

Performance Evaluation and Economic Impact of Improved Medium-Duration Paddy Variety MTU-1281 through Frontline Demonstrations in Upland Areas of Eluru District

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Publication Date: 2026/10/07

Abstract: Paddy (*Oryza sativa* L.) remains a crucial cereal crop underpinning global food security, with India standing as a major producer. Despite the availability of superior cultivars, farmers frequently continue cultivating traditional, aging varieties such as MTU-7029 (Swarna), resulting in yield stagnation and suboptimal resource utilization. To evaluate the production potential, adoptability, and economic viability of the modern, non-lodging, medium-slender rice variety MTU-1281, frontline demonstrations (FLDs) were conducted by Krishi Vigyan Kendra (KVK), Venkataramannagudem, across five upland villages in the Eluru district of Andhra Pradesh during the kharif seasons of 2024 and 2025. The results demonstrated that the intervention package using MTU-1281 achieved a higher mean grain yield of 7,125 kg ha⁻¹ compared to 6,408 kg ha⁻¹ under conventional farmer practices. The technology gap and extension gap were recorded at 375 kg ha⁻¹ and 717 kg ha⁻¹, respectively, with a favorable technology index of 5.0%. Furthermore, economic analysis revealed a higher net return of Rs. 70,095 ha⁻¹ and a benefit-cost (B:C) ratio of 2.07 for the demonstration plots, outperforming the local control (net returns of Rs. 53,145 ha⁻¹ and B:C ratio of 1.86). These findings underscore that targeted frontline demonstrations effectively bridge knowledge gaps and accelerate the horizontal spread of climate-resilient, high-yielding rice varieties among smallholder farming communities.

Keywords: Frontline Demonstrations, Rice (*Oryza sativa*), MTU-1281, Yield Attributes, Technology Gap, Economic Viability.

How to Cite: Dr. Ch. Kiran Kumar; Dr. E. Rekha; Dr. A. Devi Vara Prasad Reddy; Dr. K. Archana (2026) Performance Evaluation and Economic Impact of Improved Medium-Duration Paddy Variety MTU-1281 through Frontline Demonstrations in Upland Areas of Eluru District. *International Journal of Innovative Science and Research Technology*, 11(9), 3097-3099. <https://doi.org/10.38124/ijisrt/26sep1392>

I. INTRODUCTION

Rice is one of the most vital cereal crops globally, serving as the primary staple food for more than half of the world's population (Khush, 2005). In India, rice occupies a prominent position in both cultivation area and aggregate production, covering approximately 43.90 million hectares with a total production of 114.45 million tonnes and an average productivity of 2,607 kg ha⁻¹ (Government of India, 2020). Although global paddy production has nearly doubled over the past 25 years largely due to the adoption of improved agricultural technologies and high-yielding cultivars (Fageria, 2007), the persistence of traditional

varieties among rural farming communities remains a major constraint to realizing maximum yield potentials.

In the Eluru district of Andhra Pradesh, paddy is predominantly cultivated during the kharif season across an extensive area of 1.54 lakh hectares, with an average production of 4.2 lakh tonnes and productivity reaching 5,002 kg ha⁻¹. Despite a wide array of high-yielding rice cultivars released for general cultivation since 1995, an overwhelming proportion of the area continues to be occupied by the aging variety MTU-7029 (Swarna). This prolonged cultivation of legacy varieties often stems from a lack of on-farm awareness, limited extension exposure, or

uncertainty regarding how new varieties perform under micro-farming conditions (Singh et al., 2008).

Selection of proper cultivars, coupled with refined agronomic practices, plays a monumental role in breaking yield ceilings (Singh et al., 2008; Pingali et al., 1997). Krishi Vigyan Kendras (KVKs) provide a vital interface between agricultural research stations and farming communities through assessment, refinement, and frontline demonstrations (FLDs) of proven technologies (Das et al., 2010). To address the stagnation caused by continuous cultivation of MTU-7029, KVK Venkataramannagudem introduced MTU-1281 into the upland agro-ecosystems of Eluru district. This study aimed to evaluate the production performance, technological gaps, and economic viability of MTU-1281 under field conditions.

II. MATERIALS AND METHODS

The field evaluation of rice variety MTU-1281 was conducted by Krishi Vigyan Kendra, Venkataramannagudem, during the kharif seasons of 2024 and 2025 across five selected upland rainfed villages of Eluru district. A total of 10 frontline demonstrations were laid out, each spanning 0.2 ha. Certified seed of MTU-1281 was procured from Andhra Pradesh Rice Research Station, Maruteru. The locally cultivated MTU-7029 (Swarna), managed under conventional farmer practices, served as the control.

