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## Purchasing behavior of farmers towards selected BT cotton seeds in Amreli District of Gujarat

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### Abstract

Seed is the most important input component for productive agriculture. Cotton is one of the most important commercial crops cultivated in India and accounts for around 25 per cent of the total global cotton production. It is popularly known as the “white gold” and “fiber king” across the nation. It plays a major role in sustaining the livelihood of an estimated 6 million cotton farmers and 40-50 million people engaged in related activity such as cotton processing & trade. The Indian Textile Industry consumes a diverse range of fibers and yarns and the ratio of use of cotton to non - cotton fibers in India are around 60:40 whereas it is 30:70 in the rest of the world. The study covered 120 farmers from Amreli district of Gujarat state.

The socio-economic analysis of the respondents revealed that a majority of the farmers (54.16 per cent) were involved in both farming and animal husbandry. In terms of land ownership, around 40 per cent owned land between 4 and 10 hectares. The study also found that 56.66 per cent of farmers had been cultivating Bt. cotton from 4 to 6 years. The top factors influencing the purchase of Bt. cotton seeds were production, best results, and quality. Farmers had a positive perception of Bt. cotton in terms of production, ball size, spray requirements, picking, number of balls, row cotton price, germination, promotional activity, and ball weight.

Promotional tools such as farmer meetings and company campaigns were widely used, emphasizing the importance of direct interaction and targeted marketing efforts. However, farmers faced constraints in purchasing the seeds, with high price being the most significant concern. Non-availability of seeds at the desired time and quantity, as well as poor seed quality, were also identified challenges.

**Keywords:** Seed, Bt Cotton, factors influencing the purchase of Bt. cotton seed, farmers perception, promotional tools, constraints faced by farmers

### Introduction

India is one of the major players in the agriculture sector worldwide and it is the primary source of livelihood for ~55 per cent of India's population. India has the world's largest cattle herd (Buffaloes), largest area planted to wheat, rice, and cotton, and is the largest producer of milk, pulses, and spices in the world. It is the second-largest producer of fruit, vegetables, tea, farmed fish, cotton, sugarcane, wheat, rice, cotton, and sugar. Agriculture sector in India holds the record for second-largest agricultural land in the world generating employment for about half of the country's population. Thus, farmers become an integral part of the sector to provide us with means of sustenance (ibef.org, 2022).

Cotton is one of the most important commercial crops cultivated in India and accounts for around 25 per cent of the total global cotton production. It plays a major role in sustaining the livelihood of an estimated 6 million cotton farmers and 40-50 million people engaged in related activity such as cotton processing & trade. Due to its economic importance in India, it is also termed as "White-Gold". Global production in 2021-22 is estimated at 25.89 million tons (1522 lakh bales) which is 6.20 per cent higher in comparison to previous year's production of 24.38 million tons (1433 lakh bales). Global cotton consumption is estimated at 26.16 million tons (1538 lakh bales) which is around 2 per cent higher in comparison to previous year's consumption of 25.66 million tons (1509 lakh bales). India is one of the largest cotton producing country in the world with estimated production of 315.43 lakh bales (ICAC, 2022).

Bt. cotton is a genetically modified variety of cotton that contains a gene from the soil bacterium *Bacillus thuringiensis* (Bt). This gene produces a toxin that is harmful to certain pests that commonly attack cotton plants, such as the bollworm. Bt cotton was first commercially introduced in the United States in 1996 and has since been widely adopted in cotton-growing regions around the world.

The benefits derived from Bt. cotton are Reduced use of pesticides, Higher yields, Improved quality, Reduced labour costs, Increased income, and Improved environmental sustainability (Mandal *et al.*, 2020) [7]

The objectives of the study were:

- To identify the factors for the purchase of Bt cotton hybrid seeds
- To study farmers' perception about Bt cotton hybrid seeds
- To identify important promotional activities for the purchasing of Bt Cotton hybrid Seeds
- To study constraints faced by farmers while purchasing Bt Cotton hybrid Seeds

**Material and Methods**

**Sources of the data:** Primary as well as secondary data were collected to meet the stipulated objectives of the study.

