Journal of AgriSearch **5**(3):159-162
An Open Access International Peer Reviewed Quarterly
ISSN : 2348-8808 (Print), 2348-8867 (Online)
https://doi.org/10.21921/jas.5.3.3

Direct seeded rice: An option for enhancing the productivity, improving resource use efficiency and minimizing the production cost of the rice

DEOKARAN, MANDHATA SINGH, ARIF PARVEZ, J S MISHRA, BP. BHATT
KVK Buxar, ICAR Research Complex for Eastern Region, Patna, India

ARTICLE INFO

Received on	:	26.07.2018
Accepted on	:	27.08.2018
Published online	:	05.09.2018

ABSTRACT

A front line demonstration on direct seeded rice was conducted during *Kharif* season of 2014 and 2015 to enhance the productivity of rice, improving resource use and minimizes the production cost. Front line demonstration is a medium to make awareness about the technology direct seeded rice (DSR) and popularised amongst farmers. The present study showed that yield attributing characters under DSR was higher compared to farmers practice-puddled transplanted rice (PTR).However, grain yield under PTR was slightly higher (5.1%) than DSR. Economics of rice production technology, favour DSR over farmers practice-puddled transplanted rice (PTR) due to higher net return and a benefit-cost ratio under DSR as compared to transplanting. Direct seeded rice fetches a high net return of Rs. 39,875 with benefit-cost ratio of 2.74, as compared to PTR, attributed by the involvement of high cost for land preparation and nursery raising, transplanting and irrigation under transplanting.

Keywords: DSR, Rice, Resource Use Efficiency, Productivity

INTRODUCTION

The rice-wheat cropping system is a predominantly cropping system of the Middle Indo-Gangetic plain region (Meena *et al.*, 2016), where rice is traditionally grown by transplanting 4-6 week old seedling in puddle field, transplanted rice is required at least 25 ha-cm of water for puddling operation, which creates a dense layer in the sub-soil to prevent seepage losses (Kumar *et al.*, 2018). The crop requires about 140 ± 10 ha-cm of irrigation in addition to the adaptation of suitable variety, and application of recommended dose of fertilizer to realize yield levels of about 6±2 t/ha. Generally, about 40 to 50% water goes to paddy cultivation in the region. In many parts of the Middle Indo Gangetic Plains water is increasingly becoming scarce because of its other competing end uses in national economies. In India, rice is staple crop (Singh *et al.*, *2009*) cultivated in 44.6 million hectares with a total production of 96 million tonnes and ranks next to China (Balakrishna and Satyanarayana 2013; Chowdhury *et al.*, 2014). To meet the demands of ever-increasing population and maintenance of self-sufficiency, the present production level needs to be increased up to 120 million tonnes by the year 2020.The production can be increased vertically viz. timely sowing, promoting water use efficiency and maintaining a plant population sufficient to achieve high rice productivity. It is therefore important that alternative methods that are more water efficient and less labour – intensive be developed to enable farmers to produce more at less cost (Kumar *et al.*, 2017).One way to reduce water demand is to grow direct seeded rice instead of the conventional puddled transplanted rice. In Bihar rice is grown in 32 districts and among them, 11 districts falls under high productivity group, i.e. yields more than 3500 kg/ha. Nine districts falls under medium productivity group i.e. yields in the range of 2500 to 3000 kg/ha. Eight districts falls having medium to low productivity i.e. yields in the range of 2000 to 2500 kg/ha. Buxar district is facing low rainfall, erratic rainfall since 2013(681.4 mm), 2014 (590.1 mm) and 2015 (866.95mm) so the district is under low productivity i.e. yields in the range of 2000 to 2200 kg/ha. Buxar district is falling under medium productivity group with an average yield of 2123 kg/ha (Siddiq, 1999). Farmer's productivity of rice in the district is far lower than the potential yields of improved rice varieties and. Hence frontline demonstrations were initiated with an objective to increase water use efficiency and the productivity of rice through the popularization of improved production technologies and to find out the technology gap and technology index.

MATERIALS AND METHODS

The present investigation was carried out by Krishi Vigyan Kendra, Buxar, Bihar during *kharif* seasons of 2014 and 2015 in the farmers' fields of five adopted villages namely *Kukurha, Surundha, Yadav Dera, Geruabandh* and *Rajapur* of Buxar district. During these two seasons of study, an area of 10 ha was covered with a plot size of 0.4 ha under frontline demonstration with an active participation of 25 farmers. As suggested by Sagar and Chandra (2003) before conducting the front line demonstrations, the meeting was conducted in each village and interested farmers list was prepared. Specific skill training was imparted to the selected farmers regarding different aspects of cultivation. The packages of demonstration (DSR) and existing farmers' practices (PTR)

SMS (Soil Science), KVK Buxar (ICAR RCER Patna)
SMS (Agronomy), KVK Buxar (ICAR RCER Patna), corresponding author email:
Farm Manager, KVK Buxar (ICAR RCER Patna)
Head, Division of Crop Research, ICAR RCER, Patna
Director, ICAR RCER, Patna
*Corresponding Author Email : mandhataagro@gmail.com

are presented in Table 1. The soils under study were clay loam in texture with pH ranging from 7.2 to 7.8. The available nitrogen, phosphorus, and potassium range from 161-249, 33-44 and 205-299 kg/ha, respectively.

