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Direct seeded rice: Purely a climate smart village technology

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Abstract

Transplanting after repeated puddling is the conventional method of rice cultivation which is not only laborious but also increases the cost of cultivation. The other problems of this method are unavailability of labour during peak period, scarcity of water, deterioration of soil health. Replacement of existing traditional method of rice cultivation with sustainable production of rice and increase soil health is needed. Direct seeded rice is one of the methods popularizing for upland rice cultivation which avoids repeated puddling, prevents soil degradation and plow-pan formation, facilitates timely establishment of rice, saves water and labour, reduces production cost and increases yield. A field study was conducted to make comparison between two methods of rice cultivation i.e. Direct Seeded Rice (DSR) and puddle transplanting in two successive *kharif* seasons of 2017 & 2018 at farmer's field in Chandī and Nalanda districts of Bihar. DSR method recorded statistically at par grain yield with conventional transplanting method. However, numerically higher grain yield of 37.64q /ha was recorded in conventional transplanting method compared to DSR i.e. 34.76 q/ha. Maximum mean plant population of 10.41 and higher mean number of productive tillers of 70.63 per running meter were recorded by DSR method over the conventional transplanting method with plant population of 4.11 and 45.90 average productive tillers per running meter. However, maximum weight of 1000 grains i.e. 24.3 g was recorded in conventional transplanting method than DSR i.e. 22.98g. Net monetary return and benefit cost ratio of Rs 36527/ha and 1.40 respectively was recorded by DSR followed by transplanting method of rice with Rs. 36483/ha and 1.16 net monetary return and benefit cost ratio respectively.

Keywords: Direct seeded rice, puddle transplanting method, economics

Introduction

Among the various food grain crops, rice (*Oryza sativa*) is one of the most important food crops in the world; it is the essential food for the more than 50% of the global population. In India, it is grown on an area of about 43.5 M ha with a total production of 105.5 MT and productivity of 2.4 t /ha during 2014-15. Rice is one of the major staple food in India and it meets 43% of calorie requirement of more than two third of the Indian population. Rice is generally grown in *kharif* season. Repeated puddling and transplanting is one of the traditional methods of rice cultivation adopted in rice growing areas of India. In this method labour requirement and the water requirement is maximum. Scarcity of water during the critical growth stage may affect on the yield of rice. It also has effect on establishment and growth of the succeeding crops. It was therefore necessary to identify alternative method of rice cultivation which is more economical, saves labour and irrigation water. In the areas, where limited irrigation facility is available rice is cultivated by direct seed rice (DSR) method. It is an oldest principle of crop establishment since 1950s in developing countries. Bhullar *et al.* (2018) ^[1] reported that DSR method saved 14 person-day/ha and 18-20% irrigation water as compared to puddle transplanting method. DSR is gaining popularity even in poor farmer who has less land because of low input and more output, saves labour cost, less drudgery, early crop maturing, low methane emission, and helps in improving soil health condition. It also help reduce production risks in possible drought situations and when rainfall at planting time is variably high as reported by Kumar and Ladha, (2011) ^[6].

The present study was therefore conducted at farmer's field to compare the results of two methods of rice cultivation i.e. DSR and puddled transplanting.

Materials and Methods

The study was conducted on farmer's field at Chandī, Nalanda districts of Bihar under Borlaug Institute of South Asia (BISA) project implemented by BAIF during two successive seasons of *kharif* 2017 and *kharif* 2018. Five farmers from 4 villages namely, Dasturpar, Bhagwanpur, Murlabhegha and Sumka were selected for study purpose.

The study was conducted on 0.40ha area with DSR method and 0.40ha area conventional method of rice transplanting at each farmer.

DSR method: Sowing was done in 2nd week of June in dry field followed by one irrigation. Seed rate was 30kg per ha. Seeds were treated with Carbendazim @ 4g per kg of seed.

Puddled transplanting method: Nursery was raised using 10 kg seed to transplant one hectare area. Seedlings of 25 to 28 days old were used for the transplanting and it was done in 2nd week of July in puddle fields.

Fertilizer application: Uniform chemical fertilizer dose of 80:40:20kg NPK/ha was applied as basal to both the treatments through Urea, DAP and MoP. Remaining 40 kg N/ha was applied in two splits as 20kg at tillering stage and

20 kg at panicle initiation stage. In addition, Zinc Sulphate was broadcasted @ 25 kg /ha at the time of sowing in DSR treatment and during last ploughing in transplanting treatment to fulfil the requirement of zinc.

