P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating (2025): 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 7; July 2025; Page No. 798-803

Received: 05-05-2025
Accepted: 07-06-2025

Indexed Journal
Peer Reviewed Journal

Perceived constraints for procurement and production of hybrid pearl millet seeds: Empirical investigation of farmers in Gujarat

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DOI: https://www.doi.org/10.33545/26180723.2025.v8.i7k.2219

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Abstract

Hybrid seeds have emerged as a very promising agri input in the recent times, having direct bearing on agricultural productivity and farmers' prosperity. Despite far reaching impact and multiple benefits of hybrid seeds variety, their adoption among Indian farmers remain limited due to various constraints. The present empirical research work, utilizing the published theoretical literature and descriptive cross-sectional research design, examines the constraints faced by farmers in procurement and production of hybrid pearl millet seeds. The study was conducted in the purposively selected Banaskantha district of North Gujarat region of Gujarat state. A total of 200 farmers were selected across four talukas using a multistage random sampling approach and surveyed using a structured interview schedule. The data were analysed using Garrett's ranking technique. The results revealed that the top most five constraints faced by farmers were high price of the seeds, concerns about seed authenticity, inadequate credit access, fear of spurious products and lack of technical knowledge; highlighting that economic barriers, product authenticity concerns, and limited access to knowledge and resources significantly affect hybrid seed adoption among farmers. Findings of this landmark empirical investigation emphasize the need for addressing these constraints through focused awareness programs, fair pricing, quality assurance measures, and targeted farmer training to encourage greater acceptance and adoption of hybrid pearl millet among the farmers in the surveyed region.

Keywords: Adoption, constraints, credit access, hybrid pearl millet, procurement, production, seed

Introduction

Agriculture remains a fundamental pillar of India's economy, ensuring food security and providing livelihoods for a large portion of the rural population. Among various agricultural inputs, seeds are the most crucial component in determining crop performance. High-quality seeds contribute significantly to yield improvement - estimated at 15-25% under normal conditions and up to 45% when supported by appropriate agronomic practices (Chaudhari and Thakkar, 2025) [2]. The superior performance of agriculture in India has progressively depended on hybrid technology to improve production. Notwithstanding technological developments and the increasing presence of public and private sector seed corporations, obstacles remain at the grassroots level concerning the acceptance and acquisition of hybrid seeds. As India advances towards becoming a global hub for seed production and innovation, hybrid seed varieties have emerged as a point of attraction due to its potential to offer higher yields, uniform quality, and resilience under varying climatic conditions (Joshi *et al.*, 2025) [5]. However, the successful diffusion of hybrid seed technologies depends not only on supply-side advancements but also on understanding demand-side realities, particularly the factors considered by end-users, i.e., farmers while buying and their satisfaction level with the purchased hybrid seed variety.

The Indian seed industry has evolved considerably with the advancement of plant breeding techniques, seed certification systems, and increased public-private participation. It is currently ranked as the fifth largest in the world, reflecting the growing emphasis on quality inputs in Indian agriculture.

Talking about Pearl millet (*Pennisetum glaucum*), locally known as bajra, it is one of the major cereal crops grown in India, especially in arid and semi-arid regions. It is valued for its ability to withstand high temperatures, drought, and poor soil fertility. Gujarat is a leading producer of pearl millet, with Banaskantha district in North Gujarat region contributing significantly due to its suitable agro-climatic conditions and expanding irrigation infrastructure. Recent years have seen a gradual shift among farmers toward hybrid varieties of pearl millet due to their higher yield potential, better grain quality, and disease resistance. However, the adoption of hybrid seeds is influenced by several factors including seed cost, farmer awareness, brand trust, and access to credit and technical guidance.

In the context of wide scale acceptance and adoption of hybrid pearl millet seeds, it is of paramount importance to

examine the constraints faced by farmers during seed procurement and production of hybrid pearl millet seeds in Banaskantha district of Gujarat. The study intends to offer practical insights that can support improved seed adoption, targeted extension efforts, and informed decision-making for sustainable agricultural development in similar agro-ecological regions. The findings will certainly help the companies in the marketing business of hybrid pearl millet seeds by strategizing their efforts for overcoming these constraints on one hand and contributing to farmers' welfare and nation's prosperity on the other.

