Assessment of Adoption Levels of Recommended Cotton Cultivation Practices in Jamnagar District, Gujarat

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ABSTRACT

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| This study investigates the assess adoption level of cotton growers in the Jamnagar district, where cotton is a major cash crop that generally yields better returns than expected despite several factors hindering profitability. A multi-stage sampling technique was used to select 120 farmers from the Jamnagar district. Primary data was gathered through structured questionnaires. The adoption levels of recommended cotton cultivation practices were analyzed by three point scale measure and categorized in low, medium and high adoption, revealing a mean adoption index of 18.02 with a standard deviation of 1.96. The results show that majority of farmers that is 57.50% had a medium level of adoption, while education playing a key role in influencing adoption of recommended practices among cotton growers. Effective pest initiation spraying, pink bollworm management, and fungal foliar disease control have been significant barriers. Enhanced on-field demonstrations and reinforced extension services for pest control will improve adoption, leading to higher yields and increased profitability in the region. |

***Keywords****: Cotton; Adoption levels, cotton growers, cultivation practices*

1. INTRODUCTION

Cotton is a vital fiber and cash crop in India, playing a crucial role in the nation's industrial and agricultural economy. It is the only agricultural commodity that serves as a source of both fiber and food. Cotton is a natural fiber derived from the fluffy fibers surrounding the seeds of the cotton plant, which belongs to the genus \*Gossypium\*. It has a deep-rooted and rich history spanning thousands of years. India has long been a major producer and exporter of cotton, with its cultivation holding significant historical and economic importance. The country's cotton industry plays a crucial role in both the national economy and the agricultural sector. India's key cotton-producing states include Gujarat, Maharashtra, Andhra Pradesh, Telangana, Punjab, Haryana, Rajasthan, Madhya Pradesh, Karnataka, and Tamil Nadu. Cotton is Gujarat's most significant non-food cash crop, covering approximately 26 lakh hectares annually and yielding about 120 lakh bales of lint, 25 lakh tonnes of cottonseed, and 110 lakh tonnes of stalks, with a total value of around ₹16,000 crores. This highlights cotton's critical role in the state's agricultural economy (Prajapati *et al.,* 2018; Prajapati *et al.,* 2020). The Saurashtra region accounts for 16 lakh hectares of cotton cultivation, contributing roughly 60% of the state’s total cotton area and production. Notably, all three species of cotton are grown in Saurashtra, making it a key region for cotton cultivation and emphasizing the need for focused research to improve productivity. Cotton occupies about 4.5 lakh hectares in the Surendranagar district which is leading coton dristrict in Saurashta. Based on conservative estimates, if 5 lakh hectares of cotton were to receive irrigation, additional production of 15-18 lakh bales could be achieved. Moreover, hybrid cotton would be cultivated instead of desi cotton, leading to a superior-quality yield. Surendranagar has also been identified as a center for a cotton research institute by GSBTM (*Anon*., 2024).The Jamnagar district's climatic conditions are highly favorable for cotton cultivation, yet the crop's productivity remains significantly below the desired level. These challenges, coupled with the limited use of standardized practices and inputs by farmers, lead to yields that fall below average (Sathish *et al.*,2019; Sathish *et al.*, 2022; Pithiya *et al.*, 2024; Oganja *et al.*,2024; Kumar *et al*.,2024; Kumar *et al.,*2024). Not only have these, the lack of water availability along with the limited use of micro-irrigation techniques, results in significant economic losses due to low production (Rohit *et al*., 2015; Parmar *et al.,* 2024). Cotton growers are also encountering various challenges in selecting, adopting, and utilizing agricultural inputs (Ghangale *et al.*,2018; Vennila *et al.,* 2018; Nakum *et al.,* 2024). The low prices of cotton due to heavy glut in the market are a problem due to lack of well-organized marketing system (Kormla *et al.,*2015; Katariya *et al.*,2016; Sulthana *et al.,*2019; Vasoya *et al.,*2024; Nakum *et al.,* 2025). This gap can be bridged through the timely adoption of improved cotton cultivation technologies by farmers (Meena *et al*., 2023; Pithiya *et al.*, 2024; Nariya *et al.,* 2024; Oganja *et al.*, 2024; Nakum *et al.,* 2024). The present study was conducted in the Jamnagar district of Gujarat state to understand farmers' knowledge to improve cotton production and to identify the knowledge gap of cotton growers.

2. material and methods

The study was conducted in Jamnagar district of Gujarat state. To study adoption level A multi-stage sampling technique was used and total 120 number of Bt cotton farmers were interviewed for collecting information by using the designed schedule. The data was collected by survey method adopting personal interview. Analytical tools like simple tabular method, percentage method and Chi-square test was used for research study.

