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Farmer-perceived constraints in hybrid paddy procurement: A rural field investigation

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Abstract

India's agricultural growth is becoming more and more dependent on hybrid technology, especially for staple crops like paddy, to make sure that food is safe, that harvests are strong, and that production goes up. Even though science has made progress and more seeds are available, people still find difficulties in hybrid paddy adoption very often, especially in rural areas. The difference is mostly caused by farmers' perceptions of socio-economic, infrastructural, and structural barriers, which make it harder for them to buy and use hybrid seeds. It is important to understand these limits since the success of new ideas in the seed sector depends on how well farmers embrace them and how well they work in the field. This study is significant since it emphasises the demand-side perspective, acknowledging that the adoption of sustainable technology necessitates more than mere supply-chain efficiency. The study employs descriptive cross-sectional research in the tribal belt of Vyara taluka in Tapi district of Gujarat state, aiming to systematically identify and prioritise the principal challenges encountered by 100 hybrid paddy farmers. Thorough analysis of the collected data enables the researchers to come up with useful ideas in the form of actionable suggestions that can help make policies that are fair to everyone and intervention plans that work in the area.

Keywords: Agri-input, constraints, farmer perception, hybrid paddy, input supply chain, procurement, rural farmers

Introduction

The superior performance of agriculture in India has progressively depended on hybrid technology to improve production, especially in grains such as wheat and paddy. 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 paddy has emerged as a point of attraction due to its potential to offer higher yields, uniform quality, and resilience under varying climatic conditions (Federation of Seed Industry of India [FSII], 2024; Singh *et al*., 2019) [1, 2]. However, the successful diffusion of hybrid seed technologies depends not only on supply-side advancements but also on understanding demand-side realities, particularly the constraints perceived by end-users, i.e., farmers.

In rural agrarian systems, the gap between hybrid seed development and its effective adoption is often shaped by a variety of field-level barriers. These include financial limitations, market irregularities, knowledge deficits, accessibility concerns, and climatic challenges (Sushil *et al*., 2023; Ministry of Agriculture & Farmers' Welfare [MoA&FW], 2023) [3, 4]. In addition, the Indian seed sector continues to face persistent issues such as low seed replacement rates, the dominance of self-pollinated varieties, and region-specific agro-economic vulnerabilities (Srivastava, 2018; Habib-ur-Rahman *et al*., 2022) [5, 6]. For hybrid paddy, in particular, procurement becomes a function of not just availability but affordability, timely access, and farmer confidence in the quality and performance of the seeds—factors often undermined by systemic gaps in extension, credit flow, and infrastructure (Chand, 2019; Kumaria, 2024) [7, 8].

This study emphasises the examination of the constraints as perceived by farmers in buying or using hybrid paddy seeds within a rural agricultural context. The analysis puts forwards that understanding these constraints from the farmers' end view is crucial for executing effective policy interventions, supply chain changes, and technological adaptations handcrafted to local conditions.

Review of Literature

A thorough review of the literature reveals that multiple studies have been conducted to explore farmers' behaviour, seed procurement practices, and constraints in paddy cultivation. Maheriya *et al*. (2014) [9] identified knowledge gaps, high input costs, and labour shortages as primary barriers to the adoption of recommended paddy technologies. Similarly, Salunkhe *et al*. (2014) [10] and Singh *et al*. (2022) [11] emphasised the role of demographic and

socio-economic factors such as age, education, landholding, and income in shaping adoption behaviour. In the context of hybrid paddy, Hadimartono *et al*. (2017) [12] and Pandey *et al*. (2020) [13] underscored the influence of input quality, expected yield, availability, and credit facilities on seed purchasing decisions. Studies by Tengil and Sharma (2017) [14] and Salunkhe *et al*. (2019) [15] highlighted systemic constraints like poor input supply, market volatility, and lack of timely extension services. Nagesia and Thakkar (2024) [16] advocated addressing the constraints related to market access and infrastructure to enhance the adoption levels of farmers for hybrid tomato seeds. By implementing targeted marketing campaigns, conducting field demonstrations, forming collaborations, emphasizing high yield and quality, and providing robust customer support and loyalty programs, seed companies can significantly improve their market presence and farmer satisfaction.

