was 60.83

per cent among large farmers, while in case of small and marginal farmers it was 50.00 and 49.17 per cent respectively. It was noted that most of the farmers were sowing NCS-145, NCS-913, NCS-858, and NCS-138 varieties of Bt cotton in the study area. Regarding level of adoption of recommended soil treatment, it was found that marginal, small and large farmer with MPS 11.67, 15.00 and 20.83 per cent adoption respectively. This aspect was ranked seventeenth by marginal, large and eighteenth by small farmers.

Analysis of [Table-2] indicate that the adoption about recommended seed rate, it was found that large, small and marginal farmers had 59.17, 55.00 and 43.33 per cent adoption respectively. This practice was ranked thirteenth by large, tenth by small and marginal farmers, in order of adoption of Bt cotton production technology. The extent of adoption about recommended plant to plant and row to row spacing, it was found that large, small and marginal farmers had 42.50, 32.50 and 26.67 per cent adoption respectively. This practice was ranked fifteenth by large, small and sixteenth by marginal farmers, in order of adoption of Bt cotton production technology. Likewise, the adoption about recommended depth of sowing was 41.67, 31.67 and 27.50 MPS in large, small and marginal farmers,

respectively. This practice was ranked sixteenth by large farmers, small farmers and fifteenth by marginal farmers. It was found that the level of adoption about seed treatment to prevent seed born disease was 29.17, 38.33 and 46.67 per cent

among marginal, small and large farmers respectively. This practice was ranked fourteen by large, marginal and small farmers.

**Table-2** Extent of adoption of Bt cotton production practices by the respondents  $n = 120$

| S. No | Aspect                                                              | Marginal farmers |      | Small farmers |      | Large farmers |      | Total |      |
|-------|---------------------------------------------------------------------|------------------|------|---------------|------|---------------|------|-------|------|
|       |                                                                     | MPS              | Rank | MPS           | Rank | MPS           | Rank | MPS   | Rank |
| 1.    | Adoption of Bt cotton varieties                                     | 49.17            | 9.5  | 50.00         | 13   | 60.83         | 12   | 53.33 | 11   |
| 2.    | Proper soil treatment to prevent the soil born diseases             | 11.67            | 17   | 15.00         | 18   | 20.83         | 17   | 15.83 | 17   |
| 3.    | Recommended seed rate                                               | 43.33            | 11   | 55.00         | 10   | 59.17         | 13   | 52.50 | 12   |
| 4.    | Recommended spacing (i.e. PXP, RXR)                                 | 26.67            | 16   | 32.50         | 15   | 42.50         | 15   | 33.89 | 15   |
| 5.    | Recommended depth of sowing                                         | 27.50            | 15   | 31.67         | 16   | 41.67         | 16   | 33.61 | 16   |
| 6.    | Proper seed treatment to prevent the seed born diseases             | 29.17            | 14   | 38.33         | 14   | 46.67         | 14   | 38.06 | 14   |
| 7.    | Recommended time of sowing                                          | 85.00            | 1    | 85.83         | 1    | 89.17         | 1    | 86.67 | 1    |
| 8.    | Recommended method of sowing                                        | 65.00            | 3    | 71.67         | 4    | 75.00         | 6    | 70.56 | 4    |
| 9.    | Application of nitrogenous fertilizers as per recommendation        | 64.17            | 4    | 76.67         | 3    | 88.33         | 2    | 76.39 | 3    |
| 10.   | Application of phosphatic fertilizers as per recommendation         | 78.33            | 2    | 79.17         | 2    | 80.00         | 3    | 79.17 | 2    |
| 11.   | Recommended doses of micro nutrient application                     | 9.17             | 18   | 15.83         | 17   | 20.00         | 18   | 15.00 | 18   |
| 12.   | Time of fertilizer application as per recommendation                | 56.67            | 6    | 63.33         | 8    | 68.33         | 9    | 62.78 | 9    |
| 13.   | Use of herbicides for weed control                                  | 40.83            | 13   | 50.83         | 12   | 62.50         | 11   | 51.39 | 13   |
| 14.   | Use of mechanical methods for weed control                          | 52.50            | 8    | 67.50         | 6.5  | 77.50         | 5    | 65.83 | 6    |
| 15.   | Recommended irrigation management                                   | 49.17            | 9.5  | 67.50         | 6.5  | 74.17         | 7    | 63.61 | 7.5  |
| 16.   | Recommended insecticides, their concentration and time of spray     | 55.00            | 7    | 62.50         | 9    | 73.33         | 8    | 63.61 | 7.5  |
| 17.   | Recommended fungicides, their concentration and time of application | 42.50            | 12   | 53.33         | 11   | 67.50         | 10   | 54.44 | 10   |
| 18.   | Recommended harvesting methods                                      | 58.33            | 5    | 70.00         | 5    | 79.17         | 4    | 69.17 | 5    |

