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Performance of Rice Variety RNR 15048 under Frontline Demonstrations in Uttara Kannada District, Karnataka, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Abstract

Background: The field performance of rice variety RNR 15048 (Telangana Sona) under an integrated production package requires assessment in specific farming environments.
Aims: To assess the field performance, yield attributes, economic feasibility, and pest and disease responses of rice variety RNR 15048 under frontline demonstrations (FLDs) in farmers' fields across Uttara Kannada district, Karnataka.
Study Design: A frontline demonstration (FLD) design used purposive sampling to select participating farmers and compared improved production technologies with traditional local practices (farmers' check).

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Place and Duration of Study: Farmers' fields in Malagi and Banavasi villages of Uttara Kannada district, Karnataka, during the kharif seasons of 2024–25 and 2025–26.
Methodology: The demonstrations involved 10 participating farmers (five in Malagi and five in Banavasi). An improved package of practices (variety RNR 15048, seed rate of 25 kg/ha, line sowing of pre-germinated seeds, spacing of 20 × 10 cm, balanced soil-test-based NPK application, integrated weed management, and need-based plant protection) was evaluated against local farmers' practices. Data on growth parameters (plant height, tillers per hill, and panicle length), grain yield, insect pests (leaf folder, yellow stem borer, and earhead bug), blast disease severity, and economic returns were recorded and analysed.
Results: The demonstrations recorded grain yields of 56.0 q/ha in 2024–25 and 59.5 q/ha in 2025–26, compared with 40.0 q/ha and 41.5 q/ha, respectively, in the check, representing yield advantages of 40.0% and 43.4%. Demonstration plots showed more favourable crop growth attributes, including plant height (96.0–97.0 cm), tillers per hill (30.0–30.6), and panicle length (26.0–27.2 cm). Lower leaf folder incidence (1.78%–1.82%) and blast severity (1.80–2.00 PDI) were recorded in demonstration plots. The benefit–cost (B:C) ratio reached 2.80 in the demonstration, compared with the reported value of 1.99 in the check, during 2025–26.
Conclusion: Frontline demonstrations indicated higher grain yields, lower recorded blast severity, and favourable economic outcomes for the RNR 15048 production package during 2025–26 in Uttara Kannada district. Participating farmers also reported suitability for delayed sowing and favourable grain appearance and cooking quality.

Keywords: RNR 15048; Telangana Sona; rice; frontline demonstration; grain yield; farm economics.

1. Introduction

Rice (*Oryza sativa* L.) is a major food crop and an important component of farm livelihoods in India. Rice productivity in rain-dependent and monsoon-influenced production environments is affected by the timing and distribution of rainfall, crop establishment and the occurrence of pests and diseases. Short-duration varieties with acceptable grain and cooking quality can provide farmers with additional flexibility where sowing or transplanting is delayed (Mondal *et al*., 2022). RNR 15048, popularly known as Telangana Sona, is a short-duration, fine-grain rice variety developed at Professor Jayashankar Telangana State Agricultural University. Published varietal information describes it as a short-slender, fine-grain type with a duration of about 125 days, good cooking quality and resistance to rice blast (Chandra Mohan *et al*., 2021).

As observed by Nikitha *et al*. (2018), "RNR 15048 is highly photosensitive in nature and performs well even under low nitrogen levels; however, early sowing triggers excessive vegetative growth due to a prolonged growth phase, leading to lodging and severe reduction in fertile grain filling per panicle". Therefore, standardising the location-specific sowing window is critical to preventing crop loss. A separate study of summer paddy found that the transplanting window and choice of variety influenced growth, yield, and economic outcomes under its experimental conditions, illustrating the importance of evaluating crop timing locally (Upadhyay *et al*., 2025).

Frontline demonstrations are an important extension approach for assessing and showcasing improved crop technologies under farmers' field conditions. They also provide an opportunity to document crop performance, economic returns and farmers' perceptions in a practical production setting. Previous FLD work on rice varieties including RNR 15048 has reported improvements in yield and farm returns under improved production and protection practices compared with farmers' practice (Shankar *et al*., 2025). In this context, demonstrations of RNR 15048 were conducted in Malagi and Banavasi villages of Uttara Kannada district during 2024–25 and 2025–26. The present paper documents the growth, yield, selected pest and disease observations, economics and farmers' feedback recorded in the demonstration programme. Field demonstrations of a short-duration rice variety in Tamil Nadu also compared an improved cultivation package with farmers' practices and documented differences in grain yield and economic returns (Ganapathy *et al*., 2024). On-farm research in Timor-Leste similarly examined how recommended management packages affect the productivity and cost–benefit performance of direct-seeded rice (Goto *et al*., 2025).

