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PROMOTION OF SYSTEM OF RICE INTENSIFICATION (SRI) METHOD IN MID-CENTRAL TABLE LAND ZONE OF ODISHA

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Abstract: The study was carried out through front line demonstrations during *rabi* season of 2009, 2010 and 2011 to promot the System of Rice Intensification(SRI) method in mid central table land zone of Odisha. The demonstration results showed that the improved practice of SRI recorded higher plant height (100.4 cm), effective tillers plant^{-1}(20.8), Length of panicle (23.3 cm), filled grains panicle^{-1}(151.8) than the conventional practice. The same also produced grain yield 46.4 q ha^{-1} which is 41.5 % higher yield than conventional practice with harvest index (47.8%) and production efficiency(37.2 kg ha^{-1} day^{-1}). The SRI method gave higher gross return Rs. 48213.3 ha^{-1} with a benefit-cost ratio 2.69 and additional net return Rs.14826.7 ha^{-1} as compared to farmers practice and the study showed that Extension/ horizontal spread of area from 25 hectare during 2010 to 85 hectare during 2011 under improved technology thus the existing conventional practice can be replaced by SRI method for higher productivity and income.

Keywords: Economics, Extension gap, Grain yield, Rice, SRI.

Introduction

Rice production in India has increased in past three decades continuously beginning with green revolution but stagnated since 1999. To meet the demand of growing population and maintaining self sustainability, the present production level needs to be increased to at least 120 million tons by 2020 with an average productivity of 4.03 t ha^{-1}. The increase in production has to be achieved in the backdrop of declining and deteriorating resource based such as land, water, labour and other inputs and without adversely affecting the quality of environment. This is only possible through intensification of rice cultivation (Biswal *et al.*, 2014). Rice is the predominant crop of Odisha with a total coverage of 4.0 million hectare and area under rice crop in Angul district of the state is 0.08 million hectare with a productivity of 9.89 q ha^{-1} which is 48 % less than that of state (Anonymus 2012). In future, there is no scope for further expansion in rice area and to achieve this goal, conventional breeding methods need to be supplemented with the innovative techniques. Achieving self-sufficiency in rice production and maintaining price stability are important political objectives in low-income countries because of the importance of this crop in providing

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national food security and generating employment and income for low-income people (Ghosh *et al.*, 2009).In recent past wide spread concerns have been expressed over stagnation in the yield of rice. The System of Rice Intensification popularly known as SRI is being advocated to many extensionists to boost the rice productivity and restore the lost soil health. System of rice intensification (SRI) originated in Madagascar and by adopting this method average rice yields can be about the doubled without changing the cultivars or the use of purchased input (wang, *et al.*, 2003). SRI method was developed in 1983 by Father Heneri de Laulinie in Madagascar which attracted attention in other countries only after 1997. The new improved technologies will eventually lead to the farmers to discontinue the old practice and to adopt new technology (Sharma *et al.*,2011). Keeping in view such problems and objectives, farmers participatory field demonstration was conducted to study the effect of SRI method on growth, yield and economics in rice cultivation for replacing the conventional practice.

Materials and Methods

The study was carried out through front line demonstrations during *rabi* season of 2009, 2010 and 2011 at three villages *Kushasingha, Tukuda and Nuagaon* in Angul district under mid central table land zone of with the active participation of farmers after different extension approaches through regular field visit & interpersonal communication made by the scientists of Krishi Vigyan Kendra, Angul. The demonstration site lies in 84^0 54′ to 85^0 03′ E longitude and 20^0 52′ to 24^0 50′ N latitude and average elevation of 300 m above sea level. The mean maximum and mean minimum temperature registered in the years was 32.3^0 C and 13.3^0 C respectively. Total 171.5 mm rainfall received during the cropping period. The soil of the experimental site was slightly acidic in reaction(pH-5.0 to 5.4), sandy loam texture with medium organic carbon content (0.50 to 0.55 %), medium in nitrogen(202 to 212 kg ha^{-1}), low in phosphorus(9.1 to 9.7 kg ha^{-1}) and medium in potassium(162.-167 kg ha^{-1}) contents.