MPS = Mean per cent score

Further analysis of [Table-2] indicates that adoption regarding recommended time of sowing was 85.00, 85.83 and 89.17 MPS among marginal, small and large farmers, respectively. This practice was ranked first by marginal farmers, small and large farmers. The level of adoption of recommended method of sowing was 65.00, 71.67 and 75.00 MPS among marginal, small and large farmers respectively. This aspect was third ranked by marginal farmers, fourth ranked by small farmers and sixth ranked by large farmers. It was noted that level of adoption of recommended nitrogenous fertilizers was 64.17, 76.67 and 88.33 per cent by marginal, small and large farmers respectively. This aspect was fourth ranked by marginal farmers, third ranked by small farmers and second ranked by large farmers. A view of table further indicates that the adoption of recommended phosphatic fertilizers was 78.33, 79.17 and 80.00 per cent by marginal, small and large farmers respectively. This aspect was second ranked by marginal and small farmers and third ranked by large farmers. It was noted that level of adoption of recommended dose of micro-nutrients was 9.17, 15.83 and 20.00 per cent by marginal, small and large farmers respectively. This aspect was eighteenth ranked by marginal farmers, seventeenth ranked by small farmers and eighteenth ranked by large farmers. It was noted that level of adoption of time of fertilizer application as per recommendation was 56.67, 63.33 and 68.33 per cent by marginal, small and large farmers respectively. This aspect was sixth ranked by marginal farmers, eighth ranked by small farmers and ninth ranked by large farmers. A view of table further indicates that the adoption about use of herbicides for weed control was 40.83, 50.83 and 62.50 per cent among marginal, small and large farmers respectively. This aspect was thirteenth ranked by marginal farmers, twelfth ranked by small and eleventh by large farmers. It was found that the adoption of mechanical methods for weed control was 52.50, 67.50 and 77.50 per cent among marginal, small and large farmers. This aspect was eighth ranked by marginal farmers, 6.5th ranked by small farmers and fifth ranked by large farmers.

It was noted that level of adoption of recommended irrigation management practices was 49.17, 67.50 and 74.17 per cent by marginal, small and large farmers respectively. This aspect was 9.5th ranked by marginal farmers, 6.5th ranked by small farmers and seventh ranked by large farmers. A view of table further indicates that the adoption about recommended insecticide, their concentration and time of spray was 55.00, 62.50 and 73.33 per cent MPS in marginal, small and large farmers respectively. This aspect was seventh ranked by marginal farmers, ninth ranked by small and eighth rank by large farmers.

Likewise, the adoption of recommended fungicides their concentration and time of application was 42.50, 53.33 and 67.50 MPS in marginal, small and large farmers respectively. This aspect was twelfth ranked by marginal farmers, eleventh ranked

by small and tenth by large farmers. It was noted that level of adoption of recommended harvesting methods was 58.33, 70.00 and 79.17 MPS in marginal, small and large farmers respectively. This aspect was fifth ranked by marginal and small farmers and fourth ranked by large farmers.

