

An economic analysis of market acceptance and performance of Rice varieties grown in Northern Telangana Zone

ABSTRACT

This study aims to conduct an economic analysis of market acceptance and performance of rice varieties grown in the Northern Telangana Zone, where diverse rice cultivars face cultivation and marketing challenges. The objectives are to identify and document rice cultivars released by PJTSAU, study technological attributes preferred by stakeholders, and document constraints faced by stakeholders. A purposive sampling technique was used to select 90 farmers, 30 traders, and 30 consumers, totaling 150 participants. Data were collected using well-developed schedules and analyzed using tabular analysis, Rice Preference Index (RPI), Garrett ranking technique, and other suitable methods. The results showed that Telangana Sona (RNR 15048) is highly favored for its long grain size, high head rice recovery, and strong market demand, despite its susceptibility to stem borer and higher fertilizer requirements. Pranahitha (JGL 11727) is appreciated for its good rice quality but faces significant challenges, including high susceptibility to lodging, pests, and diseases, and lower germination rates. Kunaram Rice-1 (KNM 733) showed acceptable profitability but struggled with low market demand, poor grain quality, and higher water requirements. The study concludes that while Telangana Sona excels in market appeal and profitability, Pranahitha and Kunaram Rice-1 need targeted interventions to overcome their specific constraints. Enhancing pest resistance, improving grain quality, and reducing input requirements are essential for optimizing the potential of these varieties. Addressing these challenges through improved management practices and technology adoption can significantly benefit farmers and boost the marketability of these paddy varieties.

Keywords: Rice varieties, Northern Telangana, Market acceptance, Rice Preference Index

1. INTRODUCTION

In the Northern Telangana Zone, rice cultivation is a significant agricultural activity, contributing substantially to the livelihood of farmers and the overall food security of the region. This area, encompassing districts such as Adilabad, Komaram Bheem Asifabad, Nirmal, Mancherial, Nizamabad, Jagtial, Peddapalli, Kamareddy, Rajanna Sircilla and Karimnagar has diverse agro-climatic conditions that favor rice production. The Northern Telangana Zone is characterized by its varied topography, soil types, and irrigation facilities, which influence the types of rice varieties cultivated. According to recent agricultural statistics, the region's rice cultivation area spans approximately 1.2 million hectares,

producing an average yield of 3.8 to 4.2 tons per hectare. This accounts for about 10% of Telangana's total rice production, reflecting the zone's pivotal role in the state's agriculture sector (Agricultural Statistics at a Glance, Government of Telangana, 2022). In the agricultural year 2022-2023, Northern Telangana produced approximately 4.8 million tons of rice, marking a significant contribution to the state's total rice output of 12.5 million tons (Department of Agriculture, Government of Telangana, 2023). The market performance of rice varieties in Northern Telangana is influenced by several factors, including quality parameters, consumer preferences, pricing policies etc.,. So there is a need to know the nature and extent of different varieties, their quality parameters, acceptance and preference by different stake holders. Azabagaoglu and Gaytancioglu (2009) from their study on "Analyzing consumer preference to different rice varieties in Turkey" reported that the market price of the variety as the major criteria. Gyawali *et al.* (2007) and Morris and Bellon (2004) reported that the involvement of farmers in decision- making processes makes improved rice varieties compatible with farmers requirements which is the need of the hour. Nishi *et al.* (2017) from their study on "Farmers' preferences to varietal attributes as an indicator for acceptance and adoption of aromatic rice (*Oryza sativa*) varieties" reported that Pusa Basmati 1509 (RPI-6.69) ranked highest and it was followed by Pusa Basmati 1121 (RPI-6.56) and Pusa Basmati 1 (RPI-6.52). So this study aims to identify the cultivars Pranahitha (Jgl 11727), Telangana sona-RNR (15048), Kunaram rice 1 (KNM-733) released by PJTSAU in rice and document the features with specific reference to market, to identify and study technological attributes of rice preferred by stake holders and to document constraints opined by stake holders among the cultivars.