While various methodologies, including Garrett ranking and factor analysis, have been employed, most research remains regionally dispersed and lacks a consolidated approach integrating socio-economic profiling, buying behaviour, and adoption constraints specific to hybrid paddy seeds in tribal regions like Vyara taluka.

Materials and Methods

Study Region

The study was confined to the tribal belt of Vyara taluka in Tapi district in the state of Gujarat. The region was purposively selected due to the presence of favourable abiotic factors such as land, climate, and geographical conditions, along with an ever-standing and extensive history of paddy cultivation. These factors collectively served as the primary rationale for the selection of the study area.

Research Design

A descriptive cross-sectional research design was deemed appropriate for the present study. This design was adopted as the researcher exercised no control over the variables under investigation. Emphasis was placed on the exploration of facts and ground realities that had already occurred. The investigation of constraints was considered central to descriptive research, as the difficulties encountered by farmers had already been experienced prior to the study. A cross-sectional approach was employed to capture data at a specific point in time, distinguishing it from longitudinal designs that examine respondents across multiple time frames to establish long-term causal relationships. The present study aimed to explain the constraints perceived by farmers between June and July 2024. Accordingly, the research was accurately characterised as a descriptive cross-sectional study.

Data Collection

Both primary and secondary data were utilised to conduct the study scientifically and systematically. Primary data were collected employing a structured interview schedule. The instrument for primary data collection was developed based on a long-listed review of literature, with a specific focus on studies related to similar agro-climatic regions and the paddy crop. Personal interviews were conducted by directly approaching and building friendly rapport with each respondent to ensure clarity and obtain responses that accurately reflected ground realities and personal experiences. Such time-consuming, pocket-unfriendly efforts were essential for establishing reliable research benchmarks. Secondary data had been sourced from both written and oral references, such as peer-reviewed research publications, including research and review articles, unpublished master-level theses, and critical insights shared by field-level experts of the farming fraternity. This blended approach supported the derivation of insights that were both grounded in evidence and hand-crafted to the specific conditions of the study area.

Sampling Design

Multistage sampling technique was employed to construct a sample size of 100 hybrid paddy farmers. In the first stage, the Vyara taluka was purposively selected from among the seven talukas of the Tapi district, owing to its prominence in paddy cultivation. In the second stage, ten villages were selected through a simple random sampling method. The sampling frame was prepared using data retrieved from the district administration website, and the lottery method was utilised to ensure randomisation. During the final stage, ten hybrid paddy farmers were randomly selected from each village to achieve the targeted sample size. The sampling frame for each village was obtained from the respective village panchayat offices. The selection of respondents was carried out entirely through the lottery method, thereby minimising potential researcher bias and enhancing the objectivity of the sampling process. A detailed sampling plan is provided in Table 1.

Table 1: Sampling plan for the study

Vyara taluka of Tapi district - 100 hybrid farmer respondents		
Stage 1 (Purposive Sampling Technique)	**Stage II (Simple Random Sampling Technique)**	**Stage III (Simple Random Sampling Technique)**
Taluka	**Villages**	**No. of Respondents**
Vyara	Katkui	10
	Bedkuva Najik	10
	Ambiya	10
	Tadkuva	10
	Khuntadiya	10
	Vadkui	10
	Jhankhari	10
	Mirpur	10
	Kanja	10
	Chikhalda	10
Sample Size		100

Data Analysis

The Garrett ranking method was employed to analyse the responses collected during the data collection phase. This method, developed by Henry Garrett, has been widely applied for the analysis of constraints in agricultural and social research. It was utilised in the present study to examine the pre-identified constraints prevailing in the study region and to ascertain their current relevance. Based on credible and robust secondary data, eight major constraints were identified for inclusion in the study, namely: high price, poor crop performance, timely availability, lack of technical knowledge, market fluctuations, non-availability of credit in time, poor seed quality, and lack of awareness.