Five different farmers each having 0.2 hectare of land cultivated the HYV rice *lalat* with recommended package of practices in each year. The farmers practices involved conventional method of rice transplanting of 25 days old seedlings with (15×10) cm spacing at the rate of 2-3 seedlings per hill, 2-4 cm standing water, chemical weeding by application of Butachlor. The improved practice of SRI included transplanting 8-12 days old seedlings in (25×25) cm spacing at the rate of 1 seedling per hill, weeding by cono weeder with alternate drying and sucking in medium land irrigated situation. Thus, reduced the water, seed expenses and enhances the grain yield and maintenance of soil health. The crop was transplanted during 2nd week of January and harvested during 3rd week of May in each year. Observations on different yield parameters and final crop yield (grain & straw) were taken and economic analysis was done by calculating cost of cultivation, gross return, net return and B:C ratio on the basis of prevailing market price of inputs and minimum support price the produce. Harvest index is the relationship between economic yield and biological yield (Gardner *et al.,* 1985).

It was calculated by using the Following formula:

$$\text{Harvest index (\%)} = \frac{\text{Economic yield}}{\textit{Biological yield}} \times 100$$

Production efficiency value was calculated with using formula by Tomar and Tiwari, (1990). Extension gap was calculated by the formula suggested by Samui*, et al.*(2000).

Extension gap = Demonstration yield-Farmers yield.

Tabular analysis involving simple statistical tools like mean was done by standard formula to analyses the data and draw conclusions and implications (Gomez and Gomez, 1984).

Results and Discussion

Grain Yield, Straw yield and Harvest index:

Results of front line demonstrations (Table-1) indicated that the improved practice of SRI method recorded grain yield 46.4 q ha^{-1} which was 41.5% higher than that of farmers practice. The improved practice also produced higher straw yield (50.5 q ha^{-1}) and harvest index (47.8 %). SRI provides better aeration, more space and less competition, which enabled the plants to grow vigorously. This might be due to have better partitioning of dry matter, which leads to increase the number of effective tillers, filled grains $panicle^{-1}$owing to higher tiller and grain production. These results are in agreement with the findings of Krishna *et al.*(2008). Dobermann (2004) also advocated method of SRI and reported yield advantages of 20% over the conventional practice.

Plant height, Length of panicle, Effective tillers $plant^{-1}$, Filled grains $panicle^{-1}$:

The SRI method produced (Figure 1) higher plant height (100.4 cm), Effective tillers $plant^{-1}$ (20.8), panicle length (23.3 cm) and filled grains $panicle^{-1}$(151.8) in comparison to farmers practice (Hosaain *et al.*, 2003). Similarly, this result is in agreement with findings of Gupta and Sharma (1991).

Production efficiency and Extension gap:

The production efficiency (Table 1) was higher in improved practice (37.2 kg ha^{-1} day^{-1}) in comparison to local check due to more grain yield. Higher extension gap (15.9 q ha^{-1}) was found during 2010 and lower (12.1 q ha^{-1}) was during 2009. Latest production technologies will subsequently change this alarming trend of galloping extension gap (Samant, 2014).

Economics

SRI method recorded (Table 2) the higher gross return of Rs.48213.3 ha^{-1} and profitability (Rs. 83.05 ha^{-1} day^{-1}) with additional net return of Rs.14826.7 ha^{-1} over farmers practice. Higher B:C ratio (2.69) was found in improved practice due to higher net return as compared to local check(1.83) attributed to more grain production. The variation in net return and benefit-cost ratio may be attributed to the variation in the price of agri inputs and produce. This might be due to higher productivity of grain as well as straw. Bharathy (2005) reported that gross returns were higher in SRI. These finding are also similar with the findings of Kabita *et al.* (2010).

Farmers Feedback:

Farmers were convinced with the SRI method of rice cultivation due to saving of input *i.e.* seed, water with higher tillering capability, grain yield and maintenance of soil health for higher productivity and income.

Impact of the front line demonstration:

The study over three years showed (Table 3) that Extension/ horizontal spread of area from 25 hectare during 2010 to 85 hectare during 2011 under improved technology. It reduced the water, seed expenses; enhances the grain yield and maintenance of soil health and economically viable.

Conclusion

Thus, the existing farmer’s practice can effectively be replaced by SRI method in irrigated medium land in the existing farming situation for higher productivity and income.

