International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(2): 2810-2813
© 2020 IJCS
Received: 13-01-2020
Accepted: 15-02-2020

Bharati Upadhaya
Krishi Vigyan Kendra, Birauli, Samastipur, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

RK Tiwari
Krishi Vigyan Kendra, Birauli, Samastipur, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Shailesh Kumar
Krishi Vigyan Kendra, Birauli, Samastipur, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Sanjay Kumar
Krishi Vigyan Kendra, Birauli, Samastipur, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Ranjan Kuamr
Krishi Vigyan Kendra, Birauli, Samastipur, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Sanchita Ghosh
Krishi Vigyan Kendra, Birauli, Samastipur, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Corresponding Author:
Bharati Upadhaya
Krishi Vigyan Kendra, Birauli, Samastipur, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Effect of different crop establishment methods on yield attributes, yield and economics of rice in Bihar

Bharati Upadhaya, RK Tiwari, Shailesh Kumar, Sanjay Kumar, Ranjan Kuamr and Sanchita Ghosh

DOI: https://doi.org/10.22271/chemi.2020.v8.i2aq.9174

Abstract
An on-farm trial on rice crop was conducted during *Kharif* season of 2017-18 & 2018-19 to evaluate the effect of different crop establishment methods on yield attributes, yield and economics of in Samastipur district of Bihar. It was laid out in a randomized block design (RBD) with three number of treatments and replicated thrice. Three treatments were farmer's practices/ transplanting of root washed seedlings (T_1), direct seeded rice on no-tilled condition (T_2) and direct seeded rice on tilled seedbed (T_3). The results showed that higher grain yield (40.35 q/ha) was obtained in manual transplanting followed by direct seeded rice on tilled condition and direct seeded rice on no-tilled seedbed condition. Manual transplanting/farmer's practice also had maximum number of effective tillers compared to other treatments. The highest average gross returns (₹ 66,988/ha) recorded in farmer's practice/manual transplanting while average net returns (₹ 22,074/ha) and B: C ratio (0.533) was recorded in direct seeded rice on tilled seedbed.

Keywords: Crop establishment methods, rice, yield attributes, yield and economics

1. Introduction
Rice (*Oryza sativa* L.) is one of the most important food crops in the world, and staple food for more than 50% of the global population. Among the rice growing countries, India ranks first in area of 44.1 million ha, second in production of 110.15 million tonnes with an average productivity of 22.97 q/ha (INDIA STAT-Advance Estimate 2017-18). In Bihar, area under rice cultivation is 3.23 million ha with production of 6.80 million tonnes and productivity of 21.05 q/ha (Directorate of Economics and Statistics, Govt. of Bihar, 2017-18). In India rice is grown under three major ecosystems *i.e.* rainfed upland (16%), irrigated land (45%) and rainfed low land (39%) (Anonymous, 2010) [1]. Rice is grown in alluvial irrigated tract of north-west India due to high productivity and profitability. There are several ways for rice cultivation in the world. The most important cultivation methods are transplanting and direct seeding of rice (DSR). Traditionally, rice is cultivated by puddling followed by transplanting which not only leads to wastage of water but is also a costly, cumbersome and time consuming process, induces high bulk density, high soil strength and low permeability in subsurface layer which can restrict root development for water and nutrient use from the soil profile by other crops after rice. It results in degradation of soil and other resources (Pathak *et al.*, 2011) [7] and subsequently poses difficulties in seed bed preparation for succeeding crop. Production by this method requires approximately 3000 to 5000 litre of water to produce 1 kg of rice. But in recent years, this has posed an immense threat due to limitation of water. The increase in water scarcity and declining rate of per capita fresh water availability along with increasing demand of food has made the present researcher to look for alternate options which increase the water use efficiency along with saving of water. Under such situation, interventions in the form of mechanized transplanting or direct seeding of rice is the need of hour. To meet the water crisis head on, valuable gains can be achieved by growing rice with less water. DSR is a major opportunity to change production practices to attain optimal plant density and high water productivity in water scarce areas. DSR is the method of sowing seeds directly in the field. At present, 23% of rice is direct-seeded globally (Rao *et al.*, 2007) [8].