It was found that the overall adoption of recommended time of sowing was ranked first with MPS 86.67 likewise, application of phosphatic fertilizers as per recommendation with MPS 79.17, application of nitrogenous fertilizers as per recommendation with MPS 76.39, following recommended method of sowing with MPS 70.56 were ranked second, third and fourth respectively in adoption by the Bt cotton growers. A high adoption was found in these practices because these practices do not require much specialized skills by the farmers. It was found that Bt cotton growers had less adoption regarding using recommended doses of micro-nutrients with MPS 15.00, proper soil treatment to prevent the soil born diseases with MPS 15.83 using recommended depth of sowing with MPS 33.61 and adoption of following recommended spacing with MPS 33.89 and they were ranked eighteenth, seventeenth, sixteenth and fifteenth respectively. It was observed that it may be due to lack of knowledge of soil treatment chemicals, high cost of micro-nutrients may causes less adoption of these recommended practices by the Bt cotton growers.

#### Comparison of adoption among marginal, small and large farmers with respect to improved Bt cotton production technology

To find out the variation or similarity in the adoption of marginal farmers, small farmers and large farmers about improved Bt cotton production technology, 'f' test was applied. The results were presented in [Table-3].

#### Hypothesis

$H_{01}$  : There is no significant difference among the different categories of the farmers with respect to adoption of improved Bt cotton production technology.

$RH_1$  : There is significant difference among the different categories of the farmers with respect to adoption of improved Bt cotton production technology.

The data presented in [Table-3] reveal that the calculated 'F' value (24.35) is higher than tabulated 'F' value. Thus, the null-hypothesis ( $H_{01}$ ) is rejected and alternative hypothesis "there is a difference among the different categories of farmers with respect to adoption of improved Bt cotton production technology" was accepted. It means that there was difference between the marginal farmers and large farmers with respect to adoption of Bt cotton production technology. As per mean value table, the adoption level difference between large, small and marginal farmers may be due to the fact that large farmers of the study area are more

educated, possessed more knowledge of Bt cotton production technology with better cosmopolitan outlook. The cumulative effect of these entire factors might have led to comparative higher adoption among large farmers.

**Table-3** Comparison of adoption of Bt cotton production technology among different categories of farmers n=120

| Source of variation               | d.f. | SS       | MSS     | F CAL  | F TAB |
|-----------------------------------|------|----------|---------|--------|-------|
| Between the categories of farmers | 2    | 2132.15  | 1066.08 | 24.35* | 3.074 |
| Error                             | 117  | 5121.18  | 43.77   |        |       |
| Total                             | 119  | 10497.33 |         |        |       |

\*\* Significant at 5 per cent level of significance.

*Mean Value Table*

| S. No. | Categories of farmers | Mean value | SEm±  | CD   |
|--------|-----------------------|------------|-------|------|
| 1.     | Marginal farmers      | 24.40      | 3.308 | 9.25 |
| 2.     | Small farmers         | 29.60      |       |      |
| 3.     | Large farmers         | 34.73      |       |      |

### Conclusion

The findings indicated that 43.33 per cent of total respondents adopted the Bt cotton production technology to medium level, whereas 37.50 and 19.17 per cent of total respondents adopted Bt cotton production technology to high and low level respectively. The findings of the study indicated that farmers had adequate adoption regarding recommended time of sowing, application of phosphatic fertilizer as per recommendation, application of nitrogenous fertilizer as per recommendation, recommended method of sowing and recommended harvesting method, whereas they had less adoption regarding recommended dose of micro nutrients application, proper soil treatment to prevent the soil borne diseases and recommended depth of sowing. The study further indicated that there was significant difference among marginal, small and large farmers with regard to adoption of Bt cotton production technology.

### Acknowledgement

The authors are heartily thankful to Department of Extension Education, Rajasthan College of Agriculture, MPUA&T (Udaipur) for providing data collection facilities and also thankful my adviser, Dr. S.S. Sisodia and Dr. F.L. Sharma (HOD) for providing the facilities for the investigation.

### Author Contributions: None declared

### Abbreviations:

|               |   |                        |
|---------------|---|------------------------|
| %             | - | Per cent               |
| <i>et al.</i> | - | et alibi (& elsewhere) |
| f             | - | Frequency              |
| MPS           | - | Mean Per cent Score    |
| n             | - | Number of responden    |

### Conflict of Interest: None declared

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