The data for this study was analyzed using descriptive statistics such as mean and standard deviation. This method was used to estimate the adoption level. The overall adoption of cotton practices was assessed using a three-point scale: **"Fully Adopted" (2), "Partially Adopted" (1), and "Not Adopted" (0).** The packages and practices adopted by farmers for cotton cultivation are as follows:

**Table 1. Recommended package of practices for Cotton cultivation in Saurashtra**

|  |  |
| --- | --- |
| **No** | **Cotton Recommended Technologies** |
| 1 | Do you sowing government recommended Bt. cotton hybrids? |
| 2 | Three sprays of Flonicamid 50 WG 0.02% (4.0 g/10 l of water) or Diafenthiuron 50 WP 0.06% (12.0 g/10 l of water) or Dinotefuran 20 SG 0.008 % (4.0 g/10 l of water), first at pest initiation and subsequent two sprays at 15 days interval for effective and economical management of aphid, jassid, whitefly and thrips. |
| 3 | Sowing cotton crop timely (20th June) for increasing chlorophyll content, leaf area, specific leaf weight, higher heat use efficiency, reduce pink bollworm damage, higher seed cotton yield and net return. Early sowing (31st May) are also advised to sow G. Cot. Hy-8 for higher seed cotton yield and net return. |
| 4 | Three application of Sawaj Pheromone based Mating Disruption Paste (Sawaj MDP) technology @ 400g paste per application per hectare (uniformly distributed in 1000 dots between two branches) against pink bollworm, first at initiation of pest infestation and subsequent two applications at an interval of 30 days for effective, economical and ecofriendly management. |
| 5 | Five sprays of Beauveria bassiana 1. 15 WP (Min. 2 x 106 cfu/g) 0.009 % (80 g/10 litre of water), first spray at 5 % appearance of rosette flower and subsequent four spray at 10 days interval after first spray for effective and economical management of pink bollworm. |
| 6 | First spray at 75 days after sowing and second at 15 days of first spray for effective and economical management of pink bollworm. 1. Lamdacyhalothrin 2.5 EC, 0.0025% (10 ml/10 lit. of water) or 2. Deltamethrin 2.8 EC, 0.0028% (10 ml/10 lit. of water) |
| 7 | The farmers growing Bt. cotton under irrigated condition are advised to apply recommended dose of fertilizer (240:50:150 NPK kg/ha) and spray water soluble fertilizer 1 % (19:19:19 NPK) at flowering, boll formation and boll development stage of the cotton to obtain higher seed cotton yield and net return. |
| 8 | The farmers growing Bt. cotton under irrigated condition are recommended for detopping the cotton plant at 75 DAS for balance growth to obtain higher seed cotton yield and net return. This is helps to increases in thickness of leaves, length and number of sympodia, plant spread and number of bolls. |
| 9 | The farmers growing Bt. cotton under irrigated condition are advised to spray growth promoter Naphthalene Acetic Acid (NAA) @ 30 ppm (0.39 g /10 lit. water) at 50 DAS & 70 DAS for better growth to obtain higher seed cotton yield. |
| 10 | The farmers growing hybrid cotton in medium black calcareous soil are advised to apply recommended dose of nitrogen in form of urea only. |
| 11 | Three sprays of Carbendazim 12%+Mencozeb 63%WP@20g/10 lit of water, first spray at initiation of diseases and subsequent two sprays at 15 days interval after first spray for effective and economical management of fungal foliar diseases. |
| 12 | Apply 20 kg P2O5, 40 kg K2O and 20 kg sulphur (150 kg gypsum/ha) along with recommended dose of nitrogen (80 N kg/ha) for obtaining higher yield and net monetary returns as well as sustaining soil fertility under rainfed conditions. |

*\*(Anon., 2023)*

Based on the adoption score obtained by farmers was categorize under three adoption level categories, namely low, medium and high adoption level as follow:

**Table 2. Cotton Recommended Technologies**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Adoption category** | **Range** |
| 1 | Low adoption level | Below (Mean – S.D.) |
| 2 | Medium adoption level | Between (Mean ± S.D). |
| 3 | High adoption level | Above (Mean+ S.D.) |

**Chi -Square Test**

Chi-square test was used to ascertain association between socio-economic characteristics and adoption level of cotton growers. A chi-square statistic tool is one way to show a relationship between two categorical variables (Vennila *et al.,* 2023). The chi-squared statistic is a single number that tells you how much difference exists between your observed counts and the counts you would expect if there were no relationship at all in the population. It is used for data that consist of variables distributed across various categories and is denoted by χ2. The chi-square formula is:

χ2 = ∑ (Oi – Ei)2/Ei,

Where,

 Oi = Observed value (actual value)

 Ei = Expected value.

