

## Enhancing Productivity in Rice through Field Demonstrations under semi dry Condition in Ramanathapuram District, Tamil Nadu, India

### ABSTRACT

Field demonstrations were conducted at farmer's field under semi dry rice cultivation in direct sowing by seed drill with short duration drought tolerant rice variety RMD 1. A total of 155 field demonstrations were conducted at farmer's holdings organized by Krishi Vigyan Kendra, Ramanathapuram, Tamil Nadu. The selected farmers were trained for improved production technologies through training programmes organized by ICAR, Krishi Vigyan Kendra. The nearby farmers used local variety with their own cultivation practices were considered as farmer's practice (control). The yield and economics of field demonstrations were compared with farmer's practices. An average yield of 5,001 kgs/ha was recorded from RMD 1 demonstrations which showed 10.25 % increase over the farmers practice (4535 kgs/ha). The farmers have obtained additional revenue of Rs. 14,300 ha<sup>-1</sup> from semi dry rice field demonstrations with short duration rice variety, which may motivate the farmers to adopt this intervention in this district with the improved rice production technologies. The field demonstration on new varietal introduction effectively influenced the attitudes, skills, and knowledge related to improved practices in rice cultivation, fostering adoption. It also enhances the relationship between farmers and scientists.

**Keywords:** Field demonstrations, semi dry rice cultivation, seed drill sowing, grain yield, gross income, net income

### 1. INTRODUCTION

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The "Global Grain" rice is life for millions of people and cultivated widely across the world and feeds millions of people [1]. It serves as the staple food for more than half of the world's population [2]. More than four billions of world population depends on rice as their major source of calories [3]. It is highly valued and competitive commodity in the world trade over a decade's [4]. Worldwide, it was grown on an area of 166.1 million hectares with yield of 745.2 million tonnes. In India, rice ranks second in both area and production, and cultivated over 43.90 million hectares, yielding 114.45 million tonnes with a productivity of 2607 kg/ha [5-7]. It was cultivated under diverse soil and climatic conditions; the productivity level of rice was low compared to the productivity levels of many countries in the world. Also about 90 % of the cultivated land belongs to marginal, small and medium farmers which are another constrains in increasing the productivity of rice in the country. It is, therefore, there is ample scope to increase the productivity of rice in the country. The highest productivity is 6710 kg/ ha in China followed by Vietnam (5573 kg /ha), Indonesia (5152 kg/ha), Bangladesh (4375 kg/ha) etc., There are improved production technologies and introduction of suitable new high yielding variety which could be adopted in particular area to increase the productivity.

Production and productivity of rice was mainly depended on choice of varieties, season and good agronomic practices with application of balanced major nutrients [8]. Among the above components, selection of varieties plays an important role to increase the productivity [9]. Hence it is essential to introduce the drought tolerant short duration variety along with climate resilient interventions, so that overall productivity can be stabilized in rainfed agriculture. Therefore, to meet the immediate needs of the rainfed rice farming, there is a need to popularize the short duration drought tolerance variety with good agricultural practices suitable for rainfed farming to meet the challenges in rice cultivation. Cultivation of short duration drought tolerant rice variety has the potential to increase the productivity and needs to be promoted and popularized. Front line demonstrations of new variety with improved agriculture practices could significantly increase the farm income. These field demonstrations (FLDs) results were compared with current farmers practice in Ramanathapuram District of Tamil Nadu, to highlight relative yield advantages, cropping intensity, weed control, and plant protection

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Comment [PK31]: Improved production technologies like introduction of suitable, new high yielding varieties could be adopted in particular areas for increase in the rice productivity.

Comment [PK32]: depends mainly

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measures. Keeping in this regard, the present study was conducted at farmer's field by field demonstrations with short duration drought tolerant rice variety RMD 1 by seed drill direct sowing under semi dry condition.