**Primary data:** Primary data were collected from the respondents with the help of schedule.

**Secondary data:** Secondary data were collected from Literature, Private and Government publications and websites.

**Research design**

This study employs a descriptive research design, which aims to provide an overview of the purchasing behaviour of farmers in 11 talukas of Amreli district. The sampling method used was non-probability, specifically a purposive sampling technique. The sample unit were Bt. Cotton growing farmers, and the sample size was 120. The study takes place over a period of 60 days. To gather data, a semi-structured schedule utilized to ensure that authentic information is collected from the respondents. Analytical tools such as tabular analysis, graphical presentation, Likert Scale and Garrett's Ranking Technique were used to analyze the data collected. Overall, the study's findings provide insights of factors influencing while purchasing Bt. Cotton seeds, farmers perception, promotional activities and constraints faced by farmers.

**Analytical Tools**

**Henry Garrett ranking technique**

Garrett ranking technique was used to rank the preference indicated by the respondents on different factors. As per this method, respondents was asked to assign the rank for all factors and the outcomes of such ranking converted into score value with the help of the following formula:

$$\text{Percent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

Where

R<sub>ij</sub> = Rank given for the i<sup>th</sup> variable by j<sup>th</sup> respondents

N<sub>j</sub> = Number of variables ranked by j<sup>th</sup> respondents

**Weighted average mean**

Likert scale was use to study farmers' perception about selected Bt cotton hybrid seeds. After gathering all the completed schedules from the respondents, total responses for each item were gathered and tabulated. In order to use the Likert-scale for interpretation, weighted mean to represent each question was computed. To compute for the weighted mean, each value must be multiplied by its weight. Products

was added to obtain the total value. The total weight was computed by adding all the weights. Then total value was divided by total weight. Statistically, the weighted mean was calculated using the formula

$$\text{Weighted Mean (X)} = (F_1X_1 + F_2X_2 + F_3X_3 + F_4X_4 + F_5X_5) / X_t$$

Where,

F = Weight given to each response

X= Number of responses

X<sub>t</sub>= Total number of responses

**Results and Discussion**

**Table 1:** Age of the farmers

Age	Frequency	Percentage (%)
20 and below	0	0
21 to 40	28	23.33
41 to 60	70	58.33
60 and above	22	18.33
Total	120	100

Table 1 discovered that farmers age was a significant demographic factor that influences perception and decision-making. The table also revealed that, there were 58.33 per cent farmers between the ages of 41 to 60, 23.33 per cent farmers between the ages of 21 to 40, 18.33 per cent farmers between the ages of 60 and above, and there are no any farmers are age of 20 and below in the study area.

**Table 2:** Education of Farmers

Education	Frequency	Percentage (%)
Below S.S.C	44	36.66
S.S.C	26	21.66
H.S.C	25	20.83
Under Graduate	15	12.50
Post Graduate and Above	10	8.33
Total	120	100

The farmers education shows their capacity to get a handle on data from different sources. A farmer who is literate can do his job well and also contributes in farming. They have improved their knowledge and are able to read market conditions. The study revealed that only 8.33 per cent of farmers had education up to post graduate and above, despite the fact that 12.50 per cent of farmers had done under graduation, 20.83 per cent farmers had education up to HSC, 21.66 per cent had education up to SSC, and 36.66 per cent had education below SSC level. In order to bring technological advancement and innovative farming to rural areas, it is necessary to increase the number of farmers with advanced degrees.

**Table 3:** Occupation of Farmers

Occupation	Frequency	Percentage (%)
Farmer	24	20.00
Farmer + Animal Husbandry	65	54.16
Farmer + Service	10	8.33
Farmer + Business	21	17.50
Total	120	100

Table 3 present that out of 120 respondents, 54.16 per cent reported of being involved in both farming and animal husbandry. These individuals practice farming while also raising and caring animals, demonstrating a combination of

agricultural and livestock-related occupations. 20 per cent identified themselves solely as farmers, indicating that they are primarily engaged in agricultural activities. 17.5 per cent of the respondents reported of being farmers who also run their own businesses. This suggests that they are engaged in agricultural activities while simultaneously managing their own business ventures, potentially related to agriculture or other sectors, and 8.33 per cent of the respondents mentioned combining farming with a service-based occupation. Overall, the data illustrates a diverse range of occupational combinations among the respondents, with a significant number engaged in a combination of farming and animal husbandry.

