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Research Article

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Popularization of improved short-duration Rice variety Telangana Sona (RNR 15048) through Frontline Demonstrations in Nalgonda District, Telangana.

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ABSTRACT

Frontline demonstrations on rice (275 No) were carried out by Krishi Vigyan Kendra, Kampasagar during four *Kharif* seasons 2016 to 2019 in Nalgonda District, Southern Telangana Zone under Left Canal Nagarjuna Sagar Project command area with the main objective of assessing the performance of improved short duration rice variety Telangana Sona (RNR 1504) with latest crop production and protection technologies against farmer's practice. The improved practice comprised of improved short-duration rice variety RNR 15048, seed treatment, nursery management, recommended cultural practices at the time of transplanting, application of recommended dosage of fertilizers, adopted need-based production and protection measures that resulted in significantly higher yield (6790 kg ha^{-1}) with 12.0 percent increase yield in demonstration plots over the farmer's practice (6048 kg ha^{-1}) during four-year study period. The technology gap ranged between 0 to 350 kg ha^{-1} with a mean of 210 kg ha^{-1}. The lowest extension gap (518 kg ha^{-1}) was observed in *kharif* 2019 and it was the highest (1050 kg ha^{-1}) in *kharif* 2018. The average extension gap was 742 kg ha^{-1}and the technology index was in the range of 0.0 to 5.0% with a mean of 3.0%. The demonstrations recorded a higher gross return Rs. 1,18,815 ha^{-1} with a profitability of Rs. 67,190 ha^{-1} and additional net return Rs. 19,167.0 ha^{-1} as compared to farmer's practice. The mean benefit-cost ratio was 2.3 in demonstrations over the farmer's practice 1.8. The results based on a comparison between demonstrations and farmers' practice indicated that the yield, gross returns, net income, and benefit-cost ratio in frontline demonstrations were higher than in the local farmer's practice. The Farmers practice recorded lower yields and incurred higher expenditure as farmers used local varieties, applied overdose of fertilizers, and indiscriminate use of pesticides, spending more money on managing the pests and diseases.
Keywords: Rice, Frontline Demonstrations, Yield, Extension gap, Technology gap.

INTRODUCTION

Rice (*Oryza sativa* L) is the main staple food for more than half of the world's population (Babtunde *et al*. 2016). In India self-sufficiency in food grain production is mainly achieved through rice crop is being cultivated in an area of 43.78 m ha with a production of 118.43 m t and an average productivity of 2705 kg ha^{-1}while in Telangana rice occupies 3.2 m ha with a production 11.9 m t and an average productivity of 3700 kg ha^{-1}. In Nalgonda district, it is being cultivated in 2.8 lakh ha with a production of 9.6 L t and an average productivity 3440 kg ha^{-1}. The productivity of rice has increased from 2102 kg ha^{-1}in 2005-06 to 2705 kg ha^{-1}in 2019-20. Development of high-yielding short-duration rice varieties, adoption of improved and location-specific technologies, the rapid expansion of rice crops into nontraditional areas due to increased irrigation facilities, developed infrastructure, use of optimum dosage of fertilizers, and price policy support are the major factors for increased rice production in India (Singh *et al*. 2017). Frontline demonstrations (FLD) are the foremost effective and useful extension tool to demonstrate the latest improved technologies i.e., High Yielding Varieties (HYV), crop production and protection technologies, and management practices to be followed on farmer's fields developed at research stations. The field-level organizations are playing a major role in KVKs in the application of technology through the assessment, refinement, and dispersion of proven technologies under different agro-climatic situations or regions (Das, 2007). FLDs with proven technologies might minimize the adoption gap by yield enhancement.