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## 2. MATERIALS AND METHODS

Front line demonstrations on rainfed crop management in semi dry rice by seed drill direct sowing was conducted by Krishi Vigyan Kendra, Ramanathapuram during 2019-2020 in 155 farmer's holdings in seven blocks of Ramanathapuram district, Tamil Nadu. The soil type of the district is generally clay loam low-medium fertility status. The climatic conditions of the research locations are tropical. Average rainfall of the region is 850-950 mm per annum and relative humidity ranges from 45-85 per cent. Each demonstration was conducted on an area of 0.4 ha and the same area adjacent to the demonstration plot was kept as farmer's practices. The package of improved production technologies (Table 1) includes seeds of improved variety (RMD 1), bio fertilizers and post emergency herbicide was applied as per schedule. Seeds were treated with Carbendazim (50% WP) @ 2.0g/ one kg of seeds. Seed drill sowing was done during September in every year with a seed rate of 50kg/ha in line sowing by tractor drawn seed drill and maintaining a spacing of 30cm between rows. Recommended fertilizer (100:50:50 kg NPK/ha) was applied and optimum plant population was maintained in all the demonstrations. For weed management, the post emergence herbicide of Bispyribac Sodium @ 250 ml/ha applied during 15-20 days after sowing followed by one hand weeding was done at 35-40 days after sowing. Recommended dose of fertilizer was applied through basal application and top dressing for nutrient management. Fipronil (5% SC) @ 500 ml/ha and Chloranilprole (18.45%) @ 100 ml/ha used for pest management. For disease management, Hexaconazole (5% SC) and Propiconazole (25% EC) were applied for disease management. All the demonstrations and control plots were frequently monitored by KVK Scientists. The benefit cost ratio was calculated based on gross return and cost of cultivation. The yield data were collected from both demonstration and farmers' practice plots. The harvested produce were sold by the farmers at district regulated market and average sale price (Rs. 20/kg) was used for calculating gross income. The cost of cultivation, gross return and Benefit:Cost ratio were worked out [10] (Samui et al, 2000). During

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the harvesting period, the yield data were collected and analyzed statistical method described by [11].

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### 3. RESULTS AND DISCUSSION

The results of all the demonstration plots and control plots (farmers practice) were presented in Table 2. The key differences were observed between demonstration package and farmer's practices. In the demonstrated only recommended variety, bio-agents and foliar nutrients ( $\text{KNO}_3$ ) were used which were given to farmers (no cost basis) by the KVK, under TN-IAMWARM project and all the other package of practices were timely performed by the farmers itself under the direction of KVK scientists. Under farmer's practice, they used own seeds of local variety for sowing without bio-inoculants seed treatment. The performance of short duration rice variety RMD 1 with comparison to the farmers cultivating local variety as farmers practice (Control) was monitored periodically by KVK, Scientists, Ramanathapuram.

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#### 3.1 Grain yield

With regard to grain yield in demonstration fields, the maximum grain yield 5160  $\text{kg}\cdot\text{ha}^{-1}$  was recorded in Thirupulani block and minimum yield (4750  $\text{kg}/\text{ha}$ ) was observed in Ramanathapuram block. The average grain yield of all demonstration was 5001.42  $\text{kg}/\text{ha}$ , and in farmers practice, the yield was 4520  $\text{kg}/\text{ha}$ . The yield increment was 10.25 % increase over the farmers practice (control). These outcomes are somewhat comparable to [12]. The grain yield on rice was already reported in their research papers by [13].

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#### 3.2 Economic Analysis

The economic analysis of field demonstrations and farmers practices was presented in Table 3. The cost of cultivation for the demonstrations was Rs. 45,000/ha and gross income was Rs. 1,00,000/ha. The cost of cultivation for farmer's practice was Rs. 50,000/ha and gross income was Rs. 90,700/ha. The average net income for demonstration plots were Rs. 55,000 and for farmers practice was Rs. 49,200/ha. The farmers getting additional revenue of Rs. 14,300  $\text{ha}^{-1}$  by cultivating the short duration drought tolerance rice variety RMD 1 along with improved production

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interventions(demonstrations). These findings are aligned with those of [14-18]. The additional yield and net return (Rs. 55,000) was due to demonstration of short duration drought tolerant rice variety along with improved production technologies and timely supply of critical inputs. Similar kind of front line demonstrations results in rice was already reported by [19-20] and in finger millet by [21]. The RMD 1 rice variety produced higher yield in all the demonstrations over the farmers practice (control). The yield advantages mainly due to direct sowing of short duration drought tolerant variety by seed drill sowing along with improved production technologies and timely recommendation by KVK. The Front-line demonstration program effectively influenced the attitudes, skills, and knowledge related to improved practices in rice cultivation, fostering adoption. It also enhanced the relationship between farmers and scientists, fostering mutual confidence. During the demonstrations, the farmers emerged as primary sources of information on improved paddy cultivation practices and served as new suppliers of high-quality pure seeds in their locality and neighbouring areas for subsequent crops. The new varietal (RMD 1) demonstrations along with improved production technologies demonstrated, contributed to an average increase in grain yield of 10.25 % when compared to the existing farmers practices. The cost of this yield augmentation was a nominal of Rs. 14,300 per hectare; an amount was affordable even by small and marginal farmers.