3. RESULT AND DISCUSSION

**3.1 Practice-wise adoption about recommended cotton cultivation practices**

The adoption level index reflects the actual use of improved cultivation practices by cotton growers. Information regarding knowledge of various cultivation practices is provided in Table 3. The data in the table indicate different levels of knowledge across 12 recommended cotton cultivation practices followed by respondents.

Among farmers, the highest adoption rate was observed for the use of variety (92.08%), followed by the recommended dose of fertilizer (90.83%) and growth promoters (83.75%), suggesting a strong focus on best practices. However, lower adoption rates for pest and disease management, such as spraying for pest initiation (72.92%), pink bollworm management & fungal foliar disease control (67.92%), indicate areas for improvement. Additionally, detopping cotton (22.50%) is poorly adopted, highlighting a significant opportunity for improvement.

**3.2 Adoption level of respondents regarding cotton**

The adoption level index reflects the actual use of improved cultivation practices and the decision to fully adopt innovations over time by cotton growers. The respondents were divided into three groups—high, medium, and low—based on their extent of adoption. The mean and standard deviation (SD) values were found to be 18.02 and 1.97, respectively. The majority of farmers had an adoption level index ranging between 16.06 and 19.98 percent. Among the respondents, 57.50% (69 Nos. of farmers) had a medium level of adoption, followed by 28.33% (34 Nos. of farmers) having a high level and 14.17% (17 Nos. of farmers) with a low level of adoption.

**Table 3. Practice-wise adoption about recommended cotton cultivation practices**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr No.** | **Package of practices** | **Score** | **Percentage** | **Rank** |
| 1 | Use of variety | 221 | 92.08 | I |
| 2 | Spray for pest initiation and subsequent | 175 | 72.92 | VIII |
| 3 | Sowing time | 194 | 80.83 | V |
| 4 | Against pink bollworm Pest infestation | 163 | 67.92 | X |
| 5 | Effective and economical management pink bollworm | 186 | 77.50 | VI |
| 6 | Spray for insecticide | 170 | 70.83 | IX |
| 7 | Recommended dose of fertilizer | 218 | 90.83 | II |
| 8 | Detopping the cotton | 54 | 22.50 | XII |
| 9 | Growth promoter | 201 | 83.75 | III |
| 10 | Does of nitrogen | 179 | 74.58 | VII |
| 11 | Fungal foliar diseases | 163 | 67.92 | X |
| 12 | Higher yield and net monetary | 196 | 81.67 | IV |

The Table 4 highlight the chi-square analysis evaluates the relationship between various socio-economic parameters and the adoption of improved cotton cultivation practices. Most parameters, including age, landholding, occupation, family size, annual income, social participation, extension participation, source of information, training received, and mass media exposure, showed no significant difference, indicating they do not strongly influence adoption levels. However, education (χ² = 49.39, p < 0.05) showed a significant difference, suggesting that higher education levels positively impact the adoption of improved farming practices. This highlights the importance of farmer education in enhancing agricultural advancements.

**Table 4. Adoption level of respondents regarding cotton**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Chi-Square Calculated**  | **Chi-Square Tabular**  | **Degree of Freedom** | **Remarks** |
| Age | 0.92 | 9.40 | 4 | No significant difference |
| Land holding  | 1.72 | 16.11 | 8 | No significant difference |
| Occupation | 1.63 | 9.41  | 4 | No significant difference |
| Education | 49.39 | 15.21 | 8 | Significant difference |
| Family size | 1.29 | 9.43 | 4 | No significant difference |
| Annual income | 2.10 | 9.39 | 4 | No significant difference |
| Social participation | 3.34 | 12.19 | 6 | No significant difference |
| Extension participation | 2.31 | 12.22 | 6 | No significant difference |
| Source of information | 2.29 | 12.12 | 4 | No significant difference |
| Training received | 6.72 | 15.49 | 4 | No significant difference |
| Mass media | 3.33  | 9.44  | 4 | No significant difference |

4. CONCLUSION

The study revealed that most cotton farmers in Jamnagar exhibited a medium level of adoption (57.50%) of recommended practices. The practices like improved varieties and fertilizer application saw high adoption, while pest and disease management and detopping of cotton remained having very low adoption rate. The education playing a key role in influencing adoption of recommended practices among cotton growers. To enhance adoption levels and productivity of cotton growers, targeted interventions such as on-field demonstrations and strengthened extension services focusing on awareness of pest control, optimal sowing time, and agronomic best practices will contribute to higher yields and profitability in the region.

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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