Labour saving in direct rice seeding causes the reduction of 11.2% in total production cost. DSR methods have several advantages over transplanting. In addition to higher economic returns, DSR crops are faster and easier to plant, less labour intensive and consume less water (Bhushan *et al.*, 2007) [2]. Thus, it saves labour and water. It needs only 34% of total labour and saves 27% of total cost of transplanting. Keeping these objectives, the present on-farm trial on **"**Effect of different crop establishment methods on yield attributes, yield and economics of rice in Bihar" was planned.

Materials and Methods

An On-Farm trial was conducted by Krishi Vigyan Kendra, Samastipur during *kharif* season of 2017-18 and 2018-19 in Samastipur district of Bihar. The trial was laid out in randomized block design with three replications. The trial was comprised of three treatments *viz.*, farmer's practices/ transplanting of root washed seedlings (T_1), direct seeded rice on no-tilled condition (T_2) and direct seeded rice on tilled seedbed (T_3). Variety 'Rajendra Bhagwati' was taken which has been released in the year 2010 by the Department of Genetics and Plant breeding at RPCAU, Pusa, Bihar. Rajendra Bhagwati is of semi-dwarf statured (100-110 cm) with long slender grain. It matures in 110-115 days and is moderately resistant to sheath blight disease. It is recommended for cultivation in Bihar.

A uniform dose of 120 kg N, 60 kg P_2O_5, 40 kg K_2O and 25 kg Zn/ha was applied in all the treatments. Half of total nitrogen and full dose of P_2O_5, K_2O and Zn were applied to rice crop as basal application (sowing/transplanting) and remaining half dose of nitrogen in the form of urea was top dressed in two equal splits, at tillering and panicle initiation stage during both the years, respectively. In direct seeded treatments, sowing was done by tractor drawn zero-till seed-cum-fertilizer drill with a row spacing of 20 cm apart and seeding depth was maintained at 2–3 cm using depth control wheel of the planter. Seed rate of 25 kg/ha was used. The herbicide glyphosate @ 1 kg/ha was applied in no-till treatments before the seeding to knock down the weeds, pendimethalin @ 1 kg/ha followed by bispyribac sodium @ 25 g/ha at 20 DAS/DAT were applied for weed control. Observation on effective tillers per square meter area was taken at maturity stage. The crop was harvested at maturity stage and then sun-dried. Later on, grain yield was computed in terms of kg/ha at 14% moisture level. Test weight (g) of 1000-seeds was also recorded. The economics were calculated *viz.*, gross returns (₹/ha), net returns (₹/ha) and B: C ratio, separately. The data recorded for different crop parameters were analyzed using analysis of variance (ANOVA) technique for randomized block design at 5% level of significance.

Results and Discussion

Yield attributes and yield of the trial results in the year 2017-18 and 2018-19 are shown in tabular form in Table 1 and Fig (a). Total cost of cultivation, gross returns, net returns, and B: C ratio for the two consecutive years were calculated and presented in Table 2 and Fig (b) and (c).

The highest panicles/m^2 (219.19/m^2) was observed with manual transplanting which was statistically at par with direct seeded rice on tilled condition. Data obtained from the trial showed that test weight statistically similar under all the crop establishment methods of rice cultivation. Similar results were obtained by Gill *et al.* (2006) [4].

Data pertaining to the grain yield elucidated that grain yield was significantly influenced by different crop establishment methods. The highest grain yield was recorded under farmer's practice/manual transplanting *i.e.*, 40.25 q/ha and 40.45 q/ha during the year 2017-18 and 2018-19, respectively which was statistically at par with direct seeded rice on tilled condition *i.e.*, 37.63 q/ha and 38.83 q/ha during the year 2017-18 and 2018-19, respectively but significantly superior over direct seeded rice on no-tilled condition. Similar results were corroborated by the findings of Gill *et al.* (2006) [4].