**Table 4:** Land Holding of Farmers

Land Holding	Frequency	Percentage (%)
Marginal (up to 1.0 ha)	05	4.16
Small (1.01 to 2 ha)	16	13.33
Semi-medium (2.01 to 4.0 ha)	37	30.83
Medium (4.01 to 10 ha)	48	40.00
Large (more than 10 ha)	14	11.66
Total	120	100

The farmer's land holding is crucial because it determines the farmer's consumption of agro-inputs and risk-taking capacity. Table 4 revealed that in the study area, 40 per cent of farmers owned land between 4 to 10 ha, 30.83 per cent owned land between 2 to 4 ha, 13.33 per cent owned land between 1 to 2 ha, 11.66 per cent owned land larger than 10 ha, and the remaining farmers owned land less than 1 ha. It demonstrates that the majority of farmers were semi-medium and medium (70.83 per cent).

**Table 5:** Farming Experience of Farmers

Farming Experience	Frequency	Percentage (%)
Less than 5 Years	22	18.33
5 to 10 Years	25	20.83
10 to 15 Years	39	32.50
More than 15 Years	34	28.33
Total	120	100

Table 5 discovered that 32.50 per cent of farmers had 10 to 15 years of experience in the agriculture however, 28.33 per cent of farmers had more than 15 years of experience, 20.83 per cent had 5 to 10 years of experience, and 18.33 per cent had less than 5 years of experience. Larger part of farmers had over 10 years of cultivating experience. However, it should be noted that the farm may experience technological, social, and environmental shifts during this time. This demonstrates that farmers must regularly improve their farming methods as well.

**Table 6:** Annual Household Income of Farmers

Annual Household Income	Frequency	Percentage (%)
Less than 50000	34	28.33
50001 to 1,00,000	36	30.00
1,00,001 to 2,00,000	35	29.16
More than 2,00,001	15	12.50
Total	120	100

Table 6 revealed that, around 30 per cent farmers had an annual income between ₹ 50001 to 1,00,000, 29.16 per cent farmers earn between ₹ 1,00,001 to 2,00,000, followed by 28.33 per cent farmers earn less than ₹ 50,000, and only 12.50

per cent farmers earned more than ₹ 2,00,001 annually from farming activities.

**Table 7:** Years of Bt Cotton Cultivation

Years	Frequency	Percentage (%)
Less than 2 Years	10	08.33
2 to 4 Years	29	24.16
4 to 6 Years	68	56.66
More than 6 Years	13	10.83
Total	120	100

In 2002, a joint venture between Monsanto and Mahyco introduced Bt cotton to India. Table 7 revealed that out of total sample of farmers, around 56.66 per cent farmers were cultivating Bt. cotton from 4 to 6 years, 24.16 per cent farmers were cultivating from 2 to 4 years, 10.83 per cent farmers were cultivating from more than 6 years, and 8.33 per cent farmers were cultivating from less than 2 years. It shows that most of farmers were cultivating Bt. cotton from 4 to 6 years.

**Table 8:** Factors for the Purchase of Bt. Cotton hybrid seeds

Factors No	Factors	Frequency							Average Score	Rank
F1	Production	49	25	7	5	5	29	56.05	1	
F2	Best result	34	37	20	40	2	0	53.61	2	
F3	Quality	24	26	8	10	22	30	51.90	3	
F4	Low Price	16	40	15	9	33	10	51.80	4	
F5	Packaging Size	0	2	36	25	27	30	45.43	5	
F6	Availability	0	0	34	41	25	20	41.20	6	

Table 8 revealed that Production with an average score of 56.05, ranked as the top factor. This indicates that respondents consider production capability as the most important factor. With an average score of 53.61, best result ranked as second most important factor. This factor suggests that respondents prioritize achieving the best outcome, such as high crop yields or optimal performance of a product. Quality ranked as third with an average score of 51.90, which is crucial factor for customers. This indicates that respondents value the products with superior quality standards that meet their expectations. Low Price, with an average score of 51.8, ranked fourth. Packaging size ranked fifth with an average score of 45.43, and Availability ranked sixth with an average score of 41.20. Overall, the results highlight the factors that influence respondents' preferences and decision-making. Production capacity, achieving the best result, product quality, and affordable prices were particularly important factors. Additionally, factors such as packaging size and availability also contribute to customer satisfaction, but might be of relatively lower priority compared to the top-ranking factors.