In all the demonstration plots, quality seed Variety "Rajendra Sweta" was used, optimum plant population was maintained, proper and timely weed management and application of recommended dose of fertilizers at right time and in right method as well as need-based plant protection measures were emphasized and comparison has been made with the existing farmers' practice (Table 1).

The necessary steps for selection of site, farmers, and layout of demonstration etc. were followed as suggested by Choudhary (1999). The farmer's practices were maintained in case of control. The front line demonstration was conducted to popularize direct seeded rice production technologies to improve the productivity of rice and to find out the technology gap and technology index. In the present evaluation study, the data on the output of rice cultivation were collected from FLD plots, besides the data on farmers practice. To estimate the technology gap and technology index the following formulae have been used (Samui *et al*., 2000).

Technology gap: Potential yield - Demonstration yield

Technology index: {[(Potential yield - Demonstration yield) X 100] / Potential yield}

RESULT AND DISCUSSION:

Crop growth and yield

The data related to the rice traits number of tillers/m^2, panicles/m^2, panicle length, grains/panicle, fertility percentage, 1000 seed weight and grain yield were recorded (Table 2). Direct seeded rice under demonstration produced higher number of tillers/m^2, panicles/m^2, grains/panicle compared to puddled transplanted rice.

This might be due to farmers are transplanting rice without proper spacing and not maintaining the row to

Table 1: Comparison between the demonstration of the package and under FLD and control (Farmers practice) in rice

Particulars	Direct seeded rice (Demonstration)	Puddled transplanted rice(Farmers practice)
Farming situation	Irrigated	Irrigated
Soil type	Clay Loam	Clay Loam
Variety	RajendraSweta	RajendraSweta
Time of sowing/trans-planting	10 to 12th, June	8 to 10 July
Methods	Zero Tillage	Manual transplanting
Spacing	20 cm line to line	20 cm x 15 cm
Seed treatment	Carbendazim 2g/kg seed	Carbendazim 2g/kg seed
Seed rate	30 kg/ ha	20 kg/ ha
Fertilizer dose	120:60:40:25 kg N:P:K:$ZnSO_4$	120:60:40:25 kg N:P:K:$ZnSO_4$
Fertilizer application time and methods	1/3 N, full P and ½ K applied at time of sowing, 1/3 N and full Zn applied at tillering, 1/3 N and ½ K applied at PI stage	½ N, full P and K applied as basal, ¼ N and full Zn applied at tillering and ¼ N applied at PI stage
Water management	DSR crop does not require continuous submergence Total five irrigation was given for proper growth and development Maintain thin film of water at PI stage upto 15 Days	Continuous submergence
Weed management Pre-emergence	Application of Pendimethyline @ 1.0 kg a.i./ha after sowing	Application of pretilachlor@ 0.5 kg a.i./ha 3DAT
Weed management Post emergence	Application of Bispyriback Sodium @ 20g a.i./ha at 30 DAS.	Two hand weeding at 30 DAT and 60 DAT
Plant protection	Application of cartap hydrochloride @ 18 kg/ha to protect from stem borer at activetillering stage One application of propiconazole @ 0.5 kg a.i./ha for controlling the sheath blight	Application of cartap stem borer at activetillering stage One application of propiconazole @ 0.5 kg a.i./ha for controlling the sheath blight
Days taken to maturity	DSR crop mature 8-10 days earlier and provide the opportunity to advance sowing of wheat	Transplanting crop take more time, delayed in harvesting of rice and late sowing of wheat

row and plant to plant distance. In direct-seeded rice line to line distance and seed, depths are properly maintained and this led to good germination and profuse tillering in DSR (Singh and Singh, 2010). Panicle length was recorded higher under PTR and was comparable with DSR. Fertility percentage was higher under DSR compared to PTR. DSR recorded 88% fertility compared to 83% in PTR. This might be due to early panicle initiation improve the fertility percentage. 1000 seed weight under PTR were higher but much closed to DSR. Grain yield under direct seeded rice was lower under DSR compared to farmers practice but grain yield was close to DSR. Grain yield under DSR was higher mainly due to higher number of panicle and fertility percentage led to higher grain yield (Singh and Singh, 2010).