During the data collection process, respondents were asked to rank these eight constraints from one to eight, without any repetition - rank one indicating the most severe constraint and rank eight the least. For each rank assigned by the respondents, a percent position value was computed using the following formula:

$$Percent\ position\ value = \frac{100\ R_{ij} - 0.5}{N_i}$$

Where,

R_{ij} = Rank, i^{th} item, j^{th} individual; N_j = number of items ranked by the j^{th} individual

Based on the percent position values, Garrett's scores corresponding to each rank position were determined. Subsequently, a frequency-rank matrix was constructed with the identified constraints as column entries and the assigned ranks as row entries. The total Garrett value for each constraint was calculated by summing the scores obtained across all respondents. The mean for each constraint was then computed by dividing the total Garrett value by the number of respondents. On the basis of these means, final ranks were assigned to each constraint in descending order of severity or importance, thereby identifying the most critical constraint faced by the respondents.

Results and Discussion

The data collected was analysed with the Garrett ranking method. For each rank (I to VIII), percent position value was calculated, and the corresponding Garrett score was determined (Table 2).

Table 2: Rank-wise percent position value and Garrett score

Rank	Percent Position Value	Garret Score
I	6.25	80
II	18.75	67
III	31.25	60
IV	43.75	53
V	56.25	47
VI	68.75	40
VII	81.25	32
VIII	93.75	20

Table 2 displays the Garrett scores associated with different ranks' percent position values. Rank I, denoting the most significant constraint as seen by respondents, had a percentage value of 6.25 and was associated with the highest Garrett score of 80. As the rank progressed from I to VIII, signifying a reduction in perceived severity, the percentage position value rose progressively by 12.5 units every rank, culminating at 93.75 at Rank VIII. This scoring approach was essential in quantifying qualitative rankings and facilitating the ultimate prioritisation of constraints based on their means due to their inverse relationship between the percent position value and the Garrett score.

Table 3: Rank-frequency and respective Garrett score of constraints as perceived by hybrid paddy farmers

Sr. No.	Constraints	Rank given by the respondents & Garrett Score based on the rank-freq. given by the respondents							
		1st	2nd	3rd	4th	5th	6th	7th	8th
1	High Price	78 (6240)	17 (1139)	5 (300)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	Poor Crop Performance	1 (80)	0 (0)	3 (180)	7 (371)	14 (658)	21 (840)	27 (864)	27 (540)
3	Timely Availability	15 (1200)	51 (3417)	21 (1260)	8 (424)	1 (47)	2 (80)	2 (64)	0 (0)
4	Lack of Technical Knowledge	0 (0)	3 (201)	4 (240)	6 (318)	23 (1081)	26 (1040)	24 (768)	14 (280)
5	Market Fluctuations	3 (240)	13 (871)	26 (1560)	40 (2120)	9 (423)	5 (200)	3 (96)	1 (20)
6	Non-availability of Credit in Time	3 (240)	12 (804)	36 (2160)	26 (1378)	11 (517)	5 (200)	5 (160)	2 (40)
7	Poor Seed Quality	0 (0)	4 (268)	5 (300)	9 (477)	29 (1363)	18 (720)	18 (576)	17 (340)
8	Lack of Awareness	0 (0)	0 (0)	0 (0)	4 (212)	13 (611)	23 (920)	21 (672)	39 (780)

Table 3 indicates that "high price" was perceived as the most critical constraint, receiving the highest frequency of 78 respondents at the first rank, with a Garrett score of 6240. It was also ranked second by 17 respondents, producing a Garrett score of 1139, while no respondents placed it in ranks fourth to eighth, highlighting its strong severity. In contrast, constraints such as "timely availability," "market fluctuations," "non-availability of credit in time," and "lack of technical knowledge" were more evenly spread across the middle ranks. "timely availability" received its peak at the second rank with 51 respondents, yielding a Garrett score of 3417, followed by 21 respondents at the third rank, giving a Garrett score of 1260. "Market fluctuations" had 40 respondents at the fourth rank, resulting in a Garrett score of 2120, and "non-availability of credit in time" had 36 respondents at the third rank, resulting in a Garrett score of 2160. "Lack of technical knowledge" was most frequently ranked sixth by 26 respondents, with a Garrett score of 1040. At the lower end, "poor seed quality" and "lack of awareness" were primarily ranked in the bottom positions. "poor seed quality" was ranked fifth by 29 respondents, resulting in a Garrett score of 1363, while "lack of awareness" had 39 respondents at the eighth rank, giving the lowest Garrett score of 780, indicating that these constraints were perceived as relatively less severe by the majority of respondents.