Literature review

A review of existing literature offers valuable insights into previous studies concerning farmer behaviour and satisfaction in relation to hybrid seed usage. It provides a foundation for the present investigation and highlights patterns, gaps, and key influencing factors in agricultural decision-making.

Bhati *et al.* (2016) [1] studied farming households in Banaskantha and reported that socio-economic variables such as education, landholding size, and cropping patterns significantly influenced resource utilization. The majority of respondents were in the middle-age category with limited land access, underscoring the diversity in farming practices based on farm size.

Devi and Bhoi (2022) [3] analysed the adoption of the GAR-13 rice variety in Kheda and noted that younger, better-educated farmers from smaller families with multiple income sources were more inclined to adopt improved seeds. Their research highlighted the critical role of education and involvement in local institutions in shaping agricultural choices.

Singh *et al.* (2022) [14] highlighted production and marketing issues among sesame and mustard growers, such as limited irrigation, insufficient seed quality, poor storage facilities, and lack of credit. Their study emphasized the importance of improved infrastructure and farmer training to overcome these constraints.

Sindhuja *et al.* (2022) [13] studied and revealed that most farmers purchased hybrid vegetable seeds from private retail outlets and preferred cash over credit for their purchases. The study also identified yield, price, quality, pest and disease resistance, and agro-climatic adaptability as the major factors influencing farmers' buying behaviour. The results were statistically significant, and the study concluded that understanding farmers' buying behaviour can help in filling the gap between their needs and the products offered in the market.

Kumar and Masih (2023) [6] provided a comprehensive analysis of the market share and factors influencing seed demand for tomato seeds. The study revealed that hybrid seeds were the most popular followed by Syngenta, Shanker, Kalash, Kaveri, Krishidhan, Nuziveedu, and Rasi seeds. Key factors affecting demand included seed quality, availability of fertilizers and agro-chemicals, access to credit facilities, and the use of modern agricultural machinery. The study also highlighted challenges in the tomato seed marketing system, such as high commission charges and limited access to market information.

Dhola *et al.* (2023) [4] examined Bt cotton seed buyers in Amreli, noting that price sensitivity, local agro-climatic suitability, brand loyalty, and peer influence played major roles in purchase decisions. These elements underline the behavioural complexity behind seed selection in rural Gujarat.

Ladumor *et al.* (2023) [7] conducted research on fertilizer satisfaction in Kheda district and discovered that product price and performance were the main contributors to farmer satisfaction. This finding implies similar expectations for quality and cost-efficiency in the hybrid seed sector.

Patel and Thakkar (2023) [11] highlighted the changing profile of Indian farmers as they have started using smart phones and internet services. They noted that the progressive farmers of new generation are very techno friendly and when they will prefer smart-work rather than hard-work. They will use digital technologies and digital services very effectively for farming purpose. Consequently, such new age farmers will prefer to use e-retailing of agri inputs, compared to personally going to the dealers for purchasing any of the required agri inputs.

Patel and Thakkar (2023) [12] in their pioneering study focusing on awareness, expectations and usage of agricultural apps by farmers in Banaskantha district of Gujarat; highlighted the changing profile of farmers in Gujarat state with the use of various Agricultural Apps and the wide ranging expectations from the developers of these Apps. So, the farmers of Gujarat are becoming tech savvy and collect information from various sources including the internet and various agricultural Apps and may get less influenced by traditional factors affecting their buying behaviour for various agricultural inputs including hybrid seeds.

Olakiya and Lad (2024) [9] explored cumin seed purchasing trends in Rajkot and found that factors such as age, income, and educational background shaped farmers' buying decisions. High input costs and the need for climate-resilient seeds were identified as common barriers in the hybrid seed market.

Paghdar *et al.* (2024) [10] evaluated farmers' satisfaction with groundnut seeds and emphasized that price, seed quality, brand identity, and dealer influence were key decision drivers. While seed availability was generally satisfactory, pricing remained a concern, revealing the importance of affordability in rural markets.