Rice is the main crop under irrigated conditions in the Nagarjunasagar Left canal command area during both *kharif* and *rabi* seasons in the Nalgonda District, Southern Telangana. Farmers in the district cultivate mainly BPT 5204 (Samba Mahsuri) a long-duration variety and privately produced short-duration varieties like Ankur Pooja, HMT Sona, Kaveri Chintu, and Ankur Pooja Gold. Professor Jayashankar Telangana Agricultural University (PJTSAU), Hyderabad prioritized research in the area of crop improvement constantly to cater needs of the farming community of the state. The University released RNR 15048 (Telangana Sona) in 2016, a high-yielding short duration (120 -125 days) fine grain variety which is being extensively cultivated by the farmers of Telangana and Karnataka. RNR 15048 variety is suitable to late sown conditions i.e., after July 15th, and for delayed onset of monsoons and late release of canal water and is more preferred under contingency crop situations. The potential yield of this variety was 6500-7000 kg ha^{-1} and is resistant to blast, tolerant to BPH, but susceptible to panicle mites (Tamilazhaki *et al*., 2020).

The yield gap between potential yield and actual farm yield is very high due to cultivation in degraded low fertile soils (Ramachandra *et al*., 2019), non-adoption of high-yielding varieties, unawareness of the latest improved technologies, and biotic and abiotic stresses. Yield gap analysis can provide a basis for identifying better management strategies to improve the rice yield by reducing the gap between the potential and actual yield. The rice-based farming systems can reduce the yield gap and increase rice yield (Stuart *et al*., 2016). The low yields on farmer fields' are due to delayed sowing, non-availability of quality seed, unbalanced fertilizer application, hand weeding (Samant, 2017) and poor management practices, especially related to levelling, bunding, weed management, poor nutrient management, cultivation of low yielding crop varieties and high pest and disease incidence (Tanaka et al., 2017). Adoption of improved rice varieties and technologies to bridge the yield gap could improve the production and productivity of rice. Keeping given the above facts, the KVK Kampasagar has organized FLDs with improved short-duration fine grain rice variety RNR 15048 with the latest crop production and protection technologies to assess the performance and awareness of the latest improved technologies among the farming community in Nalgonda District, Telangana.

MATERIALS AND METHODS

A total of 275 no of frontline demonstrations in four villages i.e. Islavath thanda, Bhalunaik thanda, Sitya thanda, and Kapuvarigudem of Nalgonda District, Telangana were carried out by KVK, Kampasagar under Tribal Sub Plan (TSP) during *kharif* seasons only in 2016 to 2019. The KVK Scientists collected baseline data from farmers in each village and problems associated with short, medium, and late-duration rice varieties were discussed before the conduction of FLDs on rice. Later the KVK scientists explained the advantages of the cultivation of short-duration rice varieties and the adoption of the latest crop production technologies. Farmers were selected through group discussions, interaction meetings, awareness programmes, and field visits. Finally, a list of interested farmers was prepared and soil samples were collected for analysis in selected farmers' fields. The demonstrations were conducted in an area of 0.4 ha and the adjacent field was treated as farmers' practice. The demonstrations consist seed rate of 50 kg ha^{-1} of improved short-duration rice variety of Telangana Sona, sowing of green manure crop daincha @ 37.5 kg ha^{-1} followed by in-situ incorporation in the soil before transplanting of rice, seed treatment with Carbendazim @1g L^{-1} water, soil test based recommended dose of fertilizer application, application of pre-emergence herbicide Pretilachlor @ 1L ha^{-1}, adoption of need-based cultural practices viz., for every 2m a 30 cm alleyways formation at the time of transplanting, erection of pheromone traps @10 ha^{-1} at 25 days after transplanting (DAT) to monitor yellow stem borer moths, application of Carbofuran granules 3G @ 25 kg ha^{-1} to control yellow stem borer and leaf folder. In demonstration plots, farmers were advised to follow recommended improved package of practices as explained by KVK scientists compared with conventional methods adopted by farmers. The KVK scientists organized extension activities i.e., method demonstrations, farmer-scientist interactions, need-based training programs, and regular field visits to monitor the incidence of pests and diseases. Prior to harvest, a field day was organized to involve more participation of local farmers in the popularization of the technology.