2. MATERIAL AND METHODS

To determine the farmers preference for rice varieties based on varietal attributes, a total of 25 attributes were selected namely, Appropriate duration, Appropriate germination, Less inputs cost, less labour use, Appropriate panicle length, Appropriate tillering, Flowering even, Fertilizer response more , Resistant to insects and pests, Resistant to diseases, Ripening even, Appropriate height, Less or no lodging, Grain size small and slender, Appropriate yield, Easy to cultivate, Easy to harvest , Easy to thresh, Less milling loss, Good Market price, Good market demand and Appropriate Taste. Respondents were asked to assign a score between 1 to 5 for set of 25 varietal attributes. For each variety, 30 sample farmers were selected and mean scores were calculated to know the trait i.e., mostly preferred by farmers.

Further, the preferences of the farmers for identified rice varieties were measured by developing Rice Preference Index (RPI). Similarly, for identified traits distinct indicators were enlisted and their relative ranking according to importance were done by the rice breeders, agronomist and other experts of NTZ and accordingly the weight for each indicator was obtained.

To calculate the weighted scores, each score was multiplied by the weight for each trait. Thus, weighted scores were summed up to obtain an aggregate weighted score for each trait.

The product of total score with the weighted scores for a particular trait for a variety was added to arrive at the grand weighted score.

The grand weighted score was further divided by the number of farmers to arrive at the preference ranking score. The varieties were finally ranked according to the rice preference index scores Sharma *et al* (2017).

$$RPI = \frac{\sum_{k=1}^m \sum_{j=1}^{25} \sum_{i=1}^n w_{ij} X_{ijk}}{\sum_{k=1}^m}$$

where, RPI= Rice preference index,

w_i = weight of the j^{th} characteristic of the i^{th} rice variety,

X_{ijk} = farmers preference score assigned towards j^{th} characteristic of i^{th} rice variety by k^{th} farmer,

i =rice variety ranging from 1 to n ,

j =characteristic of rice variety ranging from 1 to 25,

k = number of respondent farmers ranging from 1 to m .

Northern Telangana Zone was selected purposively because of its highest area under rice cultivation. Purposive sampling technique was used for selection of over all 90 farmers, 30 traders and 30 consumers for the selected rice varieties. For each of the three selected varieties Pranahitha (Jgl 11727), Telangana sona-RNR (15048), Kunaram rice 1 (KNM-733) - data was collected from 30 farmers, 10 traders and 10 consumers each from Jagtial, Nizamabad and Peddapally districts. Hence, the total sample becomes 150 presented below in the table .1. Data was collected with the help of well-developed schedules. Tabular analysis, Rice Preference Index (RPI), garette ranking technique and other suitable techniques were employed to arrive at the conclusions.

Table 1: Experimental design

Variety	District	Mandal	Villages	No. of farmers	No. of traders	No. of consumers
Pranahitha (Jgl 11727)	Jagtial	Jagtail rural	Gullapet	8	10	10
			Habsipur	7		
			Polasa	8		
			Thimmapur	7		
Telangana sona-RNR (15048)	Nizamabad		Nyalka	8	10	10
			Arsapally	7		
			Makloor	7		
			Gunjili	8		
Kunaram rice 1 (KNM-733)	Peddapally		kalvasrirampur	8	10	10
			Pegadapally	7		
			Muttaram	8		
			Adavisrirampur	7		
Total				90	30	30
Grand total					150	

3. RESULTS AND DISCUSSION

The perception of millers on the marketability of three paddy varieties—Pranahitha (11727), Telangana Sona-RNR (15048), and Kunaram Rice 1 (KNM-733) reveals distinct differences in key attributes. Telangana Sona-RNR is highly favored, with 93.33% recognizing its long grain size, 100% noting its high head rice recovery, 90% indicating high consumer demand, and 70% acknowledging its good rice quality. Pranahitha also shows favorable perception but lags behind Telangana Sona-RNR, with 70% for both long grain size and high head rice recovery, 56.67% for consumer demand, and 76.67% for good rice quality. Kunaram Rice 1 is the least preferred among the three, with only 43.33% for long grain size, 60% for high head rice recovery, 30% for consumer demand, and 36.67% for good rice quality. This analysis highlights Telangana Sona-RNR as the superior variety in terms of market preference, making it the top choice for millers and consumers based on its traits presented below in the table 2

Table 2: Perception of millers on selected paddy varieties with specific reference to market

Particulars	Pranahitha (11727)		Telangana sona-RNR (15048)		Kunaram rice 1 (KNM-733)	
	Yes	%	Yes	%	Yes	%
Long grain size	21	70	28	93.33	13	43.33
High head rice recovery	21	70	30	100	18	60
More consumer demand	17	56.67	27	90	9	30
Good rice quality	23	76.67	21	70	11	36.67