Table 2: Growth and yield parameters of rice under demonstration and farmers practice

Methods	No of tillers/m2	Panicles / m2	Panicle length	Grains/ panicle	Fertility percentage	1000 seed weight	Grain yield
DSR	480	461	26.8	480	88	24.3	40.5
PTR	460	448	27.5	468	83	24.5	42.6

Economics

Economic analysis of data indicated that cost of cultivation under DSR was minimum compared to farmers practice (Table 3). Gross return, net return and B:C RATIO were higher under DSR compared to farmers practice- transplanting. Net return of Rs 39,875 was recorded under DSR which was 22.95% higher to farmers practice transplanting. The benefit-cost ratio of 2.74 recorded under DSR and 1.97 with farmers practice transplanting. Cost of cultivation minimum under DSR was due to direct sowing of seed with zero till seed drill, less requirement of water and labour. Net return and B:C Ratio was higher mainly due to lower cost of cultivation and higher return.

Table 3: Economics parameters of rice under demonstration and farmers practice.

Methods	Cost of cultivation	Gross return	Net return	B :CR atio
DSR	22900	62775	39875	2.74
PTR	33600	66030	32430	1.97

Data related to the cost of cultivation and contribution of different input component presented in Fig 1.

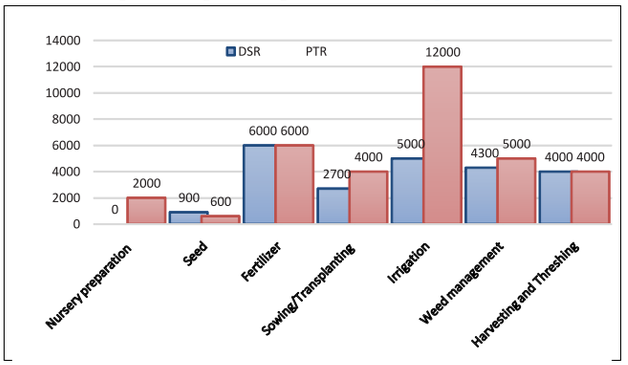

Fig. 1: Cost of cultivation of direct seeded rice and puddled transplanted rice

Showed that nursery and land preparation cost under transplanting was higher and it is a necessary process but in direct seeded rice it not requires and saves the diesel cost for land preparation, avoid irrigation needs for nursery and transplanting. Cost of seed under direct seeded rice was higher compared to transplanting and it is necessary for maintain proper plant population. Fertilizer and application cost under both DSR and transplanting was the same. Sowing cost under DSR was low compared to transplanting and it's save labour and water requirement during sowing.

Transplanting required much water and more number of labours for uprooting and transplanting of seedlings. Weed management is very important under direct seeded rice but