Data was recorded on both demonstrations and farmer's practice and per cent increase or decrease yield over the check, gross returns, net returns, additional net returns, and benefit-cost ratio and also collected data on yield gap I (Technology gap), yield gap II (Extension gap) and technology index were calculated based on following formula were given by Sawardekar *et al*. (2003).

Increase or decrease yield over Demonstration plot Yield (kg ha^{-1}) - Farmer's practice yield (kg ha^{-1}) the farmer's practice (%) = ______ × 100
Farmer's practice Yield (kg ha^{-1})

Yield Gap I (kg ha^{-1}) = Potential Yield (kg ha^{-1}) – Demonstration Yield (kg ha^{-1})

Yield Gap II (kg ha^{-1}) = Demonstration Yield (kg ha^{-1}) – Farmer's practice Yield (kg ha^{-1})

Potential Yield (kg ha^{-1}) – Demonstration Yield (kg ha^{-1})
Technology Index (%) = ______ × 100
Potential Yield (kg ha^{-1})

Additional net returns (Rs.ha^{-1}) = Demonstration net returns (Rs.ha^{-1}) - Farmer's practice net returns (Rs.ha^{-1})

RESULTS AND DISCUSSION

Grain Yield:

Frontline demonstrations on short-duration rice variety RNR 15048 revealed significant mean grain yield (6709 kg ha^{-1}) in demonstration plots against farmer's practice (6048.0 kg ha^{-1}). The mean grain yields recorded were 6650, 7000, 6825 and 6685 kg ha^{-1}, respectively in demonstration plots and farmer's practice mean grain yields (5950, 6300, 5775 and 6167 kg ha^{-1}, respectively) were obtained during *kharif* 2016, 2017, 2018 and 2019. The highest grain yield (7000 kg ha^{-1}) was recorded in demonstration plots during *kharif* 2017 as compared to farmer's practice (6300 kg ha^{-1}) and the lowest yield was recorded in *kharif* 2016 due to scanty rainfall. The per cent increase in yield over the farmer's practice was 12.2%, 11.0%, 18.0% and 8.0%, respectively during 2016, 2017, 2018 and 2019, respectively with mean of 12.0% (Table 1). Increased grain yield in demonstration plots were due to the adoption of recommended improved short-duration fine grain variety RNR 15048, seed treatment with Carbendazim @1g L^{-1} water, in-time sowing, nursery raising after July 15th, timely transplanting (21 days age old seedlings), proper nursery management, timely application of weedicides, prophylactic and need-based plant protection measures. Practising better agronomic practices boosted grain yields in improved practice (Stuart *et al*., 2018). The higher yields in demonstrations were due to the adoption of improved varieties, intensive use of irrigation water and fertilizers, and expansion of irrigated areas (Mohanty and Yamano, 2017). These results are also in accordance with Jayalakshmi *et al*., 2021; Verma *et al*., 2016; Mitra *et al*., 2014; Prital Singh *et al*., 2020; Geetha *et al*., 2017; Mishra, 2009; and Narendra Singh *et al*., 2021.

Technology gap:

During four years of study, the technology gap between the improved practice and farmer's practice ranged from 0 kg ha^{-1} to 350 kg ha^{-1} with an average 210 kg ha^{-1} (Table 1) and the wide technology gap could be due to changes in the agro-climatic conditions, differences in managerial abilities across the farmers, farm instructional facilities available at different locations, and soil heterogeneity (Ravi Kumar *et al*., 2018). Most farmers have not followed the recommended package of practices, the latest improved technologies and recommended dose of chemicals, fertilizers, pesticides, and weedicides in rice crops from sowing to harvesting. Singh *et al*. (2021) reported that the use of the latest scientific technologies and the full recommended package of practices gave higher yields and net returns. Singh *et al*., (2020) also observed a wider technology gap between improved and farmers' practices in chickpea frontline demonstrations.