The table .2 illustrates the criteria considered by millers for choosing between three paddy varieties—Pranahitha (JGL 11727), Telangana Sona (RNR 15048), and Kunaram Rice 1 (KNM-733)—for milling. Telangana Sona (RNR 15048) emerges as the most preferred choice, ranking first in total mean score with 3.63. This variety is particularly favored for its good rice quality (ranked 1st with a score of 2.7), high head rice recovery (ranked 1st with a score of 4.38), and strong market demand (ranked 2nd with a score of 4.27). Pranahitha (JGL 11727) follows closely behind with a total mean score of 3.47, ranking second. It is noted for its good keeping quality and taste (ranked 2nd with a score of 4.2) and good grain quality (ranked 2nd with a score of 2.97). Kunaram Rice 1 (KNM-733) ranks third with a total mean score of 2.92, performing relatively well in all criteria but not standing out in any particular aspect. This analysis indicates that Telangana Sona (RNR 15048) is the preferred choice among the three varieties for milling, primarily due to its superior rice quality, high head rice recovery, and strong market demand.

Table 3.: Criteria for choosing selected paddy varieties for milling

S.No.		Pranahitha (JGL 11727)		Telangana sona (RNR 15048)		Kunaram rice 1 (KNM-733)	
1	Good grain quality	2.97	5	3.97	3	1.6	3
2	Good rice quality	4.37	1	2.7	5	3.33	5
3	High head rice recovery	3.33	4	4.38	1	3.63	1
4	Less breakage of rice	3.47	3	3.13	6	3.4	6
5	More market demand	2.47	6	4.27	2	2.4	2
6	Good keeping quality and taste	4.2	2	3.3	4	3.13	4
	Total mean score and rank	3.47	2	3.63	1	2.92	3

Table 3 illustrates that Telangana Sona-RNR (15048) is perceived 80%, higher consumer satisfaction in most categories. It received the highest ratings for good appearance (80%), good flavour after cooking (76.67%), and good cooking quality (83.33%). Pranahitha (11727) also performed well, with 80% or higher consumer satisfaction for most attributes except for good taste, where it scored 83.33%. Kunaram Rice 1 (KNM-733) received lower scores overall, with the lowest ratings for good appearance (40%) and good taste (43.33%). Telangana Sona-RNR (15048) appears to be the preferred choice among consumers, likely due to its favorable attributes across various quality indicators.

Table 4: Perception of consumers on selected paddy varieties with specific reference to market

Particulars	Pranahitha (11727)		Telangana sona-RNR (15048)		Kunaram rice 1 (KNM-733)	
	Frequency	%	Frequency	%	Frequency	%
Good appearance	22	73.33	24	80	12	40
Less breakage of rice	24	80	22	73.33	20	66.67
Good flavour after cooking	21	70	23	76.67	19	63.33
Good taste	25	83.33	19	63.33	13	43.33
Good cooking quality	26	86.67	25	83.33	16	53.33
Good keeping quality	23	76.67	24	80	16	53.33
Reasonable price	21	70	27	90	14	46.67

The table 4 presents the economics of paddy cultivation for three paddy varieties—Pranahitha (JGL 11727), Telangana Sona (RNR 15048), and Kunaram Rice-1 (KNM 733)—in terms of operational and fixed costs per hectare. In terms of Operational Costs: Pranahitha has the highest total operational cost at ₹65,627.39 per hectare, followed closely by Telangana Sona at ₹65,006.88 per hectare, and Kunaram Rice-1 at ₹66,162.83 per hectare. This indicates that Kunaram Rice-1 is slightly more expensive to cultivate in terms of operational costs. In terms of fixed Costs Telangana Sona has the highest total fixed cost at ₹22,288.75 per hectare, followed by Pranahitha at ₹21,688.58 per hectare, and Kunaram Rice-1 at ₹20,560.38 per hectare. This suggests that Telangana Sona requires more investment in fixed costs compared to the other two varieties. In terms of total Cost The total cost of cultivation is highest for Pranahitha at ₹87,315.96 per hectare, followed by Telangana Sona at ₹87,295.63 per hectare, and Kunaram Rice-1 at ₹86,723.21 per hectare. Despite having lower operational

and fixed costs individually, Kunaram Rice-1 total cost is slightly lower due to its lower fixed costs. In conclusion, while Pranahitha and Telangana Sona have similar total costs, Kunaram Rice-1 emerges as a slightly more cost-effective option for paddy farmers.