Table 4: Constraints as perceived by hybrid paddy farmers

Sr. No.	Constraints	Total Garrett Value	Mean	Rank
1	High Price	7679	76.79	I
2	Poor Crop Performance	3533	35.33	VII
3	Timely Availability	6492	64.92	II
4	Lack of Technical Knowledge	3928	39.28	VI
5	Market Fluctuations	5530	55.30	III
6	Non-availability of Credit in Time	5499	54.99	IV
7	Poor Seed Quality	4044	40.44	V
8	Lack of Awareness	3195	31.95	VIII

Table 4 summarises the final outcome of the Garrett ranking analysis, presenting the total Garrett values, their corresponding means, and the obtained ranks for each of the eight identified constraints. "High price" emerged as the most severe constraint, securing the highest total Garrett value of 7679 and a mean of 76.79, thereby attaining Rank I. This confirms that the majority of respondents consistently viewed input cost as the most pressing issue. Following closely, "timely availability" was ranked second, with a total Garrett value of 6492 and a mean of 64.92, indicating that timely access to inputs was also a major concern among farmers. "Market fluctuations" and "non-availability of credit in time" received the third and fourth ranks, respectively, with means of 55.30 and 54.99, reflecting moderate levels of severity. "Poor seed quality" and "lack of technical knowledge" occupied the middle-to-lower tiers, with ranks V and VI, respectively, based on means of 40.44 and 39.28. The least severe constraints were "poor crop performance" and "lack of awareness", which obtained the lowest means of 35.33 and 31.95 and were placed at Rank VII and Rank VIII, respectively. This suggests that while acknowledged, these constraints were not perceived as critical by most respondents.

Suggestions

1. High price was perceived as the foremost constraint among the surveyed rural hybrid paddy farmers. This implies rural farmers don't feel the value claimed by the seed marketers. Hence, companies or marketers should focus on optimum value delivery to the rural farmers through their downstream stakeholders like distributors, dealers, and retailers. Value should be delivered in the right spirit, context, manner, and form to improve farmers' end view on seed prices.
2. For any agri-input, timely availability of input is the topmost priority. Seeds not available at the intended time may tend to alter the entire cropping schedule, in extreme cases, resulting in crop switching. Therefore, to refrain from crop switching and harness maximum market share, efforts must be aligned to strengthen the supply chain, improve efficiencies, and orient marketing efforts towards the timely availability of seeds. Sales audit and distributor supplies audit should be practiced regularly to reduce anomalies in the supplies.
3. As reported by the rural farmers, regarding the non-availability of credit in time, the region accommodates rural farmers who mainly fall in the bracket of small and marginal farmers, and with annual family income typically less than two lakhs rupees. This leads to rural farmers lacking cash during input purchases. This necessitates that rural farmers should have credit-based purchase options. Hence, dealers should be provided with credit-based initiatives by the companies, like equated monthly instalment (EMI), or a down payment option in close collaborations with microfinance institutions at the point of purchase or the dealer's doorstep. This will also help to increase dealers' preference among the rural farmers, ultimately leading to enhanced brand loyalty and customer retention.

Conclusion

The investigation conducted in the region elucidates the constraints as perceived by the hybrid paddy farmers. Eight pre-identified constraints were tested, among which high price was perceived as the most critical constraint. This displays a strong sense of economic consciousness among the respondents. Another such critical constraint was the timely availability, i.e., seeds were not timely available when required. In a strong connection, the non-availability of credit at the time of purchase, associated with seed price market fluctuations, tends to put farmers into a whirlpool of disturbances. However, seed producers and marketers, government institutions, and other stakeholders should focus on eliminating such constraints to uplift the farming community. This will significantly channelize efforts to promote the adoption and acceptance of hybrid seeds in the Indian agricultural ecosystem, showcasing a small but crucial step towards prosperous farmers, a prosperous India, particularly in rural India.

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