Weed control: One hand weeding followed by application of Bispyribac Sodium 10% @ 250ml/ha after 18 DAS was given in DSR method.

Remaining all other agronomic and other practices were followed same in both the treatments. Data on growth yield and yield attributing characters were collected and analysed using two samplet-tests.

Results and Discussion

Table 1: Effect of different methods of rice cultivation on yield and yield attributing parameters

Cultivation Method of Rice	Panicle length (cm)		Grain yield (q/ha)		No. of grains/panicle		1000 grain weight (g)	
	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice
Mean	24.30	22.98	37.64	34.76	167.98	156.60	22.84	22.12
Number of observations	20	20	20	20	20	20	20	20
P(T<=t) two-tail	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of different rice cultivation methods on different growth parameters

Cultivation Method of Rice	Plant height (cm)		No of plant/ running meter		No of tiller /running meter	
	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice
Mean	79.95	78.31	4.11	10.41	45.9	70.63
Number of observations	20	20	20	20	20	20
P(T<=t) two-tail	NS	NS	2.78	2.78	2.31	2.31

The results of two different methods of rice cultivation on yield and yield attributing parameters were presented in Table-1 while those on growth parameters in Table-2. It is revealed from Table 1 & 2 that, no significant differences were observed in plant height, panicle length, grain yield, number of grains per panicle and 1000 grain weight between two methods of rice cultivation. However, numerically maximum grain yield of 37.64 q/ha was recorded by conventional transplanted rice method which was at par with DSR method with 34.76 q/ha. Similar results were obtained by Kumar and Ladha 2011^[6] and Joshi *et al.*, 2013^[4] that there were no significant differences for grain yield in direct seeded rice and puddle transplanted rice. Gill *et al* 2006^[3] also reported that the grain yield of rice was not significantly differing due to the direct seeded rice method and conventional transplanting methods of rice cultivation.

Maximum plant height of 79.95 cm & 78.31 cm, length of panicle with 24.30 cm & 22.98 cm, number of grains per

panicle 167.98 & 156.60 and 1000 seed weight of 22.84g & 22.12g were recorded in conventional transplanted rice method and DSR method respectively. Gangwar *et.al.* 2008 reported similar results that there was no significant difference observed among the growth and yield attributing characters in two methods of rice cultivation.

Significantly maximum number of plants (10.41) and higher number of productive tillers (70.63) per running meter were recorded in DSR method compared to conventional rice transplanted method which was 4.11 and 45.90 respectively. Although there were more number of plants and tillers per running meter in DSR method than conventional method, it has not attributed to the grain yield. Vivekanandhini *et al* 2018^[7] also reported that, maximum plant height, number of panicles per meter running row and grain yield was recorded by direct seeded rice method among all the methods of rice establishment.

Table 3: Economics of two different methods of rice cultivation

Method of sowing	Cost of cultivation		Gross monetary return (Rs/ha)		Net monetary return (Rs/ha)		BC Ratio	
	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice	Conventional method	Direct seeded Rice
Mean	31270	26049	67753	62576	36483	36527	1.16	1.40
Number of observation	20	20	20	20	20	20	20	20
P(T<=t) two-tail	2.31	2.31	-	-	NS	NS	NS	NS

**In calculation rate of Paddy presumed Rs 18/kg

The economics of two methods of rice cultivation and thereby the benefit cost ratio are presented in Table-3. It is indicated from the table that, there was no significant difference observed in the net monetary return due to the methods of rice cultivation. However, maximum net monetary return of Rs 36527/ha was recorded by DSR method followed by

conventional transplanting method with Rs 36483/ha. Bhullar *et al* 2018^[1] reported that DSR method of rice cultivation minimized the cost of cultivation and gave maximum net monetary return of Rs 79710/ha over puddle transplanted rice method with Rs75680/ha net monetary return. The highest cost benefit ratio 1.40 was recorded by DSR followed by

conventional transplanting method of rice cultivation^{1,16}. Similar trend of economics was also observed by Kahloon *et al.* 2012^[5].

Conclusion

From the two years on farm research study it is concluded that the DSR method of rice cultivation is cost saving, more remunerative with less labour requirement and helpful for areas where the availability of irrigation water is limited. This method can be promoted among the farmers in Bihar for large scale adoption.

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