Nagesia and Thakkar (2024) [8] evaluated farmers' awareness and brand preferences for hybrid tomato seeds in Latehar district of Jharkhand and 'High yield compared to another brand' and 'Quality of fruit compared to other brands' came out to be the most influencing factors; followed by "Resistant to seed borer" and "Dealers' influence on brand" with third and fourth rank respectively. The least influencing two factors were found to be 'Attractive package and unit size' and 'Availability on credit'. Major constraints were found to be 'Market accesses' to sell the produce, 'Infrastructure' like irrigation facility and value addition facility for the produce after harvest and the 'Perceived risk' of climate (untimely rain and hail stones) as well as the diseases.

Joshi *et al.* (2025) [5] examined perceived constraints of farmers for procurement of hybrid paddy seeds in the tribal belt of South Gujarat region and reported that high price was perceived as the most critical constraint, followed by timely availability, non-availability of credit at the time of

purchase, and seed price market fluctuations.
In total, the literature indicates that it will take more than enhancing access and affordability to raise the rate of adoption of hybrid seeds among farmers. Developing trust through good supply chains, on-farm demonstrations, and efficient agricultural extension services have also been pointed out.
In nutshell, there have been plethora of research studies highlighting the factors considered important while making purchase decision for hybrid seeds of different crops, associated buying behaviour of farmers, their satisfaction level and the constraints. But, there is a dearth of empirical research on assessment of perceived constraints of farmers for procurement and production of hybrid pearl millet seeds, particularly in North Gujarat region of Gujarat state; and this study is a sincere attempt to fill that void. In and all, this study stands out as a landmark study for developing thorough understanding about the constraints of farmers for purchasing and production of hybrid pearl millet seeds.

Materials and Methods

The present empirical investigation was conducted in Banaskantha district of North Gujarat region Gujarat State, a region well-known for its robust agricultural activity. A large segment of the local population is engaged in farming and allied sectors. This region is well recognized for its extensive cultivation of hybrid pearl millet. This was the reason behind purposively selecting this district for this research owing to its agricultural prominence in terms of extensive cultivation of hybrid pearl millet; which provided a representative setting for the study.

Reaserch design

A descriptive cross sectional research design was adopted to examine the perceived constraints of farmers during procurement and production of hybrid pearl millet seeds. This design is suitable as it helps in systematically describing the present conditions without making any changes to the environment. It allows the researcher to collect detailed information about major problems farmers face during procurement and production of hybrid pearl millet seeds. The descriptive nature of the design helps to capture the real-time experiences and opinions of farmers, offering insights into current practices and challenges. It is called cross-sectional because the data was collected at one specific point in time from a sample that represents the larger farming community.

Data collection

Data collection was conducted over a period of three months from March to May 2025.

Primary data: Primary data were collected from a sample of 200 farmers.

Secondary data: Secondary data were collected from obtained from relevant research reports, web resources, and seed company publications.

Data collection instrument

A structured interview schedule was used as a research instrument to collect required data and information to fulfil the objectives of the research.

Method of data collection

The data collection was carried out using personal interviews with the farmers.

Sampling design

Area of Research

The study was conducted in four talukas of Banaskantha district based on their active involvement in pearl millet farming namely Deesa, Dhanera, Tharad, and Vav.

Sampling Method

Multistage random sampling technique was utilized to select the study area and farmers. In the first stage, Banaskantha district was selected purposively. Then, in the second stage, four talukas were selected randomly. Next, in the third stage, five villages were selected randomly from each taluka. In the fourth stage, ten farmers growing hybrid pearl millet were selected, making a total sample size of 200 respondents.

Sample Size

In this study total 200 farmers were selected from the in Banaskantha district of North Gujarat region Gujarat State

Table 1: Sampling Plan

District (Stage I)	Name of Taluka (Stage II)	No. of Villages (Stage III)	No. of farmers from each village (Stage IV)	Total no. of farmers
Banaskantha	Deesa	5	10	50
	Dhanera	5	10	50
	Tharad	5	10	50
	Vav	5	10	50
Total		20		200

Analytical tool

For analysis, both descriptive and statistical techniques were employed, including the use of averages, percentages, and the Garrett Ranking method to assess and prioritize the constraints faced by farmers in purchasing and production hybrid seeds.

Henry Garrett Ranking Method

The Garrett ranking technique was used to explore constraints as perceived by farmers for procurement and production of hybrid pearl millet seeds.
In Garrett ranking technique, per cent position was calculated using following formula.