Recent field evidence supports the use of integrated, location-specific production packages when rice technologies are evaluated under farmers' conditions. Soil-test-based nutrient prescriptions can improve grain yield, nutrient-use efficiency, and profitability by matching fertiliser inputs more closely with crop demand and indigenous soil fertility, while integrated weed management can reduce weed competition and sustain yield in direct-seeded rice systems (Singh *et al*., 2021; Kashyap *et al*., 2022). These findings are relevant to the present demonstration because the improved package combined balanced soil-test-based fertilisation, line sowing, integrated weed management, and need-based crop protection rather than evaluating the variety in isolation. Consequently, differences between the demonstration and farmers' practice should be interpreted as the field response of RNR 15048 within an integrated management package, while recognising that varietal potential and crop management jointly determine the observed performance. An on-farm study in Indonesia found that a locally adapted rice variety combined with appropriate plant population and site-specific nutrient management increased yields relative to farmers' management practices (Sembiring *et al*., 2025).

Frontline demonstrations are also useful for assessing whether a technology that performs well in research settings retains agronomic and economic value under heterogeneous farm conditions. Rice FLDs conducted in other Indian production environments have reported higher grain yield and narrower extension gaps when improved varieties are combined with recommended crop management, while demonstrations of the system of rice intensification have similarly documented gains in productivity and profitability relative to prevailing farmer practices (Bisen *et al*., 2024; Kapur *et al*., 2023). At the adoption stage, farmers' evaluation of a rice variety extends beyond yield alone: crop duration, suitability to local conditions, pest and disease response, grain type, cooking quality, and marketability can influence varietal preference and continued use (Bhuyan *et al*., 2022; Paul *et al*., 2026). Accordingly, documenting both measured field performance and farmer feedback provides a more complete basis for judging the local relevance of RNR 15048 in Uttara Kannada.

Although these studies provide evidence on rice production packages and on-farm demonstrations in other settings, the literature discussed above does not establish how the RNR 15048 demonstration package performs in terms of growth, yield, selected pests and diseases, economics and farmer feedback in the two study villages of Uttara Kannada district.

The objective of the present study was to compare the growth attributes, grain yield, selected pest and disease observations, and economic returns recorded under the RNR 15048 frontline demonstration package with those under local farmers' practices, and to document participating farmers' feedback during the two study seasons.

2. Materials and Methods

The frontline demonstrations were conducted in farmers' fields in Malagi and Banavasi villages, Uttara Kannada district, Karnataka, during the 2024–25 and 2025–26 crop seasons. Five farmers participated in each village, giving a total of 10 participating farmers across the two villages using a purposive sampling method. Before conducting the study, interactive group meetings were held with farmers to identify existing technological gaps.

The demonstrated variety was RNR 15048 (Telangana Sona), which was introduced along with a recommended package of practices developed by the University of Agricultural Sciences, Dharwad. Other local varieties grown by participating or adjoining farmers served as the control (farmers' practice) for comparison (Samui *et al*., 2000). The detailed comparison of critical inputs, sowing details, and technological gaps between the improved frontline demonstration package and traditional farmers' practices is presented in Table 1.

Table 1. Comparison of different agronomic practices followed in farmers field

Sr. No.	Particular	Frontline Demonstration (IP)	Farmers' Practice (FP)
1	Variety	RNR 15048 (Telangana Sona)	Local Check Varieties
2	Seed Rate (kg/ha)	25 kg/ha	Higher seed rate (over-sowing)
3	Sowing Method	Line sowing of pregerminated seeds	Traditional broadcasting / Random transplanting
4	Spacing	20 x 10 cm	Irregular spacing
5	Sowing Date	June 1st fortnight	Dependent heavily on sudden monsoon onset
6	Fertilizer Application	Balanced NPK doses based on soil test package	Imbalanced / Excessive Nitrogenous fertilizers only
7	Weed Control	Integrated Weed Management (Pre-emergent herbicide)	Manual hand weeding only (Delayed/Inefficient)
8	Irrigation	Critical stage-based water management	Continuous flooding / Unregulated regime
9	Plant Protection	Need-based recommended chemical/biological controls	Prophylactic overdoses & non-recommended brands
10	Leaf Folder & Blast Mgmt	Resistant variety + recommended fungicides/pesticides	Susceptible local checks & inadequate protection
11	YSB Pest Management	Pheromone traps installation & timed interventions	Absence of pest trapping / Delayed chemical sprays