**Table 9:** Farmer perception about Bt. cotton hybrid seeds

Parameters	S.D	D	N	A	S.A	Total	Mean	Rank
<b>More production</b>	14	17	22	25	43	120	3.58	1
Total number of ball	13	22	30	29	26	120	3.41	2
More germination percentage	35	13	39	11	23	120	3.28	3
Bigger ball size	22	25	47	15	11	120	3.27	4
More ball weight	13	14	30	37	26	120	3.13	5
Less sprays required	25	22	57	10	7	120	2.81	6
Soft picking	21	14	31	19	35	120	2.73	7
More price	14	19	42	28	17	120	2.62	8



(1-Strongly disagree (S.D), 2- Disagree (D), 3-Neutral (N), 4-Agree (A), 5- Strongly agree (S.A))

Table 9 shows the weighted average mean scores and ranks for different factors in farmers' perception. According to the farmers, the most important factor was "More production" with a weighted average mean score of 3.58. The second-ranked factor was "Total number of ball" with a score of 3.41. "More germination percentage" was ranked third with a score of 3.28, followed by "Bigger ball size" with a score of 3.27 at the fourth position. "More ball weight" is ranked fifth with a score of 3.13. The factors "Less sprays required" and "Soft picking" are ranked sixth and seventh, with scores of 2.81 and 2.73 respectively. Finally, "More price" ranked eighth with a score of 2.62. These rankings provide insights into the factors that farmers prioritize when evaluating and selecting cotton seeds.

**Table 10:** Important Promotional Tools for The Purchasing of Bt. Cotton hybrid seeds

Promotional Tools	Frequency	Percentage (%)	Rank
Company campaign	105	87.50	1
Farmers suggestion	101	84.17	2
Farmer meeting	99	82.50	3
Retailers' suggestion	95	79.17	4
Leaflets	85	70.83	5
Posters	78	65.00	6

Table 10 represents the frequency and percentage of different promotional tools used for Bt. cotton. The most frequently used promotional tool was "Company campaign" with a frequency of 105, accounting for 87.50 per cent of the respondents. The second most commonly used tool was "Farmers suggestion" with a frequency of 101, representing 84.17 per cent of the respondents. "Farmer meeting" ranked third, being used by 99 respondents, accounting for 82.50 per cent of the total. "Retailers' suggestion" was the fourth most utilized tool with a frequency of 95, representing 79.17 per cent of the respondents. "Leaflets" were used by 85 respondents, accounting for 70.83 per cent of the total, and "Posters" are used by 78 respondents, representing 65.00 per cent of the respondents. These numbers indicate the effectiveness and popularity of various promotional tools in reaching out to farmers and creating awareness about Bt. cotton products.

**Table 11:** Constraints Faced by Farmers While Purchasing Bt. Cotton seeds

Parameters	S.D	D	N	A	S.A	Total	Mean	Rank
High Price	13	6	15	15	71	120	4.04	1
Non Availability at Time	14	12	10	27	57	120	3.84	2
Non Availability of Credit Facility	17	19	7	28	49	120	3.61	3
Non Availability of Required quantity	18	23	17	35	27	120	3.25	4
Poor Quality of Seed	57	22	21	13	7	120	2.09	5

Table 11 presents the mean scores and ranks of the constraints faced by farmers while purchasing Bt. cotton hybrid seeds. The highest mean score of 4.04 is assigned to the constraint of "High Price," indicating that farmers perceive the cost of these hybrid seeds to be relatively expensive. The second-highest mean score of 3.84 was given to the constraint of "Non Availability at Time," indicating that farmers facing challenges in accessing the seeds when they need them. The

constraint of "Non Availability of Credit Facility" ranked third with a mean score of 3.61, facing that farmers encounter difficulties in obtaining credit while purchasing the seeds. "Non Availability of Required Quantity" ranked fourth with a mean score of 3.25, indicating that farmers face challenges in finding the desired quantity of seeds. Lastly, "Poor Quality of Seed" ranked fifth with a mean score of 2.09, highlighting farmers' concerns about the quality of the hybrid seeds available in the market.

## Conclusions

The study revealed that the majority of farmers within the age range of 41-60 years and had education level up to SSC. Additionally, most of the farmers owned land holdings between 4.01 to 10 hectares (medium farmers) and engaged in agriculture combined with animal husbandry. The top factors influencing the purchase of Bt. Cotton hybrid seeds was identified as production, best result, quality, low price while packaging size ranked the lowest. According to farmers, the most important factor was more production followed by total number of ball, More germination percentage, bigger ball size, more ball weight, Less sprays required, Soft picking, and More price. Company campaigns and farmers suggestions were the most effective at reaching farmers followed by Farmer meeting, Retailers' suggestion, Leaflets, and Posters. High price of seed was the most significant constraints, followed by non-availability at time, non-availability of credit facility, non-availability of required quantity, and poor quality of seeds while purchasing Bt cotton hybrid seeds.

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