Percent position = 100 (Rij - 0.5)/ Nj

Where,
Rij = Rank given for the ith variable by jth respondents

Nj = Number of variables ranked by jth respondents

In the Garrett's ranking technique, the per cent positions were converted into scores. Thus, for each factor the scores of the various respondents were added and then mean values were estimated. The attribute with the highest value was considered as the most important one and the other follow in order.

Results and Discussion

Socio-economic profile of hybrid pearl millet farmers

Table 2: Socio-economic profile of hybrid pearl millet farmers (n=200)

Variables	Parameters	Frequency	Percentage
Gender	Male	200	100.00
	Female	00	00.00
Age	21-30	12	6.00
	31-40	49	24.50
	41-50	82	41.00
	Above 50	57	28.50
Educational qualification	Below SSC	107	53.50
	SSC	38	19.00
	HSC	32	16.00
	Graduation	13	6.50
	Post-Graduation	3	1.50
	Any other	7	3.50
Family type	Nuclear	123	61.50
	Joint	77	38.50
Farming experience	Below 5 years	13	6.50
	5-10 years	46	23.00
	11-15 years	96	48.00
	Above 15 years	45	22.50
Occupation	Farming only	43	21.50
	Farming + Animal husbandry	128	64.00
	Farming + Service	18	9.00
	Farming + Business	11	5.50
Land holding size	Marginal (up to 1 ha)	24	12.00
	Small (1.01 - 2 ha)	81	40.50
	Medium (2.01 - 4 ha)	66	33.00
	Large (more than 4 ha)	29	14.50
Type of farming	Irrigated	163	81.50
	Rainfed	37	18.50
Method of irrigation	Surface	102	51.00
	Drip	20	10.00
	Sprinkler	78	39.00
Annual family income	0 - 1,00,000	14	7.00
	1,00,001 - 2,00,000	34	17.00
	2,00,001 - 3,00,000	68	34.00
	3,00,001 - 4,00,000	53	26.50
	Above 4,00,000	31	15.50

The socio-economic analysis of the 200 farmers revealed that all were male with the majority (41%) falling within the 41-50 years age group followed by 28.5% aged above 50. Over half (53.5%) of the farmers had education below the SSC level, indicating relatively low formal education. Most belonged to nuclear families (61.5%) and had 11-15 years of farming experience (48%) reflecting established agricultural backgrounds. A significant number (64%) engaged in both farming and animal husbandry and 40.5% were classified as small landholders with 1.01-2 hectares of land. Irrigated farming dominated (81.5%) with surface irrigation being the most common method (51%). In terms of income, the largest group (34%) earned between ₹2-3 lakhs annually, suggesting a moderate-income level among the majority of hybrid pearl millet farmers in the region.

Constraints faced by farmers during procurement and production of hybrid pearl millet seeds

Table 3: Percent Position and Garrett Value (n=200)

Sr. No.	Rank	100 (R_{ij} - 0.5)/N_j	Percent Position Value	Garrett Score
1	1	100 (1-0.5)/8	6.25	80
2	2	100 (2-0.5)/8	18.75	67
3	3	100 (3-0.5)/8	31.25	60
4	4	100 (4-0.5)/8	43.75	53
5	5	100 (5-0.5)/8	56.25	47
6	6	100 (6-0.5)/8	68.75	41
7	7	100 (7-0.5)/8	81.25	33
8	8	100 (8-0.5)/8	93.75	20

Based upon the formula (100 (R_{ij} - 0.5)/N_j), percent position value and corresponding Garrett score were calculated for each rank ranging from I to VIII. The inverse relationship between percent position value and Garrett Score provides an important tool to quantify responses into a meaningful score for better analytical measurement and interpretation.

Table 4: Ranks given by farmers to each factor and garret score calculation (n=200)