3. Results and Discussion

3.1 Growth and Yield Parameters

Data from the two crop seasons showed differences in growth and yield components (Table 2). The demonstration plots recorded higher plant height, tiller number per hill and panicle length than the check plots in both years. In 2024–25, plant height was 96.0 cm in the demonstration compared with 85.0 cm in the check, while tillers per hill were 30.0 and 25.8, respectively. Panicle length was 26.0 cm in the demonstration and 20.6 cm in the check. A similar pattern was observed in 2025–26, with the demonstration recording 97.0 cm plant height, 30.6 tillers per hill and 27.2 cm panicle length, compared with 86.0 cm, 27.0, and 21.0 cm, respectively, in the check. This higher performance is attributed to the genetic potential of RNR 15048 and its favourable interaction with recommended agronomic practices. Similar results were observed by Singh (2002).

The larger tiller number and panicle length recorded in the demonstration plots are agronomically consistent with management practices that improve stand establishment, nutrient availability, and crop competition. In direct-seeded rice, soil-test-based fertiliser management has been shown to increase grain yield and nutrient-use efficiency over general fertiliser recommendations, indicating that balanced nutrient supply can support stronger crop growth and more efficient conversion of applied nutrients into harvestable yield (Singh *et al*., 2021). Similarly, integrated nutrient management treatments have produced improvements in rice yield attributes and economic performance, while integrated weed-management programmes can maintain rice yield by limiting early and season-long weed interference (Yadav *et al*., 2024; Kashyap *et al*., 2022). The present differences in plant height, tiller number, and panicle length therefore agree with the broader evidence that coordinated agronomic management can enhance crop vigour, although the contribution of individual management components cannot be separated within the FLD design.

The year-to-year consistency of the direction of response is also noteworthy. Plant height, tillers per hill, and panicle length were all higher under the demonstration package in both seasons, suggesting that the response was not restricted to a single growth trait. Comparable on-farm rice demonstrations have shown that improved establishment and crop-management technologies can increase productive tillering, yield-related attributes, and final grain output relative to conventional farmer practice (Bisen *et al*., 2024; Vijay *et al*., 2024). However, because the present comparison was conducted on participating farmers' fields and involved a complete technology package, these observations should be treated as demonstration-level evidence rather than as estimates of the independent causal effect of variety, spacing, nutrient management, weed control, or plant protection.

Table 2. Growth attributes, grain yield, and economics of RNR 15048 frontline demonstrations

Parameter	Treatment	2024–25	2025–26
Plant height (cm)	Demonstration	96.0	97.0
	Check	85.0	86.0
Tillers hill^{-1}	Demonstration	30.0	30.6
	Check	25.8	27.0
Panicle length (cm)	Demonstration	26.0	27.2
	Check	20.6	21.0
Grain yield (q ha^{-1})	Demonstration	56.0	59.5
	Check	40.0	41.5
Cost of Cultivation (Rs. ha^{-1})	Demonstration	61,080	63,680
	Check	63,680	62,000
Gross Returns (Rs. ha^{-1})	Demonstration	120,000	178,500
	Check	168,000	124,500
Net Returns (Rs. ha^{-1})	Demonstration	58,920	114,820
	Check	104,320	62,500
B:C Ratio	Demonstration	1.96	2.80
	Check	2.64	1.99
Yield Advantage (%)	Demonstration	40.0%	43.4%
Extension Gap (q ha^{-1})	Pooled Mean	16.0	18.0

3.2 Grain Yield

Grain yield in the demonstration was 56.0 q/ha in 2024–25 and 59.5 q/ha in 2025–26. The corresponding check yields were 40.0 and 41.5 q/ha. Based on the standard calculation, the demonstration yield advantage was 40.0% in 2024–25 and 43.4% in 2025–26. Timely plant protection and appropriate nutrient management may have supported the higher yields. The results are in line with Khush (2013).

The magnitude of the yield advantage indicates that the demonstrated package was able to exploit a substantial portion of the productive potential of RNR 15048 under the participating farm conditions. Rice FLD studies have reported yield gains when recommended varieties and management practices are demonstrated against prevailing farmer practices, and such gains are commonly accompanied by reductions in extension gaps and improvements in farm-level returns (Bisen *et al*., 2024; Kapur *et al*., 2023). In addition, targeted nutrient management can raise rice grain yield by improving the synchrony between nutrient supply and crop demand, while integrated weed management helps protect yield by reducing competition during sensitive crop stages (Singh *et al*., 2021; Kashyap *et al*., 2022). These mechanisms are compatible with the higher yields observed in the demonstration plots, where balanced fertilization, line sowing, weed management, and need-based plant protection were implemented together.