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#### 4. CONCLUSION

In rice cultivation under semi dry condition, drought is an important abiotic stress in this crop, can lead to considerable economic losses. The cultivation of short duration drought tolerant varieties like RMD 1, along with suitable drought resilient technological interventions can be an important step in this direction. This high yielding rice variety RMD 1 with its excellent performance in the demonstrations at Ramanathapuram district will play a significant role in improving the productivity and profitability in rice cultivation.

Comment [PK92]: rainfed rice

## REFERENCES

1. Ganapathy S, Gomadhi G, Kanchanarani R, Senthilkumar M. 2024. Impact of Varietal Demonstrations on the productivity and sustainability in rice (*Oryza Sativa* L.) at Villupuram District of Tamil Nadu, India. Asian Research J. Agriculture. 2024; 17(4): 180-185. <https://doi.org/10.9734/arja/2024/v17i4513>.
2. Khan AS, Imran M, Ashfaq M. Estimation of Genetic Variability and Correlation for Grain Yield Components in Rice (*Oryzasativa* L.). American-European J. Agric Environ. Sci. 2013; 6(2): 585–590.
3. Mohidem NA, Hashim N, Shamsudin R, Che Man H. Rice for Food Security: Revisiting Its Production, Diversity, Rice Milling Process and Nutrient Content. Agriculture. 2022; 12(6): 741. <https://www.mdpi.com/2077-0472/12/6/741>:
4. International Rice Research Institute (IRRI). (2023). Rice: Production, trade, and consumption trends. [http://books.irri.org/RT12\\_1\\_content.pdf](http://books.irri.org/RT12_1_content.pdf).
5. Agricultural Statistics at a glance. Government of India, Ministry of Agriculture & Farmers Welfare, Department of Agriculture & Farmers welfare economics & statistics division. 2022.
6. Daquiado, Nonilona P. Growth and Yield Performance of Some Lowland Rice Varieties Applied with Different Rates of Organic and Inorganic Fertilizers. Asian J. Soil Sci. Plant Nutrition. 2019; 4(2): 1-11.
7. Daquiado, Nonilona P. Growth and Yield Performance of Some Lowland Rice Varieties Applied with Different Rates of Organic and Inorganic Fertilizers. Asian J. Soil Science and Plant Nutrition. 2019;4(2):1-11.
8. Ganapathy S, Jayakumar J. Evaluation of sugarcane (*Saccharum spp.* hybrids) clones for yield, quality, and its contributing traits. J. Experimental Agric. Int.2023; 45(7):113-118.

9. Ganapathy S, Ravichandran V, Jayakumar J. Yield, Quality and disease resistance of sugarcane clones- A Field Evaluation. J. Experi. Agric. Inter. 2024; 46(5): 40-46.
10. Samui S K, Maitra S, Roy D K, Mondal A K and Saha D (2000).Evaluation on front line demonstration on groundnut (*Arachis hypogea* L.). J Indian Soc Coastal Agri Res 18: 180-183.
11. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. ICAR, New Delhi. 1978.
12. Najeeb S, Sheikh FA, Parry GA, Shikari AB, Zaffar G, Kashup SC, Ganie MA, Shah AB. Farmers participatory selection of new rice varieties to boost production under temperate agro-ecosystems. J. integrative Agric. 2018; 17(16): 1307-1314.
13. Vaishnavi Pravin Gupte, Manonmani S, Nivedha R, Suresh R, Senthil Kumar G, Raveendran M. Genetic diversity studies and identification of donors for lodging resistance in rice (*Oryza sativa* L.). Electronic J. Plant Breed. 2023; 14(3): 1158-1166.
14. Subbalakshmi L, Keerthana P, Anbumani S, Pannerselvam S. Up-scaling of water saving technologies in rice cultivation under corporate social responsibility scheme. J. Rice Research. 2021; 14(1): 29-33.
15. Ganapathy S, Nageswari K, Jayakumar J, Veeramani P. Evaluation of CO 52 rice variety for enhanced productivity in Cuddalore District of Tamil Nadu, India. Inter. J. Plant & Soil Sci. 2024;36(8):432-36.
16. Singh T, Singh R, Soni RL. Performance of rice variety P 1460 in Front line demonstrations under rainfed conditions in Southern humid region of Rajasthan. Annals of Agric. Res. (New Series). 2012; 33(3): 121-125.
17. Vikram Sigh Gaur, Uttam Kumar Bisen, Naresh Kumar Bisen, Solanki, R. Evaluation of Rice varieties under Front Line Demonstrations in the Agro-climatic Zone of the Chattisgarh Plains, Madhya Pradesh, under Irrigated condition. J. Exp. Agric. Int. 2024; 46(3): 156-161.
18. Mohammad Hashim, Singh KK, Narendra Kumar, Man Mohan Deo, Dileep Singh, Mukund Kumar. Impact of Front Line Demonstrations in Improving Rice