Table 1: Yield attributes and yields of the results for the trial year of 2017-18 and 2018-19

Treatments	Panicles/m^2		Test weight (g)		Grain yield (q/ha)	
	2017	2018	2017	2018	2017	2018
T_1: Farmer's practice/Manual transplanting	219.52	218.85	21.94	21.89	40.25	40.45
T_2: DSR on no-tilled seedbed	192.36	193.54	21.08	21.06	35.34	36.54
T_3: DSR on tilled seedbed	201.45	202.65	21.53	21.45	37.63	38.83
SEm (±)	5.24	4.05	NS	NS	0.96	0.99
CD (P=0.05)	21.11	16.31	NS	NS	3.00	3.07

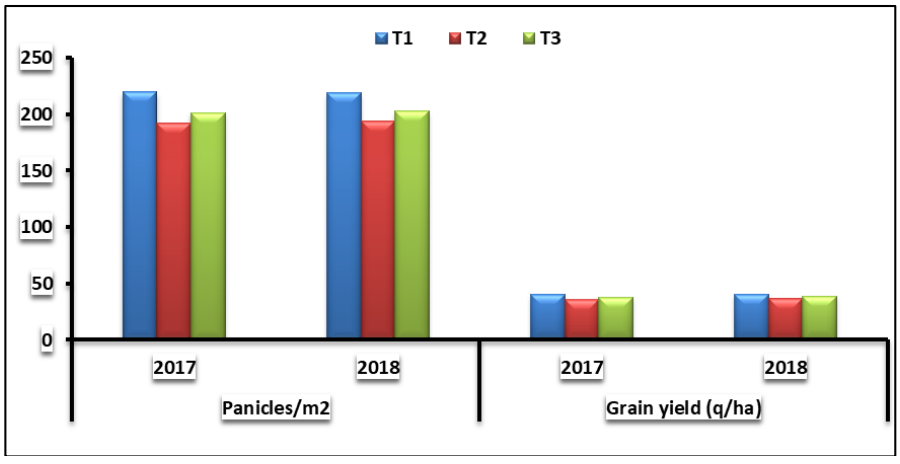

Fig (a): Effect of different crop establishment methods on panicles/m^2 and grain yield

The statistical analysis of the data revealed that crop establishment methods of rice cultivation significantly influenced gross returns. Gross returns were calculated on the basis of minimum support price of grain and prevailing market price of straw. The maximum gross returns was recorded with farmer's practice/manual transplanting (₹ 71,588/ha and ₹62,588/ha) during the year 2018-19 & 2017-18, respectively and which was significantly superior over DSR on no-tilled seedbed but found at par with DSR on tilled seedbed. This might be due to higher grain obtained from transplanted/tilled condition. Similar trend was observed by Kumar and Batra (2017). Similarly, there was significant influence of different crop establishment methods on net returns and benefit: cost ratio. The maximum net returns was recorded with DSR on tilled seedbed *i.e.*, ₹ 17,698/ha and ₹ 26,458/ha, respectively in 2017-18 & 2018-19 which was significantly superior over rest of the two treatments. Analysis of data revealed that different treatments of crop establishment methods also significantly influenced the B: C ratio. The maximum B: C ratio was recorded with DSR on tilled seedbed *i.e.*, 0.436 and 0.574, respectively in 2017-18 & 2018-19 over manual transplanting and DSR on no-tilled seedbed.

Table 2: Cost of cultivation, Gross returns, Net returns and B: C ratio of the results for the trial year of 2017-18 and 2018-19

Treatments	Cost of Cultivation (₹/ha)		Gross returns (₹/ha)		Net returns (₹/ha)		B: C ratio	
	2017	2018	2017	2018	2017	2018	2017	2018
T_1: Farmer's practice/Manual transplanting	46765	47800	62,388	71,588	15,623	23,787	0.334	0.498
T_2: DSR on no-tilled seedbed	39500	41000	54,777	64,295	15,278	23,295	0.387	0.568
T_3: DSR on tilled seedbed	40628	42000	58,327	68,453	17,698	26,452	0.436	0.630
SEm (±)	-	-	1,340.83	1,333.64	402.76	609.90	0.010	0.014
CD (P=0.05)	-	-	5,405.74	5,376.78	1,623.78	2,458.90	0.038	0.056