The increase from 56.0 q/ha in 2024–25 to 59.5 q/ha in 2025–26 should nevertheless be interpreted cautiously because seasonal rainfall distribution, pest pressure, field-specific soil conditions, and management timing can influence realised yield. The present study did not isolate these sources of variation experimentally. Accordingly, the 40.0% and 43.4% yield advantages are best understood as the observed performance difference between the complete demonstration package and the local check in each season rather than as a fixed varietal response expected across all environments. This interpretation is consistent with the purpose of FLDs, which is to assess the practical field performance of recommended technologies under farmer-managed conditions and to identify the scope for reducing the gap between improved practice and existing practice (Bisen *et al*., 2024; Kapur *et al*., 2023).

3.3 Pest and Disease Observations

Leaf folder incidence was lower in the demonstration than in the check in both years. During 2024–25, leaf folder incidence was 1.78% in the demonstration and 2.56% in the check; during 2025–26, it was 1.82 and 2.60%, respectively. Blast severity was also numerically lower in the demonstration (1.80 PDI in 2024–25 and 2.00 PDI in 2025–26) than in the check (2.18 and 2.40 PDI, respectively). Yellow stem borer moths trapped per trap were recorded as 2.60 and 2.50 in the demonstration in the respective years, while the check was recorded as 2.90 and 2.70. Earhead bug population was reported only for 2024–25 and was 2.01 per hill in the demonstration compared with 3.82 per hill in the check (Table 3). The lower recorded blast severity is consistent with published descriptions of RNR 15048 as a blast-resistant variety. Similar results were observed by Saha (2022).

The pest observations are consistent with the principle that an integrated protection programme can reduce crop injury while supporting timely intervention. Recent field work on rice leaf folder has shown that integrated pest-management modules can

reduce leaf damage and improve yield and economic returns compared with untreated conditions, while field studies on yellow stem borer confirm the value of pheromone traps for monitoring adult moth activity and informing the timing of management decisions (Panse & Karcho, 2026; Longkumer *et al*., 2024). In the present demonstrations, the combination of a resistant or tolerant varietal background, pheromone trapping, and need-based protection may therefore have contributed to the lower numerical incidence recorded for leaf folder and yellow stem borer relative to the check. Because pest observations were made within a package demonstration rather than a factorial pest-management experiment, the relative contribution of each component cannot be quantified from these data.

The blast observations also support a cautious interpretation of host resistance. RNR 15048 has previously been described as blast resistant, and contemporary rice research continues to show that substantial genetic variation exists for blast response and that resistant germplasm is an important component of disease management (Chandra Mohan *et al*., 2021; Dileep Kumar *et al*., 2024). The lower PDI values in the demonstration plots are therefore compatible with the reported resistance of the variety, but disease expression is also influenced by pathogen population, microclimate, crop nutrition, and protection practices. The two-year numerical difference should thus be considered supportive field evidence rather than proof of complete or durable resistance. This distinction is important because blast resistance can vary across environments and pathogen populations, and continued monitoring remains necessary when a variety is promoted beyond the locations in which it has been evaluated (Dileep Kumar *et al*., 2024).

Table 3. Pest and disease observations recorded in demonstration and check plots

Season	Parameter	Demonstration	Check
2024–25	Leaf folder incidence (%)	1.78	2.56
2024–25	YSB moths trapped trap^{-1}	2.60	2.90
2024–25	Blast (PDI)	1.80	2.18
2024–25	Earhead bug hill^{-1}	2.01	3.82
2025–26	Leaf folder incidence (%)	1.82	2.60
2025–26	YSB moths trapped trap^{-1}	2.50	2.70
2025–26	Blast (PDI)	2.00	2.40

3.4 Economic Performance

Economic results varied between the two seasons. In 2024–25, the demonstration recorded a cultivation cost of Rs. 61,080 per ha, gross returns of Rs. 120,000 per ha, net returns of Rs. 58,920 per ha and a B:C ratio of 1.96. The corresponding check values were Rs. 63,680, Rs. 168,000, Rs. 104,320 per ha and 2.64. In 2025–26, the demonstration recorded gross returns of Rs. 178,500 per ha and net returns of Rs. 114,820 per ha, with a B:C ratio of 2.80. The check recorded gross returns of Rs. 124,500 per ha and net returns of Rs. 62,500 per ha, with a B:C ratio of 1.99. The reported values indicate a clear economic advantage for the demonstration in the second season.