Productivity and Profitability in Jaunpur District of Uttar Pradesh, India. J. Experiment. Agric. Inter. 2023; 45(11): 74-82.

19. Hashim M, Singh KK, Dhar S. Impact of front line demonstration on performance of wheat (*Triticum aestivum* L.) in Muzaffarpur, Bihar. Annals Agric. Res. (New Series). 2022; 43(2): 142-147.

20. Mandavkar PM, Sawant PA, Mahadik. Evaluation of Front Line Demonstration Trials on Rice in Raigad Disritct of Maharashtra. J. Exten. Education. 2012; 20: 4-6.

21. Ganapathy S, Gomadhi G, Saran Kumar M, Senthil Kumar, M. 2024. Demonstration by New Finger Millet Variety ATL1 to Improve the Productivity in Villupuram District of Tamil Nadu, India. International. J. Plant & Soil Science. 2024; 36(8): 931-35. <https://doi.org/10.9734/ijpss/2024/v36i84923>

**Table 1. Comparison of Climate resilient technologies in demonstrations plots and farmer's practice**

S.No.	Technology	Recommended Practice	Farmer's Practice
1.	Cultivation Ecosystem	Reinfed	Reinfed
2.	Variety	RMD 1 (short duration- 110 days)	Local variety
3.	Soil Treatment	Bio inoculants	Not practiced
4.	Seed treatment	Azospirillum	Not done
5.	Seed rate	50 kgs/ha.	75 kgs/ha.
6.	Sowing method	By Seed drill sowing	Broad casting
7.	Weed management	Post emergency herbicide (Bispyribac sodium @ 205 ml/ac) followed by one hand weeding	Pre-emergence herbicide followed by one Hand weeding only
8.	Plant Protection	Followed Integrated pest and disease management	Generic chemicals were used.
9.	Harvesting	By combined harvester	By combined harvester

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**Table 2. Performance of demonstrations at farmer's field under semi-dry condition in Ramanathapuram District.**

S. No	Name of Block	No. of demonstrations	Grain yield(kg/ha)		
			Yield (Demonstrations)	Control (farmers practice)	% Increase
1.	Ramanathapuram block	20	4750	4470	8.50
2.	Thirupulani block	25	5150	4650	11.18
3.	Mudhukulathur Block	25	4850	4420	9.73
4.	Paramakudi Block	20	5070	4570	10.94
5.	Thiruvadani Block	20	5160	4610	11.71
6.	Kadaladi Block	25	4870	4520	7.74
7.	Kamuthi Block	20	5050	4510	11.97
		Mean	5001.42	4535.71	10.25
		CD (0.05%)	101.72	105.23	-
		CV (%)	0.83	0.95	-

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**Table 3. Yield and Economics comparison of demonstrations and farmer's practice**

Treatments/ Intervention	Seed Yield (kg/ha)	Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio	Additional Income (Rs.)
Improved Variety-(RMD 1) + Improved Production Technologies)	5001.42	45,000	1,00,000	55,000	2.22	14,300

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Farmer's Practice (Control)	4535.7 1	50,000	90,700	40,700	1.81	-
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