Table 5: Economics of paddy cultivation by paddy farmers

S. No.	Cost component	Costs (₹ ha ⁻¹)		
		Pranahitha (JGL 11727)	Telangana Sona (RNR 15048)	Kunaram rice-1 (KNM 733)
I.	Operational costs			
1	Human labour	25094.17 (28.74)	25650 (29.38)	25028.13(28.86)
2	Machine power	16193.75 (18.55)	15825 (18.13)	15775(18.19)
3	Seed	3940.83 (4.51)	2565 (2.94)	2266.67(2.61)
4	FYM	5539.58 (6.34)	5906.25 (6.77)	6327.08(7.3)
5	Fertilizers	6545.83 (7.5)	5931.25 (6.79)	6214.58(7.17)
6	Plant protection chemicals	4628.33 (5.3)	5253.33 (6.02)	5212.5(6.01)
7	Irrigation charges	1393.33 (1.6)	1250 (1.43)	1254.17(1.45)
8	Miscellaneous	431.67 (0.49)	819.17 (0.94)	386.67(0.45)
9	Interest on working capital	1859.89 (2.13)	1806.88 (2.07)	3698.04(4.26)
	Total operational costs	65627.39 (75.16)	65006.88 (74.47)	66162.83 (76.29)
II.	Fixed costs			
1	Rental value of owned land	17958.33(20.57)	19250 (22.05)	17741.67(20.46)
2	Rent paid for leased in-land	0 (0)	0 (0)	0 (0)
3	Depreciation	1758.56 (2.01)	1012.5 (1.16)	949.58(1.09)
4	Interest on fixed capital	1971.69 (2.26)	2026.25 (2.32)	1869.13(2.16)
	Total fixed costs	21688.58 (24.84)	22288.75 (25.53)	20560.38 (23.71)
	Total cost	87315.96 (100.00)	87295.63 (100)	86723.21(100)

Table 5 presents Pranahitha has a total cost of ₹87,315.96 per hectare, Telangana Sona has a total cost of ₹87,295.63 per hectare, and Kunaram Rice-1 has a total cost of ₹86,723.21 per hectare. Pranahitha yields 6175 kg per hectare, Telangana Sona yields 6317 kg per hectare, and Kunaram Rice-1 yields 6216 kg per hectare. Pranahitha has gross returns of ₹116,426.7 per hectare, Telangana Sona has gross returns of ₹131,715.83 per hectare, and Kunaram

Rice-1 has gross returns of ₹118,598.79 per hectare. Pranahitha has net returns of ₹29,110.7 per hectare, Telangana Sona has net returns of ₹44,420.21 per hectare, and Kunaram Rice-1 has net returns of ₹31,875.58 per hectare. Pranahitha has a return of ₹1.33 for every rupee spent, Telangana Sona has a return of ₹1.51, and Kunaram Rice-1 has a return of ₹1.37. Telangana Sona (RNR 15048) emerges as the most profitable variety, with the highest net returns per hectare at ₹44,420.21 and the highest returns per rupee spent at ₹1.51. Pranahitha (JGL 11727) and Kunaram Rice-1 (KNM 733) also show profitability, with net returns of ₹29,110.7 and ₹31,875.58 per hectare respectively. These figures suggest that all three varieties are economically viable for paddy farmers, with Telangana Sona exhibiting the highest profitability.

Table .6: Profitability of paddy cultivation by paddy farmers

S.No.	Particulars	Pranahitha (JGL 11727)	Telangana Sona (RNR 15048)	Kunaram rice-1 (KNM 733)
1	Total cost of cultivation (₹ ha ⁻¹)	87315.96	87295.625	86723.21
2	Yield (kg ha ⁻¹)	6175	6317	6216
3	Gross returns (₹ ha ⁻¹)	116426.7	131715.83	118598.79
4	Net returns (₹ ha ⁻¹)	29110.7	44420.21	31875.58
5	Returns per rupee spent	1.33	1.51	1.37