Extension gap:

The Extension gap of 700 kg ha^{-1}, 700 kg ha^{-1}, 1050 kg ha^{-1} and 518 kg ha^{-1}, respectively were recorded during *kharif* 2016, 2017, 2018 and 2019, respectively with a mean of 742 kg ha^{-1} (Table 1). The highest extension gap was observed in 2018 and it was low in 2019. The extension gap emphasized the importance of educating the farmer's through various extension methods i.e., training and method demonstrations to adopt improved latest agro technologies to lessen wide extension gap and adoption of the latest crop production technologies would change these alarming trends of galloping of extension gap. Adoption of improved transfer of technologies in demonstrations resulted in higher yields than farmers' practice. The extension gap can be bridged by encouraging the farmers to adopt improved practices while refining or modifying the existing technology by the concerned scientists to address the socioeconomic and environmental issues that can bridge the research gap (Ramachandra *et al*., 2019). Similar results were reported by Singh *et al*. (2021) in rice, Singh *et al*. (2021) in wheat crop, and Mamata *et al*. (2020) in wheat crop.

Technology index:

The technology index shows the feasibility of evolved technology on the farmer's fields. The lower value of the technology index, the higher the feasibility of the technology. The technology index of 5.0%, 0.0%, 2.5% and 4.5%, respectively were observed in *kharif* 2016, 2017, 2018 and 2019. The average technology index was 3.0% during the four years of the FLD programs (Table 1) which shows the efficacy of good performance of technical intervention adoption. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of rice and these results were in accordance with Deka *et al*. (2018).

Economics:

Data on economic parameters like gross returns, cost of cultivation, net returns, and benefit-cost ratio were presented in Table 2. Higher gross returns of Rs. 1,10,390.0 ha-1, Rs. 1,19,700.0 ha^{-1}, Rs. 1,22,168.0 ha^{-1} and Rs. 1,23,004.0 ha^{-1}, were recorded in demonstrated plots as compared to Rs. 98,761.0 ha^{-1}, Rs. 1,07,730.0 ha^{-1}, Rs. 1,03,373.0 ha^{-1} and Rs. 1,13,473.0 ha^{-1}, respectively on farmer's practice during *kharif* 2016, 2017, 2018, 2019, respectively. The overall mean of four years indicated the average gross return was significantly high in demonstration plots (Rs. 1,18,815.5 ha^{-1}) over the farmer's practice (Rs. 1,05,836.5 ha^{-1}). The higher gross returns in demonstrations were due to higher yields and low cost on inputs and adoption of recommended package of practices. Cost of cultivation was low in improved practice because of adoption of recommended agronomic and cultural practices, whereas in farmer's practice the expenditure was more on the cost of inputs due to recommendations of local pesticide dealers.

The net returns of Rs. 57,265 ha^{-1}, Rs. 69,075 ha^{-1}, Rs. 79,293 ha^{-1} and Rs. 72,129 ha^{-1} were higher in improved practices as compared to farmer's practice (Rs. 40,020 ha^{-1}, Rs. 51,480.0 ha^{-1}, Rs. 44,123 ha^{-1} and Rs. 56,473 ha^{-1}, respectively) during *kharif* 2016, 2017, 2018 and 2019. The mean net return was Rs. 67,191 ha^{-1} in demonstrations while in farmer's practice it was Rs. 48,024 ha^{-1}.

Table 1. Yield performance of rice variety RNR 15048 under Frontline demonstrations (FLDs) vs Famer's practice (FP)

Year	No of Demos	Potential yield (kg ha^{-1})	Yield (kg ha^{-1})		Increase in yield over the control (%)	Technology Gap (kg ha^{-1})	Extension Gap (kg ha^{-1})	Technology Index (%)
			Demo	Check				
2016	25	7000	6650.0#	5950.0#	12.0	350.0#	700.0#	5.0#
2017	25	7000	7000.0#	6300.0#	11.0	0.0#	700.0#	0.0#
2018	200	7000	6825.0##	5775.0##	18.0	175.0##	1050.0##	2.5##
2019	25	7000	6685.0#	6167.0#	8.0	315.0#	518.0#	4.5#
Average	275	7000	6790.0	6048.0	12.0	210.0	742.0	3.0
t-value			5.27					
p-value			0.002*					

Mean of 25 famers; ##Mean of 200 farmers; *Significant at P=0.05.