➤ Crop Management and Interventions

KVK scientists facilitated optimized sowing, balanced fertilizer application, weed management, and need-based plant protection through regular field visits and farmer interactions. Field days and group meetings were organized at critical crop stages.

Table 1 Comparison Between Technological Interventions and Existing Farmer Practices Under FLDs in Paddy.

Parameter	Technological interventions (MTU-1281)	Existing practice (MTU-7029)
Variety	MTU-1281	MTU-7029 (Swarna)
Land preparation	Three thorough ploughings	Conventional / variable tillage
Seed treatment	Specialized biofertilizers	Untreated / untargeted seed use
Seed rate	40 kg ha ⁻¹	30 kg ha ⁻¹
Nutrient and plant protection	Science-based NPK dosing and need-based IPM	Unbalanced fertilizer and pesticide use

➤ Data Collection and Analytical Metrics

Yield data from demonstration and control plots were recorded at harvest. Biometric observations included plant height, productive tillers, panicle length, grains per panicle, filled grains per panicle, and 1000-grain weight. Technology gap, extension gap, and technology index were computed using standard formulae (Samui et al., 2000):

- Technology gap = Potential yield – Demonstration yield
- Extension gap = Demonstration yield – Farmers' practice yield

- Technology index (%) = [(Potential yield – Demonstration yield) / Potential yield] × 100

III. RESULTS AND DISCUSSION

➤ Crop Growth and Yield Parameters

MTU-1281 demonstrated clear agronomic superiority over MTU-7029. The mean grain yield was 7,125 kg ha⁻¹ under the demonstration package, compared with 6,408 kg ha⁻¹ under farmer practice. The yield advantage was associated with greater productive tillers, more filled grains per panicle, and higher test weight.

Table 2 Comparative Performance of Paddy Variety MTU-1281 Under Demonstration and Farmers' Practices.

Yield parameter	Demonstration (MTU-1281)	Farmers' practice (MTU-7029)
Plant height (cm)	126	110
Productive tillers plant ⁻¹	265	197
Panicle length (cm)	21.2	20.4
Grains panicle ⁻¹	251	236
Filled grains panicle ⁻¹	225	194
1000-grain weight (g)	20.5	16.5
Grain yield (kg ha ⁻¹)	7,125	6,408
Straw yield (kg ha ⁻¹)	6,044	4,859
Harvest index (%)	47.21	46.52

➤ Technology Gap, Extension Gap and Technology Index

A technology gap of 375 kg ha⁻¹ was observed between the potential yield of 7,500 kg ha⁻¹ and the demonstration yield. The extension gap of 717 kg ha⁻¹

indicates substantial scope for improving farm productivity through varietal replacement and scientific crop management. The technology index of 5.0% indicates strong field-level feasibility of MTU-1281.

Table 3 Technology Gap, Extension Gap, and Technology Index of MTU-1281 Under FLDs.

Area under FLDs (ha)	Potential yield	Demo yield	Farmers' yield	Technology gap	Extension gap	Technology index (%)
10	7,500	7,125	6,408	375	717	5.0

➤ *Economic Analysis*

The demonstration package generated substantially higher gross and net returns despite a marginally higher cost

of cultivation. Net returns increased by Rs. 16,950 ha⁻¹, while the B:C ratio improved from 1.86 under farmer practice to 2.07 under MTU-1281 demonstrations.

Table 4 Economics of Paddy Variety MTU-1281 Under Frontline Demonstrations in Upland Areas of Eluru District.

Economic parameter	FLD (MTU-1281)	Farmers' practice (MTU-7029)
Cost of cultivation (Rs. ha ⁻¹)	57,227	56,854
Gross returns (Rs. ha ⁻¹)	1,18,461	1,05,758
Net returns (Rs. ha ⁻¹)	70,095	53,145
Benefit-cost ratio	2.07	1.86

IV. CONCLUSION

The frontline demonstrations established the agronomic superiority and economic viability of MTU-1281 over MTU-7029 (Swarna) in the upland areas of Eluru district. MTU-1281 produced 7,125 kg ha⁻¹ of grain yield, net returns of Rs. 70,095 ha⁻¹, and a B:C ratio of 2.07. Wider dissemination through KVK-led frontline demonstrations can help reduce extension gaps and promote profitable, climate-resilient rice production.

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