Table .6 shows that Pranahitha has a unit weighted score of 4.03, Telangana Sona has a score of 4.25, and Kunaram Rice-1 has a score of 4.08. Pranahitha has a total score of 2509, Telangana Sona has a total score of 2564, and Kunaram Rice-1 has a total score of 2172. Pranahitha has a weighted score of 438.88, Telangana Sona has a weighted score of 452.2, and Kunaram Rice-1 has a weighted score of 364.35, assessed by 30 respondents each. Telangana Sona (RNR 15048) has the highest Rice Preference Index RPI at 15.07, indicating it is the most preferred variety among the sample farmers. Pranahitha (JGL 11727) follows with an RPI of 14.63, and Kunaram Rice-1 (KNM 733) has the lowest RPI at 12.15. This preference could be attributed to factors such as taste, cooking quality, yield, and market demand, as indicated by the various assessments in the study.

Table .7: Rice Preference Index (RPI) of selected paddy varieties by sample farmers

S.No	Particulars	Pranahitha (JGL 11727)			Telangana Sona (RNR 15048)			Kunaram rice-1 (KNM 733)		
		Unit weighted score	Total score	Weighted score or total score	Unit weighted score	Total score	Weighted score or total score	Unit weighted score	Total score	Weighted score or total score
1	Total	4.03	2509	438.88	4.25	2564	452.2	4.08	2172	364.35
2	No. of respondents			30			30			30
3	RPI	14.63			15.07			12.15		

Table 8 below illustrates that the sample farmers have identified and ranked various constraints associated with the cultivation of the Pranahitha variety of paddy. The most significant constraint, ranked first with a Garrett score of 78.6, is "More lodging," indicating a high perception that this variety is prone to lodging, leading to yield losses and difficulties during harvesting. Following closely behind is "Susceptible to pests and diseases (false smut)" with a score of 75.85, highlighting concerns about the variety's vulnerability to these issues. "Difficulty in harvesting" is ranked third at 72, indicating challenges in harvesting Pranahitha, possibly due to lodging or other factors. "Uneven flowering" is ranked fourth at 65.69, suggesting issues with uniformity in flowering that can impact grain development and yield. "Difficulty in threshing" is ranked fifth at 59.18, indicating that Pranahitha is difficult to thresh, increasing post-harvest processing time and costs. Other constraints include "Not suitable to all types of soils" (ranked sixth at 46.68 and again at eighth at 46.68), highlighting limitations in adaptability to different soil types, and "Less germination %" (ranked seventh at 43.8), indicating a perception of lower germination rates, impacting overall yield and stand establishment. "Less market demand" is ranked ninth at 47.54, suggesting lower market demand for Pranahitha compared to other varieties, which can affect its profitability and marketability. "More fertilizer needed" is ranked tenth at 30.2, indicating that Pranahitha requires more fertilizer inputs compared to other varieties, potentially increasing production costs.

Table .8: Constraints opined by sample farmers of Pranahitha variety of paddy

S.No.	Statements	Garrett score	Rank
1	Less germination %	43.8	8
2	Not suitable to all types of soils	46.68	7
3	More fertilizer needed	30.2	11
4	Susceptible to pests and diseases (false smut)	75.85	2
5	Uneven flowering	65.69	4
6	More lodging	78.6	1
7	Difficulty in harvesting	72	3

8	Difficulty in threshing	59.18	5
9	Grain quality not good	27.63	9
10	Less market demand	47.54	6
11	Cooking quality not good	26.76	10

