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Direct Seeding Through Seed Drill is Advantageous for Increasing Productivity and Profitability of Rice *(Oryza Sativa)* in Western Parts of Kurnool District of Andhra Pradesh

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ABSTRACT

Krishi Vigyan Kendra, Banavasi conducted thirty front line demonstrations on direct-sown rice with seed drill at farmer's fields of different villages in Kurnool district of Andhra Pradesh from 2017-18 to 2019-20. This DSR method showed an increase in average yield (6151 kg/ha) in comparison to TPP (5482 kg/ha). In the case of DSR, the growth parameters plant height (75.2cm), productive tillers/hill (20.7 no), plants/m^2 (34.1 no), and panicle length (19.1cm) were significantly higher as compared to the TPR method. Comparative economics of DSP and TPP method of paddy cultivation revealed that there was a difference in cost of cultivation of nearly Rs.10,000 to 12,000/ha. The benefit-cost ratio of 2.65 was also much higher than the TPR (1.95). The lower net returns of Rs.61,669/ha and low benefit-cost ratio of 1.95 indicated the non-profitability of paddy cultivation under the TPR method in the Kurnool district. Labour shortage would become a major problem after a lockdown in the agriculture sector. Thus, it could be recommended that direct seeding through seed drill may be advantageous for increasing the productivity and profitability of rice.

Key Words: Direct seeded rice (DSR), Transplanted rice (TPR), Frontline demonstrations, Economics, Labour shortage.

INTRODUCTION

Direct seeded rice (DSR) as a resource conservation technology has several advantages over transplanted rice systems (TPR) (Mohanty, 2014). It helps in minimise water consumption as it does away with raising of seedlings in nursery, puddling and transplanting. Thus, it decreases the labour required to the extent of about 40 per cent and water saving up to 60 per cent from nursery raising, field preparation, seepage, and percolation and evaporation losses. It offers certain advantages *viz*., less labour, less water requirement, less drudgery, early crop maturity (7-10 d), low cost of production, proper placement of seed and fertilizer, increase fertilizer use efficiency, improve soil health for crops and less methane emission, in different cropping systems. (Kaur and Singh, 2017). Evidence from long-term experiments showed that crop yields of paddy are stagnating and sometimes declining (; Ladha *et al,* 2003). The yield through the transplanting method has been limited by a number of factors such as labour intensive and cumbersome and it is a real drudgery to womenfolk. The major operations like nursery preparation and its management, pulling out seedlings, transporting and distribution of seedlings to the main field and transplanting consumes 25-30 per cent of the total cost of cultivation in trans-planted rice. This can be replaced by direct seeding that can reduce labour needs by more than 20% in terms of the working hours required (Santhi *et al,* 1998). The raising of nursery and manual transplanting are both labour intensive and costly prepositions (Das, 2003). Many innovations have contributed to the expanding use of resource-conserving technologies in the country. In this regard, one of the most important technology has been introduced seed-cum-fertilizer drill which can establish crops with a minimum of soil disturbance. This seed-cum-fertilizer drill can take the best advantage of residual soil moisture

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and thereby reduce irrigation requirements can help in improving the timeliness of sowing, can place seed and fertilizer nutrients at suitable soil depths, (Sing *et al,* 2012). Keeping the above facts in view, the present study was undertaken for resource conservation in rice by introducing direct-seeded rice (DSR) at the farmers' fields during 2017, 2018 and 2019 with an objective to study direct-seeded rice over the traditional method of transplanting.

MATERIALS AND METHODS

Kurnool District lies between the northern latitudes of 140 54' and 160 18' and eastern longitudes of 760 58' and 790 34'. The altitude of the district varies from 100 ft above the mean sea level. Frontline demonstrations were conducted to introduce direct-seeded rice (DSR) in Banavasi and Ventapuram blocks (10 demonstrations each year). Beneficiary selection for FLDs on DSP was done through discussion and personal contact with farmers on the basis of certain socio-personal characteristics like socioeconomic status, innovativeness, progressiveness and risk orientation. All the technological intervention was taken as per the prescribed package and practices for improved varieties of rice crops. The seed rate for DSR and TPR was 25 and 75 kg/ha, respectively. The variety sown both in DSR and TPR was BPT-5204. Sowings were done in the first fortnight of August. The recommended dose of fertilizers (240:80:80 NPK kg/ha) was applied in the demonstration field. The grain yield, input cost, net return, and additional returns were recorded and assessed of gaps in the adoption of recommended technology before laying out the frontline demonstrations (FLDs) through personal discussion with selected farmers. During three years of assessment the observations like plant height (cm), panicle length (cm), productive tillers (number), yield (kg/ha), were recorded. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analysed by using simple statistical tools.

Economic parameters

The cost of cultivation (Rs/ha) was estimated by considering the prevailing charges of agricultural operations and the market price of involved inputs. Over the course of studies, gross returns were obtained by converting the yield into monetary terms at the prevailing market rate. Net returns were obtained by deducting the cost of cultivation from gross return. The benefit-cost ratio was calculated by dividing gross returns per ha by cost of cultivation per ha.