Sr. No.	Constraints	Rank given by the respondents & Garrett Score based on the rank given by the respondents							
		1st	2nd	3rd	4th	5th	6th	7th	8th
1	Lack of high-quality seed	22 (1760)	21 (1407)	24 (1440)	22 (1166)	28 (1316)	25 (1050)	28 (924)	30 (600)
2	High price of seeds	35 (2800)	31 (2077)	32 (1920)	30 (1590)	23 (1080)	18 (738)	16 (528)	15 (300)
3	Fear of adulteration	33 (2640)	30 (2010)	29 (1740)	27 (1431)	21 (987)	23 (943)	19 (627)	18 (360)
4	Unavailability of seeds at the time of sowing	24 (1920)	22 (1474)	23 (1380)	26 (1378)	26 (1222)	25 (1025)	26 (858)	28 (560)
5	Labor shortage	27 (2160)	24 (1608)	24 (1440)	23 (1219)	23 (1081)	26 (1066)	27 (837)	26 (520)
6	Fear of spurious product	30 (2400)	29 (1943)	27 (1620)	23 (1219)	22 (1034)	26 (1066)	22 (720)	21 (420)
7	Lack of technical knowledge	28 (2240)	27 (1809)	26 (1560)	24 (1272)	24 (1128)	25 (1025)	24 (792)	22 (440)
8	Lack of credit availability	32 (2560)	28 (1876)	30 (1800)	24 (1272)	20 (940)	24 (984)	22 (726)	20 (400)

The Garrett ranking analysis highlights that the high price of seeds emerged as the most critical constraint faced by respondents, as it received the highest number of first-rank votes, indicating a major affordability issue. This is followed closely by the fear of adulteration and lack of credit availability, which reflect concerns about the quality of inputs and financial accessibility. Other notable constraints include fear of spurious products, lack of technical knowledge, and labour shortage. Unavailability of seeds at the time of sowing and the lack of high-quality seeds, which, although significant, are ranked lower in severity; and perceived as comparatively less pressing.

Table 5: Constraints faced by farmers during procurement and production of hybrid pearl millet seeds (n=200)

Sr. No.	Constraints	Total Garrett Value	Mean Score	Rank
1	Lack of high-quality seed	9648	48.24	VIII
2	High price of seeds	11034	55.57	I
3	Fear of adulteration	10738	53.69	II
4	Unavailability of seeds at the time of sowing	9817	49.08	VII
5	Labour shortage	9931	49.65	VI
6	Fear of spurious product	10419	52.09	IV
7	Lack of technical knowledge	10266	51.33	V
8	Lack of credit availability	10558	52.79	III

Pearl millet farmers reported several constraints during the procurement and production of hybrid seeds (Table 5). Among these, high price was identified as the most critical issue, with a mean score of 55.57, placing it in the first rank. This was followed by fear of adulteration, which had a mean score of 53.69, securing the second rank. The lack of credit availability and fear of spurious products were also major concerns, with mean scores of 52.79 and 52.09, ranked third and fourth, respectively. Other constraints included lack of technical knowledge (51.33, fifth), labour shortage (49.65, sixth), unavailability of seeds at sowing time (49.08, seventh) and lack of high-quality seeds (48.24, eighth). These findings highlight that economic barriers, product authenticity concerns, and limited access to knowledge and resources significantly affect hybrid seed adoption among farmers.

Conclusion

Based on empirical investigation of 200 pearl millet growers from Banaskantha district through communication approach of descriptive cross sectional research design, it was found that hybrid pearl millet cultivation is predominantly managed by male farmers aged between 41-50 years, with most having below SSC education and belonging to nuclear families. Majority have 11-15 years of farming experience, practice irrigated farming on 1.01-2 ha landholdings, and supplement their income with animal husbandry. The surveyed farmers predominantly perceived high prices of seeds as the most significant constraint, followed by fear of adulteration, lack of credit, fear of spurious product and limited technical knowledge. Limited technical knowledge indicated a critical gap in awareness and training. Price sensitivity further discouraged adoption. Fear of adulteration, fear of spurious products and lack of credit also ranked high among the barriers. These findings highlight the need for seed companies to offer fair pricing, transparent quality assurance, and stronger educational outreach through dealer support, field demonstrations and farmer-focused programs to improve adoption and trust in hybrid pearl millet seeds.

Recommendations

1. Farmers face difficulties due to high cost of hybrid seeds. To ease this burden, seed companies should offer discounts, flexible pricing options and access to credit-based payments to ensuring better affordability and adoption.
2. Farmers often worry about seed authenticity, including adulteration and spurious products. Seed companies should ensure transparent sourcing and use QR codes or unique identifiers on packaging to help farmers verify authenticity and build trust in their products.

3. Since lack of technical knowledge has also emerged as the major constraint, it is important to intensify field demonstrations, practical training programs, and farmer meetings to enhance awareness and promote better understanding among farmers.

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