Table 8 illustrates that Sample farmers identified and ranked various constraints associated with the cultivation of the Kunaram Rice-1 (KNM 733) variety of paddy. The most significant constraint, ranked first with a Garrett score of 68.5, is "Less market demand," indicating challenges in selling this variety compared to others. Following closely behind is "Low grain quality," ranked second at 66.5, suggesting that the variety is perceived to have lower grain quality, which can impact its market value and consumer acceptance. "Cooking quality not good" is ranked third at 38.6, indicating that farmers find the cooking quality of Kunaram Rice-1 unsatisfactory, affecting its appeal to consumers. "Acceptable taste" is ranked fourth at 37, suggesting that while the taste of Kunaram Rice-1 is acceptable, it is not a major factor influencing farmers' decisions. "Less test weight" is ranked fifth at 28.5, indicating that Kunaram Rice-1 is perceived to have a lower test weight, which can affect its milling and processing qualities. Ranked sixth with a Garrett score of 57.2 is "High susceptibility to pests and diseases (blast)," indicating concerns about the variety's vulnerability to blast disease, which can lead to significant yield losses. "More lodging" is ranked seventh at 56.3, suggesting that Kunaram Rice-1 is prone to lodging, which can result in yield losses and difficulties during harvesting. Ranked eighth is "Less tillering" with a Garrett score of 49.7, indicating that farmers perceive Kunaram Rice-1 to have less tillering capacity, potentially affecting its overall yield potential. "More water requirement" is ranked ninth at 47.8, suggesting that Kunaram Rice-1 requires more water compared to other varieties, which can pose challenges in water management and increase irrigation costs. Finally, "Difficulty in threshing" is ranked tenth with a Garrett score of 45.6, indicating that farmers find Kunaram Rice-1 difficult to thresh, potentially increasing post-harvest processing time and costs. These constraints highlight the various challenges faced by farmers cultivating Kunaram Rice-1, emphasizing the need for targeted management practices to address these issues and improve the variety's overall performance.

Table .9: Constraints opined by sample farmers of Kunaram rice – 1 (KNM 733) variety of paddy

S.No.	Particulars	Garrett score	Rank
1	Less market demand	68.5	1
2	Low grain quality	66.5	2
3	Acceptable taste	37	4
4	Cooking quality not good	38.6	3
5	Less test weight	28.5	5

Table 10 illustrates that Sample farmers have identified and ranked various constraints associated with the cultivation of the Telangana Sona (RNR 15048) variety of paddy. The most significant constraint, ranked first with a Garrett score of 70.73, is "Susceptible to Stemborer," indicating that farmers perceive this variety to be highly susceptible to stemborer infestations, which can lead to yield losses if not managed effectively. "Less Grain Weight" is ranked second at 62.23, suggesting that Telangana Sona produces grains with lower weight, potentially impacting its market value and yield. "Cooking Quality Not Good" is ranked third at 41.3, indicating that farmers find the cooking quality of Telangana Sona to be unsatisfactory, which can affect its consumer appeal. "More Fertilizer Needed" is ranked fourth at 29.2, suggesting that Telangana Sona requires higher fertilizer inputs compared to other varieties,

potentially increasing production costs. These constraints highlight the challenges faced by farmers cultivating Telangana Sona and the need for targeted management practices to address these issues and improve the variety's overall performance.

Table .10: Constraints opined by sample farmers of Telangana sona (RNR 15048) variety of paddy

S.No.	Particulars	Garrett score	Rank
1	Less grain weight	62.23	2
2	Susceptible to stemborer	70.73	1
3	More fertilizer needed	29.2	4
4	Cooking quality not good	41.3	3

4. CONCLUSION

The analysis of various paddy varieties, including Pranahitha (JGL 11727), Telangana Sona (RNR 15048), and Kunaram Rice-1 (KNM 733), offers valuable insights into their cultivation and market dynamics based on farmer perceptions, economic viability, profitability, and constraints.

Pranahitha (JGL 11727) faces significant challenges, such as high susceptibility to lodging, pests, and diseases, as well as difficulties in harvesting and threshing. It also has lower germination rates, less market demand, and requires more fertilizers, which impacts its overall profitability and market acceptance. Despite these issues, it shows good rice quality and consumer demand, indicating its potential if these constraints are effectively managed.

Telangana Sona (RNR 15048) is highly regarded for its long grain size, high head rice recovery, and good market demand, making it a preferred choice among millers and consumers. However, it faces challenges such as susceptibility to stemborer infestations, lower grain weight, and higher fertilizer requirements. Addressing these issues could further enhance its profitability and acceptance.

Kunaram Rice-1 (KNM 733) shows acceptable levels of yield and profitability but is hindered by lower market demand, low grain quality, and poor cooking quality. Additionally, it requires more water and is difficult to thresh, posing challenges in terms of cultivation and post-harvest processing. Improvements in these areas could make it a more viable option for farmers.

Overall, the economic analysis highlights that while all three varieties have their strengths, they also have specific constraints that require targeted interventions. Improving resistance to pests and diseases, enhancing grain quality, and reducing input requirements are critical steps toward maximizing the profitability and sustainability of these paddy varieties. Addressing these constraints through better management practices, breeding programs, and technology adoption can significantly benefit farmers and improve the marketability of these varieties.

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