Gross return (Rs/ha) = (Seed yield x Price)

$$\text{Benefit: Cost ratio} = \frac{\text{(Gross returns per ha)}}{\text{(Cost of cultivation per ha)}}$$

Net returns (Rs/ha) = [Gross return (Rs/ha) - Cost of cultivation (Rs/ha)]

RESULTS AND DISCUSSIONS

Effect of Direct seeded Rice on growth and yield attributes:

The data (Table 1) showed that the highest plant height observed in DSR (75.16, 75.19 &74.98 cm) as compared with TPR (69.84, 69.91 & 69.58 cm) in all three years in both blocks of Kurnool district. A perusal of the data (Table 2) showed that the number of plants/m^2 were found highest in DSR (20.3, 21.8 & 20.5) as compared to TPR (27.4, 27.7 & 27.2) in 2017, 2018 and 2019 respectively. The p-value from table 2 (=0.000) was less than 0.01 in all three years, indicates that there is a significant difference between the two practices with regard to the number of plants/m^2. The data (Table 3 & 4) revealed the panicle length (21.8, 21.7 & 20.5 cm) and a number of productive tillers (20.3, 21.4 & 20.7) were recorded highest in DSR than TPR. These findings were also supported by Roy *et al* (2009) that the increased/optimum plant density under DSR may be attributed to higher plant height and the highest number of effective tillers/ hill whereas TPR produced the lowest number of effective tillers/hill. Higher tillering exhibited by the crop as a result of better crop growth underline

Table 1. Effect of direct seeded rice on Plant height (cm).

	2017				2018				2019				Pooled			
Technology Option	Mean	SD	t value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value
DSR	75.16	0.27	5.06	0.003*	75.19	0.43	5.18	0.000*	74.98	0.17	5.14	0.000	75.10	0.36	8.92	0.000*
TPR	69.84	3.14			69.91	3.02			69.58	3.13			69.75	0.35		

* *Significant at 0.05% level of probability*

Table 2. Effect of direct seeded rice on No of plants/sq.m

	2017				2018				2019				Pooled			
Technology Option	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value
DSR	34.4	2.2	8.3	0.000*	34.1	1.5	8.30	0.000*	34.3	1.9	7.36	0.000*	34.1	1.9	12.13	0.001*
TPR	27.4	2.5			27.1	1.7			27.2	2.1			27.5	2.07		

* *Significant at 0.05% level of probability*

Table 3. Effect of direct seeded rice on No of productive tillers/sq.m

	2017				2018				2019				Pooled			
Technology Option	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value
DSR	20.3	1.2	5.52	0.000*	21.4	1.56	5.87	0.000*	20.5	1.18	5.60	0.000*	20.7	1.32	9.11	0.000*
TPR	16.5	1.7			17.1	1.61			16.4	1.68			16.7	1.49		

* *Significant at 0.05% level of probability*

Table 4. Effect of direct seeded rice on Panicle Length (cm)

	2017				2018				2019				Pooled			
Technology Option	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value
DSR	21.8	0.52	12.7	0.000*	21.7	0.77	12.15	0.000*	20.5	0.55	13.31	0.000*	21.3	0.69	19.07	0.000*
TPR	18.26	0.27			18.3	0.32			16.4	0.40			18.3	0.37		

* *Significant at 0.05% level of probability*

Table 5. Effect of direct seeded rice on Yield kg/ha

	2017				2018				2019				Pooled			
Technology Option	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value	Mean	SD	t-value	P value
DSR	6151	116.3	8.85	0.000*	6180	146.44	8.30	0.000*	6143	116.3	9.06	0.000*	6151	126	15.59	0.000*
TPR	5490	190.1			5487	202.87			5470	190			5482	195.85		

Table 6. Year wise economic evaluation of Direct seeded Rice

Year	Cost of Cultivation (Rs/ha)		Gross Returns (Rs/ha)		Net Returns (Rs/ha)		B:C Ratio	
	DSR	TPR	DSR	TPR	DSR	TPR	DSR	TPR
2017	51029	62863	135322	120780	84293	57917	2.651865	1.921321
2018	53450	64500	142140	126201	88690	61701	2.659308	1.956605
2019	54500	65800	147432	131280	92932	65480	2.705174	1.995137
Average	52993	64387	141631	126087	88638	61699	2.67	1.95

sowing may have resulted in a higher number of panicles/m^2. The data (Table 5) showed that the yield was recorded highest in DPR (6151, 6180 & 6143 kg/ha) as compared to TPR (5490, 5487 & 5470 kg/ha). Since the p-value from table 5 (=0.000) is less than 0.01 in all three years, hence it can be concluded that there was a significant difference between the two practices with regard to yield in which improved practice significantly more yield, than that of farmers' practice. This was also supported by Srilatha *et al* (2013) and Singh *et al* (2018).

Economics analysis

Economic performance of direct-seeded rice under frontline demonstration was depicted in (Table 6). The results revealed that the recorded lowest cost of cultivation in DSR in all three years is due to labour charges and also for irrigation. The gross returns from recommended practice (FLD's) were Rs 135322/ha, 142140/ha and 147432/ha as compared to 120780/ha, 126201/ha, and 131280/ha in farmer's practice. The benefit-cost the ratio of rice varieties also recorded higher in recommended practice with 2.66, 2.65, and 2.70 as compared to 1.92, 1.95, and 1.99 in farmer's practice. The higher net returns and B:C ratio in rice demonstration might be due to the higher grain yield of the product in the market. Recommended practice (FLDs) proved beneficial in respect of yield and economics of rice in consecutive blocks of Kurnool District in Andhra Pradesh.

CONCLUSION

The present study revealed that efforts have been made for resource conservation in rice by introducing direct-seeded rice (DSR) gave higher yield and net returns in recommended practice (FLD's) than farmers' practice in the Kurnool district. The highest grain yield was attributed to higher potential with improved technology, timely sowing, nutrient management, weed management, and insect, pest, and disease management in accordance with package and practice. Economic analysis of different parameters revealed that net returns and additional gain were recorded highest with recommended practice (FLD's). Farmers showed a great response in adopting the techniques of direct-seeded rice (DSR along with other recommended technologies of IPM, balanced use of fertilizers, use of herbicides, and irrigation management in the rice field. The study was concluded that direct sowing rice proved beneficial in respect of yield and economics.

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