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Impact of Varietal Demonstrations on the Productivity and Sustainability in Rice (*Oryza sativa* L.) at Villupuram District of Tamil Nadu, 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

Popularization of newly released variety in a new environment was important to increase the productivity and sustainability on a particular location. Keeping this inview, field demonstrations were carried out at farmer's field by introducing drought tolerant rice variety TKM 15. The variety was released by Rice Research Station, (TNAU), Thirurkuppam, during 2022. A total of ten, field demonstrations were conducted at farmer's field organized by Krishi Vigyan Kendra, Villupuram,

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and Tamil Nadu during *Kharif* 2023. The farmers cultivating variety ADT 37was used as the check variety (farmer's practice). An average yield of 4,925kg.ha^{-1} was recorded from TKM 15 demonstrations which showed 7.75% increase over the farmers cultivating variety (4570kg.ha^{-1}). The farmers have obtained additional revenue of Rs. 10,100ha^{-1}from TKM 15 demonstrations, which may motivate the farmers to adopt TKM 15 variety with the improved rice production technology. The Front-Line Demonstration on new variety introduction, effectively influenced the attitudes, skills, and knowledge related to improved or recommended practices in paddy cultivation, fostering adoption. It also enhanced the relationship between farmers and scientists, fostering mutual confidence.

Keywords: Rice; field demonstrations; TKM 15; grain yield; gross income; net income.

1. INTRODUCTION

Rice (*Oryza sativa* L.) is one the most important food crop belongs to family Poaceae. The "Global Grain" cultivated widely across the world and feeds millions of people. It serves as the staple food for more than half of the world's population [1]. More than four billions of world population depends on rice as their major source of calories [2]. It is highly valued and competitive commodity in the world trade over a decade's [3].

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 [4-6]. 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 constrain 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 per ha of China followed by Vietnam (5573 kg /ha), Indonesia (5152 kg/ha), Bangladesh (4375 kg/ha) etc., There are improved technologies and introduction of new high yielding variety which could be adopted to increase the productivity in the country [7].

Production and productivity of rice was mainly depended on choice of varieties, season and agronomic practices with supply of balanced major nutrients [8]. Among the above components, selection of varieties plays an important role to increase the productivity of farming communities [9]. Hence it is essential to popularize the new high yielding varieties to replace the deteriorating old varieties so that overall productivity can be stabilized. Therefore, to meet the immediate needs of the rice farming community, there is a need to popularize the high yielding new variety (TKM 15) with good agricultural practices to meet the challenges in rice cultivation. Cultivation of newly released drought tolerant resistant rice variety has the potential to increase the productivity and needs to be promoted and popularized. Front Line Demonstrations (FLD) of improved variety with improved agriculture practices could significantly increase the farm income. This present research compares the FLD results in Villupuram District of Tamil Nadu, emphasizing relative yield advantages, cropping intensity, weed control, and plant protection measures compared to current farmer practices. Keeping in this regard, the present study was conducted at farmer's field by field demonstrations of the newly released rice variety TKM 15.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

The new drought tolerant rice variety TKM 15 was used as the experimental materials in the present study. A total of 10field demonstrations were conducted at farmers holdings in Villupuram District, Tamil Nadu, India (latitude; 11º 46' North; longitude: 79º.46' East; altitude: 4.60 m MSL) during *Kharif* 2023 by new rice variety (TKM 15) and compared to check variety(farmer's practice) for yield and economics. The soil type of the demonstration fields isclay loam with pH 7.0- 7.5 and low in organic carbon content and total N content. The soil in available P_2O_5 and K_2O was medium. The climatic conditions of the research locations aretropical. Average rainfall of the region is 1000-1100 mm per annum and relative humidity ranges from 45-85 per cent.

2.2 Experimental Methodology and Crop Monitoring

The rice variety (TKM 15) seeds were distributed to selected farmers at no cost for one acre along with critical inputs. The critical inputs include post emergency herbicide, bio-fertilizers and water soluble fertilizers. The farmers are advised to raise the crop by semi dry sowing method after seed treatment with bio-fertilizers along with ruling rice variety as check. The selected farmers were trained for improved production technologies through training programmes funded by NICRA Project, and organized by ICAR, Krishi Vigyan Kendra, Villupuram (TN), during 2023. On 15-20th day after sowing, the post emergency herbicides (Bispyribac sodium) @ 400 ml/ha was sprayed. All the agronomic practices and need based plant protection measures were followed in all the demonstrations and control plots uniformly by monitoring the frequent visit by KVK scientists.

2.3 Data Collection and Analysis

The observations were recorded on number of productive tillers per plant and grain yield per hectare (kgs). For data collection, ten to fifteen representative plants were selected randomly in each demonstration plots in all the farmers' fields of TKM 15 as well as check variety. All the collected data were statistically analyzed by statistical method described by Pansi and Suckatme [10].

