Advances in Research

Volume 25, Issue 6, Page 545-550, 2024; Article no.AIR.129114
ISSN: 2348-0394, NLM ID: 101666096

Improving Productivity of Semi Dry Rice Through Field Demonstrations in Ramanathapuram District, 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.

Article Information

DOI: https://doi.org/10.9734/air/2024/v25i61228

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/129114

Original Research Article

Received: 28/10/2024
Accepted: 30/12/2024
Published: 30/12/2024

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 fields by ICAR, Krishi Vigyan Kendra, Ramanathapuram, Tamil Nadu. The selected farmers were trained for improved production technologies through training programmes organized by this Krishi Vigyan Kendra. Local variety with their indigenous cultivation practices was considered as farmer's practice (control). The yield

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Cite as: *Ganapathy, S., Shibi Sabastian, J. Jayakumar, and P. Arunachalam. 2024. "Improving Productivity of Semi Dry Rice Through Field Demonstrations in Ramanathapuram District, Tamil Nadu, India". Advances in Research 25 (6):545-50. https://doi.org/10.9734/air/2024/v25i61228.*

and economics of field demonstrations were compared with farmer's practices. An average yield of 5,001 kg.ha^{-1} was recorded from RMD 1 demonstrations which showed 10.25 % increase over the farmers practice (4535 kg.ha^{-1}). Farmers have obtained additional revenue of Rs. 14,300 ha^{-1} 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, skill 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; seed drill sowing; grain yield; gross income; net income.

1. INTRODUCTION

The "Global Grain" rice is life for millions of people and cultivated widely across the world and feeds millions of people (Ganapathy, et al., 2024). It serves as the staple food for more than half of the world's population (Khan, et al., 2013). More than four billions of world population depend on rice as their major source of calories (Mohidem, et al., 2022). It is highly valued and competitive commodity in the world trade over a decade (IRRI, 2023). 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^{-1} (Government of India, 2022, Daquiado, 2019, Daquiado, 2019). It was cultivated under diverse soil and climatic conditions; the productivity level in India was low compared to the productivity levels of many countries in the world. About 90 % of the cultivated land belongs to marginal, small and medium farmers which are a major constrain in increasing the productivity of rice in the country. However, there is ample scope to increase the productivity of rice in the country. The highest productivity is 6710 kg.ha^{-1} in China followed by Vietnam (5573 kg.ha^{-1}), Indonesia (5152 kg.ha^{-1}), Bangladesh (4375 kg.ha^{-1}) etc., Improved production technologies like introduction of suitable,new high yielding varieties could be adopted in particular areasfor increase in the rice productivity.

Production and productivity of rice was depends mainly on choice of varieties, season and good agronomic practices with application of balanced major nutrients (Ganapathy & Jayakumar, 2023). Among the above components, selection of varieties plays an important role to increase the productivity (Ganapathy, et al., 2024). 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 enhance the yield under rainfed rice farming, there is a need to popularize the short duration drought tolerant variety with good agricultural practices suitable for rainfed farming to meet the challenges in rice cultivation. Front line demonstrations of new variety with improved agriculture practices could significantly increase the farm income. These field demonstrations 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 measures. Hence, the present demonstrations were conducted at farmer's field with short duration drought tolerant rice variety RMD 1 by seed drill direct sowing under semi dry situation.

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 predominantly clay loam low-medium fertility status. The climatic conditions of these research locations are tropical in nature. 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 taken up with farmer's practices. The package of improved production technologies (Table 1) included seeds of improved variety (RMD 1), bio fertilizers and post emergence herbicide was applied as per schedule. Seeds were treated with Carbendazim (50%WP)

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	Rainfed	Rainfed
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 kg.ha^{-1}.	75 kgs.ha^{-1}.
6.	Sowing method	By Seed drill sowing	Broad casting
7.	Weed management	Post emergence herbicide (Bispyribac sodium @ 205 ml.ac^{-1}) 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

@ 2.0 g. kg^{-1} of seeds. Sowing was done with drill during September with a seed rate of 50 kg/ha in line sowing by tractor drawn seed drill and maintaining a spacing of 30 cm. Recommended dose (100:50:50 kgNPKha^{-1}) 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^{-1} applied during 15-20 days after sowing followed by one hand weeding at 35-40 days after sowing. Fipronil (5%SC) @ 500 ml/ha and Chlorandranilprole (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 returns and cost of cultivation. The yield data was collected from both demonstration and farmers' practice plots. The harvested produce was 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 returns and Benefit: Cost ratio was worked out (Samui, et al., 2000). During the harvesting period, the yield data were collected and analyzed statistically (Panse & Sukhatme, 1978).

3. RESULTS AND DISCUSSION

The results of all the demonstration plots and control plots (farmer's practice) were presented in Table 2. Key differences were observed between demonstration package and farmer's practices. In the demonstration plots only recommended variety, bio-agents and foliar nutrients (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 in comparison to the farmers cultivating variety (local) as farmers practice (Control) was monitored periodically by KVK, Scientists, Ramanathapuram.

3.1 Grain yield

The maximum grain yield 5160 kg.ha^{-1} was recorded in Thirupulani block and minimum yield (4750 kg/ha) was observed in Ramanathapuram block. The average grain yield of all demonstrations was 5001 kg.ha^{-1}, and in farmers practice, the yield was 4520 kg.ha^{-1}. The yield increment was 10.25 % increase over the farmers practice (control). These outcomes are similar the findings of (Najeeb, et al., 2018, Vaishnavi, et al., 2023).

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^{-1} and gross income was Rs. 1,00,000 ha^{-1}. The cost of cultivation for farmer's practice was Rs. 50,000 ha^{-1} and gross income was Rs. 90,700 ha^{-1}. The average net income for demonstration plots was Rs. 55,000 and for farmers practice was Rs. 49,200 ha^{-1}. The farmers realised additional revenue of Rs. 14,300 ha^{-1} by cultivating the short duration drought tolerant rice variety RMD 1 along with improved production interventions (demonstrations). These

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^{-1})		
			Yield (Demonstrat-ions)	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 (%)	4.73	4.95	-

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

Treatments/ Intervention	Seed Yield (kg.ha^{-1})	Cost of cultivation (Rs.ha^{-1})	Gross income (Rs.ha^{-1})	Net income (Rs.ha^{-1})	B:C ratio	Additional Income (Rs.)
Improved Variety-(RMD 1) + Improved Production Technologies)	5001	45,000	1,00,000	55,000	2.22	14,300
Farmer's Practice (Control)	4535	50,000	90,700	40,700	1.81	-

findings are aligned with those of (Subbalakshmi, et al., 2021, Ganapathy, et al., 2024, Singh, et al., 2012, Gaur, et al., 2024, Hashim, et al., 2023). The additional yield and net return (Rs. 55,000) was due to demonstration of short duration drought tolerance 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 (Hashim, et al., 2022, Mandavkar, et al., 2012, Hashim, et al., 2024) and in finger millet by (Ganapathy, et al., 2024). Rice variety RMD 1 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 wide scale adoption. It also enhanced the relationship between farmers and scientists, fostering mutual confidence. During the demonstrations, the farmers emerged as primary source 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 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 which affordable even by small and marginal farmers.

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 rainfed 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 the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/129114