The contrasting economic results between seasons demonstrate why profitability should be assessed together with yield rather than inferred from yield alone. Frontline demonstrations in rice have frequently shown that improved technologies can raise gross and net returns when the additional value of harvested grain exceeds the added cost of inputs and operations (Bisen *et al*., 2024; Kapur *et al*., 2023). Likewise, soil-test-based or integrated nutrient-management strategies can improve profitability by increasing output while using nutrients more efficiently, and recent rice studies have reported higher benefit–cost ratios under improved nutrient-management treatments than under less balanced management (Singh *et al*., 2021; Yadav *et al*., 2024). The strong B:C ratio of 2.80 for the demonstration in 2025–26 is consistent with this general pattern.

The 2024–25 values, however, show that the demonstration did not outperform the check economically in every season, despite recording a higher grain yield. This apparent divergence may reflect differences in the realised sale value of grain, input costs, or other season-specific components of the farm budget, and it highlights the need to interpret the economic table using its component values rather than the B:C ratio alone. On-farm mechanisation and technology demonstrations in rice similarly show that profitability depends on both production gains and the cost structure of the technology being introduced (Vijay *et al*., 2024). Therefore, the second-season economic advantage provides encouraging evidence for local feasibility, whereas the first-season result indicates that repeated-season economic assessment is necessary before generalising the profitability of the package across farmers and years.

3.5 Farmers' Feedback

Farmers' feedback recorded during the demonstrations indicated that RNR 15048 was appreciated for its higher yield, suitability for sowing under delayed monsoon conditions, and good cooking quality. Farmers described the grains as long and slender, soft after cooking, and non-sticky, characteristics they viewed favourably for household use and potential market appeal.

The reported feedback reflects the multidimensional criteria that farmers commonly apply when judging rice varieties. Survey-based research in Assam found that farmers considered yield, duration, suitability to the production environment, planting-time flexibility, cooking quality, pest and disease resistance, and market demand when expressing varietal preferences (Bhuyan *et al*., 2022). More recent participatory research in eastern India likewise indicates that farmer assessment of improved rice varieties combines agronomic traits, such as tillering and resistance to biotic stresses, with market-related traits including grain type, cooking quality, and marketability (Paul *et al*., 2026). The positive comments on delayed-sowing suitability, grain appearance, softness after cooking, and non-stickiness are therefore consistent with preference dimensions reported in the wider rice-adoption literature.

For RNR 15048 specifically, published varietal documentation describes a short-duration, fine-grain type with good cooking quality, suitability for late sowing, and high head-rice recovery, providing independent support for several attributes identified by the participating farmers (Chandra Mohan *et al*., 2021). Nevertheless, the feedback in the present FLD should be interpreted as descriptive evidence from participating farmers rather than as a population-level adoption study, because the number of participants was limited and no structured preference scale or market survey was reported. Its main value is therefore to complement the measured agronomic and economic results by identifying the characteristics that farmers considered practically useful under local conditions. Future demonstrations across a larger number of farmers and seasons could quantify these preference traits more systematically and examine whether positive perceptions translate into sustained seed demand and area expansion.

4. Conclusion

The frontline demonstrations conducted in Malagi and Banavasi villages over the 2024–25 and 2025–26 kharif seasons indicated that the RNR 15048 production package was associated with higher grain yields than the local farmers' practices. Grain yields reached 56.0 and 59.5 q/ha in the demonstration plots, compared with 40.0 and 41.5 q/ha in the respective checks, resulting in yield advantages of 40.0% and 43.4%. The demonstration plots also showed greater plant height, more tillers per hill and longer panicles. Recorded leaf folder incidence and blast severity were numerically lower under the demonstration package. Economic performance varied between seasons: the check recorded higher net returns in 2024–25, whereas the demonstration produced higher net returns in 2025–26. Farmers expressed favourable views of the variety's grain appearance, cooking quality and suitability for delayed sowing. These findings support further evaluation of the complete production package under comparable local conditions.

5. Limitations

The study involved only 10 purposively selected farmers from two villages over two crop seasons. The comparison assessed a complete production package against local farmers' practices, preventing the individual effects of variety, sowing method, nutrient management and crop protection from being isolated. No statistical test or formal uncertainty estimate was reported for the observed differences. Farmers' feedback was descriptive rather than based on a structured survey.

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Declaration of AI Use

This manuscript was prepared through the intellectual contributions of the author(s) to the study design, data analysis, interpretation of results, and scholarly content. ChatGPT, Claude and Perplexity were used solely to assist with grammatical refinement and reference formatting during manuscript revision. The author(s) accept full responsibility for the accuracy, integrity, and final content of the manuscript

Competing Interests

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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