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Table 1. Effect of front line demonstration on grain yield, straw yield, harvest index, production efficiency and extension gap

Year	Area (ha)	No of farmers	Grain Yield (q ha^{-1})		Straw yield (q ha^{-1})		Harvest index (%)		% of increase in grain yield over local check	Production efficiency (kg ha^{-1} day^{-1})		Extension gap (q ha^{-1})	
			IP	FP	IP	FP	IP	FP		IP	FP	IP	FP
2009	1.0	5	42.7	30.6	47.8	36.5	47.2	45.6	39.5	34.46	24.5	12.1	-
2010	1.0	5	48.3	32.4	50.4	35.6	48.9	47.6	49.1	38.64	25.9	15.9	-
2011	1.0	5	48.2	35.5	53.3	42.2	47.5	45.7	35.8	38.56	28.4	12.7	-
Mean	3.0	15	46.4	32.8	50.5	38.1	47.8	46.3	41.5	37.2	26.3	13.6	-

** IP: Improved technology (SRI method) ; FP: Farmer's practice (Conventional method)*

Table 2. Effect of frontline demonstration on cost of cultivation, gross return, net return, B:C ratio and profitability

Year	Improved practice (SRI method)					Farmer's practice (Conventional method)				
	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C ratio	Profitability (Rs ha^{-1} day^{-1})	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C ratio	Profitability (Rs ha^{-1} day^{-1})
2009	17500	42955	25455	2.45	69.74	18200	30895	12695	1.70	34.78
2010	18000	50820	32820	2.82	89.92	18750	34180	15430	1.82	42.27
2011	18200	50865	32665	2.79	89.50	19275	37610	18335	1.95	50.23
Mean	17900	48213.3	30313.3	2.69	83.05	18741.7	34228.3	15486.6	1.83	42.43

**Sale price of rice seed Rs.950/q, Rs.1000/q and Rs.1000/q for the year 2009, 2010 & 2011; straw Rs.50/q for all the years*

Table 3. Effect of front line demonstration on transfer of technology

Year	Horizontal spread of technology		
	No of villages adopted	No of farmers adopted	Area (ha)
2009	-	-	-
2010	40	150	25
2011	110	185	85
Total	150	335	110

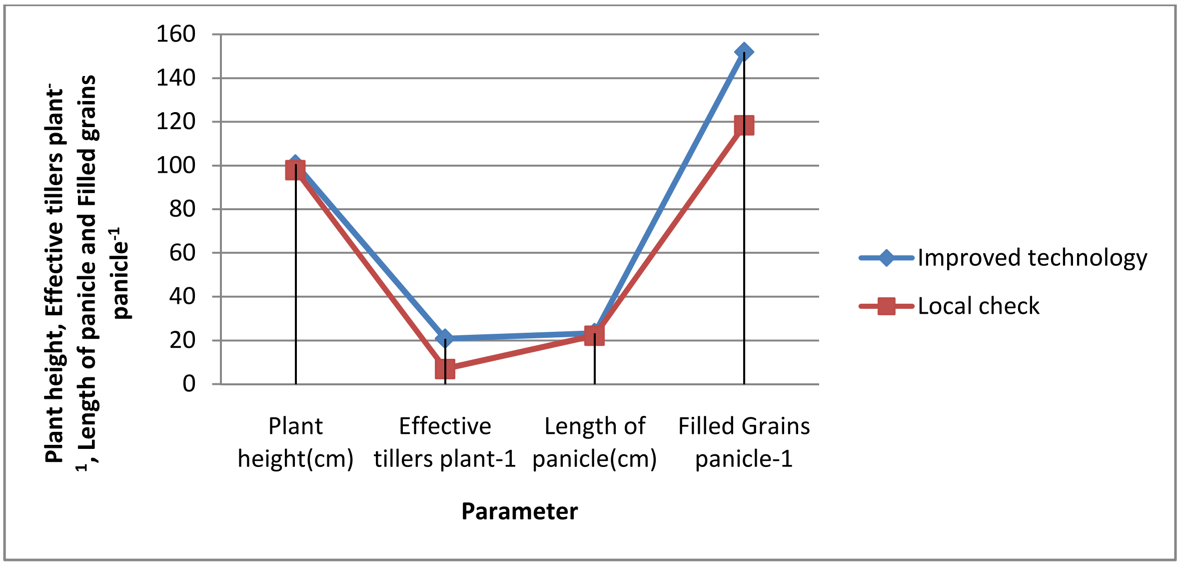

Figure 1: Effect of front line demonstration on plant height, effective tillers plant^{-1}, length of panicle and filled grains panicle^{-1}