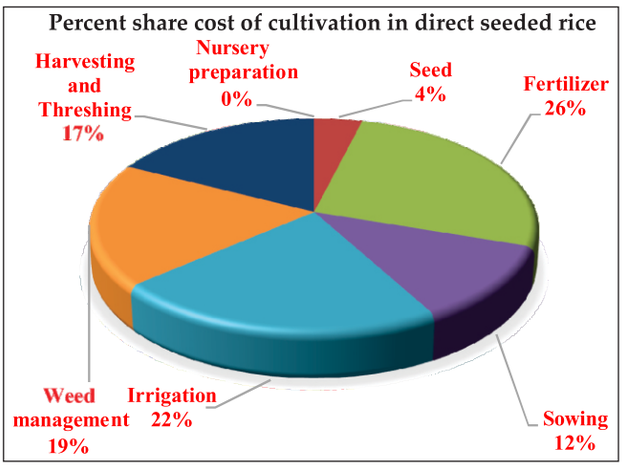

Fig 2: Input contribution of the cost of cultivation under Direct seeded rice

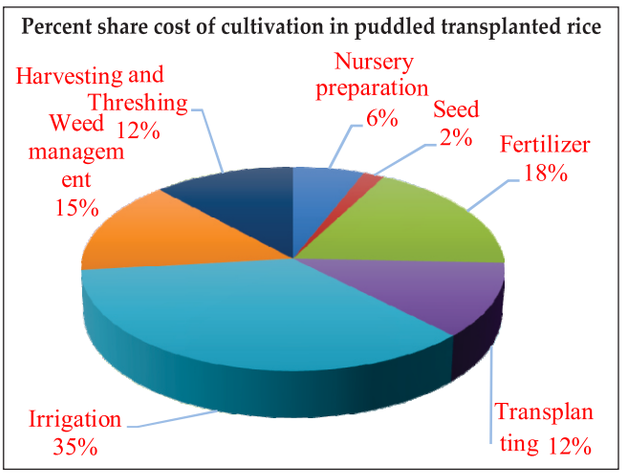

Fig 3: Input contribution of the cost of cultivation under transplanted rice

cost under weed management was lower compared to transplanting. This might be due to under DSR pre and post-emergence herbicides were used for controlling the weed but in transplanting one pre-emergence herbicides used and two hand weeding requires for weeding. Water management cost under DSR was low compared to transplanting because DSR does not required continuous standing water in the field. Harvesting and threshing cost under DSR and transplanting was the same because of both DSR and transplanting rice harvested by the harvester. Share of different inputs under cost of cultivation of DSR and transplanting were presented in Fig. 2 and Fig. 3.

Technology gap and technology index

Productivity, technology gap and technology index were analyzed and presented in table 4. Potential yield of test variety Rajendra Sweta is 45 q/ha and yield in demonstration plot was harvested an average 40.0 and 41.0 q/ha during 2014 and 2015, respectively. Technology gap was recorded 5.0 q/ha during 2014 and 4.0 q/ha during 2015.0. Technology index was recorded at 11.11 and 8.88 during 2014 and 2015, respectively.

Table 4: Productivity, technology gap and technology index in rice under FLDs

Season	Area (ha)	No of farmers	Grain Yield (q/ha)		Technology Gap (q/ha)	Technology index
			Potential	DSR		
2014	10.0	25	45	40.0	5.0	11.11
2015	10.0	25	45	41.0	4.0	8.88

CONCLUSION

On the basis of two-year front line demonstration, direct seeded rice produced the comparable yield with puddled transplanted rice. Cost of cultivation under direct seeded rice was very low with high net return of Rs 39875.0 and B:CRatio of 2.74. Direct seeded rice save the input cost viz. diesel, labour, water etc. and might be popularise amongst the farmers for getting the good rice yield with a minimum cost of cultivation.

REFERENCES

Balakrishna B and Satyanarayana PV. 2013. Genetics of Brown plant hopper (*Nilparvathalugens* Stal.) resistance in elite donors of rice (*Oryzasativa* L.). *The Bioscan* **8**(4): 1413-1416.

Choudhary BN. 1999. Krishi Vigyan Kendra - A guide for KVK managers. Division of Agricultural Extension, ICAR, pp.73-78.

Kumar S, Kumar R, Mishra JS, Dwivedi SK, Ved Prakash, Bhakta N, Singh AK, Singh SK, Singh SS and Haris AA.2017.Evaluation of rice (*Oryza sativa*) cultivars under different crop establishment methods to enhance productivity, profitability and energetics of rice in middle Indo-Gangetic Plains of India. *Indian Journal of Agronomy* **62**(3):307-314.

Kumar S., Kumar R, Mishra JS, Dwivedi SK, Ved Prakash, Rao, KK, Singh AK, Bhatt BP, Singh SS, Haris AA, Virendar Kumar, Srivastava AK, Sudhanshu Singh and Ashok Yadav.2018. Productivity and profitability of rice (*Oryza sativa*) genotypes as influenced by crop management practices under middle Indo-Gangetic Plains. *Indian Journal of Agronomy* **63** (1): 45-49.

Meena BL, Singh AK, Phogat BS and Sharma HB.2016.Improving wheat and soil productivity through integrated nutrient management (INM) and efficient planting system (EPS).Journal of AgriSearch 3(3): 147-156.

Sagar RL and Ganesh Chandra. 2003. Performance of Frontline Demonstration on Kharif Rice (*Oryza sativa* L.) in Sundarban, West Bengal. *J. Indian Soc. of Coastal. Agril. Res.* **21**(2): 69 –70.

Samui SK, Maitra S, Roy DK, Mandal AK and Saha D. 2000.Evaluation of front line demonstration on groundnut. *J. Indian Soc. Coastal Agric. Res.* **18**(2): 180-183.

Singh AK, Verma VS, Nigam HK, Manibhushan, Chandra N and Bharati RC. 2009. Growth, development, yield attribute and yield of upland rice (*Oryza sativa*) under varying environmental condition and genotypes. *Envi.& Ecol.* **27**(2A): 880-884.

Singh M and Singh RP. 2010. Efficacy of herbicides under different methods of direct seeded rice (*Oryza sativa*) establishment. *Indian J Agril. Sci.*, **80** (9):815-819.

Citation:

Deokaran, Singh M, Parvez A, Mishra JS, Bhatt BP. 2018. Direct seeded rice: An option for enhancing the productivity, improving resource use efficiency and minimizing the production cost of the rice. *Journal of AgriSearch* **5** (3): 159-162