3. RESULTS AND DISCUSSION

The results of all the demonstrations and check plots were presented in Table 1. The performance of rice variety TKM 15 with comparison to the farmers cultivating variety as farmers practice (checks) was monitored periodically by KVK, Villupuram. The data on number of productive tillers per plant revealed that, it was ranged from 14.62 to 18.52. The average of number of tillers in TKM 15 demonstrations was 16.75 and the check variety (farmers practice) was recorded in 15.17. The tillering potential of the variety directly contributes to grain yield. Number of tillers on rice was already reported by [11,12]. With regard to grain yield in TKM 15 rice demonstration fields, the maximum grain yield 5280 kg.ha^{-1}was

Table 1. Performance of Rice (TKM 15) demonstrations under semi-dry condition at farmer's field

S. No	Farmers Name & Address	No. of Tillers / Plant		Grain yield		
		TKM 15	Control	Yield (kg/ha)	Control	% Increase
1.	Kanniyappan, VNaduvanandhal	17.65	15.62	4870	4620	5.41
2.	Rathinavel, M Naduvanandhal	18.52	17.35	5280	4810	9.77
3.	Sudha, P Naduvanandhal	16.25	15.34	4870	4450	9.44
4.	Manimekalai, R Naduvanandhal	15.75	13.72	4750	4530	4.86
5.	Govindan, MNaduvanandhal	17.85	15.45	5150	4630	11.23
6.	Muralitharan, R Puliyanur	16.45	14.82	4780	4520	5.75
7.	Murugan, V Puliyanur	18.25	16.45	5070	4650	9.03
8.	Raju, S Puliyanur	16.35	14.65	4950	4460	10.99
9.	Murali, R Puliyanur	14.62	13.47	4650	4410	5.44
10.	Valarmathi, M Puliyanur	15.73	14.85	4870	4620	5.41
	Mean	16.75	15.17	4925	4570	7.75
	CD (0.05%)	2.45	2.37	454.41	451.32	-
	CV (%)	5.37	5.83	7.61	6.95	-

Table 2. 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- (TKM 15+ Improved Production Technologies)	4925	48,500	98,500	50,000	2.03	10,100
Farmer's practice (Check variety)	4570	51,500	91,400	39,900	1.77	-

observed and minimum yield was 4650 kg.ha^{-1}. The average grain yield of all demonstration 4925 kg.ha^{-1} was recorded for TKM 15 demonstrations and for farmers practice, the yield was 4570 kg.ha^{-1}. It was 7.75% increase over the farmers practice (checks). These outcomes are somewhat comparable to [13]. The grain yield on rice was already reported in their research papers by [14].

The economic analysis of field demonstrations and farmers practices was presented Table 2. The cost of cultivation for demonstrations is Rs. 48,500/ ha^{-1}and gross income was Rs. 98,500/ha^{-1}. The farmers getting additional revenue of Rs. 10,100 ha^{-1} by cultivatingthe new highyielding rice variety TKM 15 (demonstrations). These findings are align with those of [15-19]. The additional yield and net income (Rs. 50,000) was due to cultivating new high yielding rice variety along with improved production technologies and timely supply of critical inputs. Similar kind of front line demonstrations in rice was already reported by [20-22]. The TKM 15 rice variety produced higher yield over the check variety in all the demonstrations, clearly indicated that showing constant performance in Villupuram district / different locations, the TKM 15 was easily adopted to new environments and having high stability over the locations in northern district of Tamil Nadu. Any new variety giving stable performance in different locations was good shine for Indian farming. The Front-Line Demonstration program effectively influenced the attitudes, skills, and knowledge related to improved or recommended practices in paddy cultivation, fostering adoption. It also enhanced the relationship between farmers and scientists, fostering mutual confidence. During the demonstrations, 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 variety TMK 15 along with improved production technologies demonstrated, contributed to an average increase in grain yield of 7.75% compared to the existing practices of farmers. The cost of this yield increment was a nominal of Rs. 7100 per hectare, an amount was affordable even by small and marginal farmers.

4. CONCLUSION

Tamil Nadu is an important rice growing state in the country faces several abiotic and biotic stresses and this necessitates location specific rice variety for the zone. In rice cultivation, drought is an important abiotic stress in this crop, can lead to considerable economic losses. The cultivation of drought tolerant varieties like TKM 15, along with suitable improved production technological interventions can be an important step in this direction. This high yield rice variety TKM 15 with its excellent performance in the demonstrations at Villupuram district will play a significant role in improving the productivity, profitability and sustainabilityin rice cultivation.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (Chat GPT, COPILOT, *etc*) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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