Table 2. Economics and additional returns in rice variety RNR 15048 under Frontline demonstrations (FLDs) vs Farmer's practice (FP)

Year	Gross returns (Rs ha^{-1})		Cost of Cultivation (Rs ha^{-1})		Net returns (Rs ha^{-1})		Additional net returns (Rs ha^{-1})	B:C ratio	
	Demo	Check	Demo	Check	Demo	Check		Demo	Check
2016	110390.0#	98770.0#	53125.0#	58750.0#	57265.0#	40020.0#	17245.0#	2.1#	1.7#
2017	119700.0#	107730.0#	50625.0#	56250.0#	69075.0#	51480.0#	17595.0#	2.4#	1.9#
2018	122168.0##	103373.0##	51875.0##	59250.0##	70293.0##	44123.0##	26170.0##	2.4##	1.7##
2019	123004.0#	113473.0#	50875.0#	57000.0#	72129.0#	56473.0#	15656.0#	2.4#	2.0#
Average	118815.0	105836.0	51625.0	57813.0	67190.0	48023.8	19167.0	2.3	1.8

#Mean of 25 famers; ##Mean of 200 farmers.

The maximum net return of Rs. 72,129 ha^{-1} was found in *kharif* 2019 due to variations in the price of agri-inputs and minimum support price for the produce. The average additional net return of Rs. 19,167 ha^{-1} was gained in demonstration plots and the benefit-cost ratio was higher in demonstrations when compared to farmer's practice during four years study period. The average benefit-cost ratio of 2.3:1 was found in demonstrations against 1.8:1 in the farmer's practice. The higher benefit-cost ratio in demonstration plots might be due to the cultivation of high-yielding improved short-duration rice variety with improved practices against the conventional practices. In farmer's practice, more money was incurred on the purchase of pesticides to control pest and disease incidence, over application of fertilizers, and also following traditional methods in paddy cultivation from sowing to harvesting. Whereas, improved practices followed the cultivation of recommended improved varieties, seed treatment with fungicides to control early stages of soil and seed-borne diseases and pests and recommended dose of weedicides, pesticides for managing weeds, pests, and diseases and optimum usage of fertilizers based on soil test results and the reduced cost on fertilizers might result in higher net returns and benefit-cost ratio (Singh *et al*., 2021). These results indicated that improved practices are more profitable, economically viable and beneficial to rice growers under local agroecological situations. Raj *et al*. (2014) reported that replacing old varieties with the latest improved varieties increases rice production and the net income of the farmer. Similar findings were observed by Verma *et al*., (2016); Mitra *et al*., (2014); Zamir Ahmed *et al*., (2014); Jayalakshmi *et al*., (2021); Singh *et al*., (2018); Deka *et al*., (2018); Singh *et al*., (2021); Narendra Singh *et al*., (2021) and Samant, (2014).

CONCLUSION

From this study, a difference in productivity levels between demonstrations and farmer's practices was noticed. In frontline demonstrations, cultivation of improved short-duration rice variety RNR 15048 and adoption of the latest crop production and plant protection technologies increased significantly grain yields, net returns, and benefit-cost ratio as compared to farmer's practice. Yield levels were higher in improved variety against local checks by disseminating the latest agro technologies through various extension methods and the farmers should be encouraged to adopt the recommended package of practices to get higher net returns. The extension and technology gaps were widened between improved and farmers' practices and to bridge the gap popularize recommended packages of practices with specific local recommendations, emphasizing the cultivation of improved varieties with the latest agro technologies. Replacement of old varieties with improved varieties will increase the net income and productivity. Finally, it is evident that the rice variety RNR 15048 is found to be more suitable and fits well in the existing farming situations, and frontline demonstrations played a key role in the popularization of RNR 15048.

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