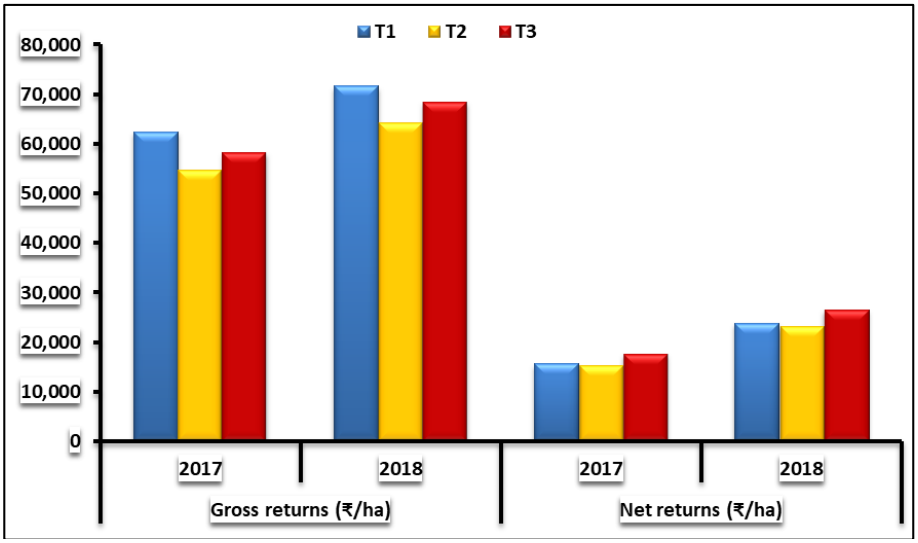

Fig (b): Gross and Net returns (₹/ha) of different crop establishment methods of paddy cultivation

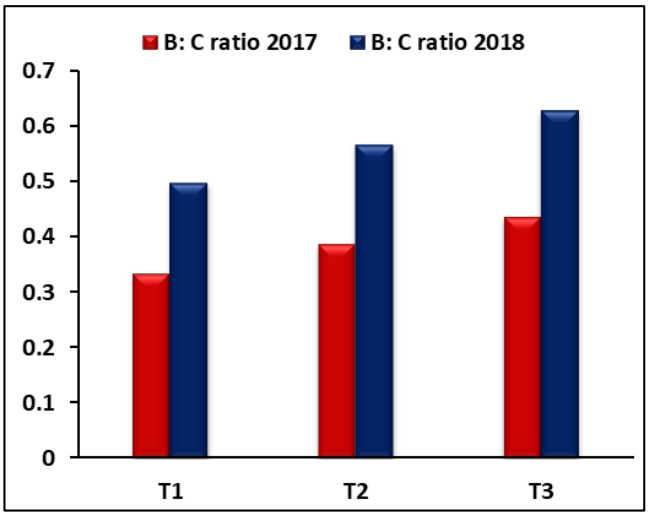

Fig (c) B: C ratio of different crop establishment methods of paddy cultivation

Conclusion

It may be concluded that rice crop established through tilled direct seeded condition should be followed to achieve higher monetary returns from rice cultivation. Although, higher grain yield was obtained in manual transplanted condition, direct seeded condition of crop establishment in paddy saves labour, water, early crop maturity, better soil physical conditions for following crops and less methane emission that provides better option to be the best fit in different cropping systems. During 2017-19, efforts have been made for resource conservation in paddy cultivation by introducing direct seeded rice technology at the farmers' fields of Samastipur district in Bihar. The study showed that the farmer's practice of manual transplanting may be replaced with DSR to increase benefit: cost ratio of paddy cultivation.

References

1. Anonymous. Krishi Diary. Indira Gandhi Krishi Vishvawidyalya Raipur (CG), 2010.
2. Bhushan L, Ladha JK, Gupta RK, Singh S, Tirol-Padre A, Saharawat YS *et al*. Saving of water and labor in a rice–wheat system with no-tillage and direct seeding technologies. Agronomy Journal. 2007; 99(5):1288-1296.
3. Directorate of Economics and Statistics, Govt. of Bihar, 2017-18. dse.bih.nic.in
4. Gill MS, Kumar A, Kumar P. Growth and yield of rice (*Oryza sativa*) cultivar under various methods and time

of sowing. Indian Journal of Agronomy. 2006; 51(2):123-127.
5. INDIA STAT- 2017-18. http://www.indiastat.com/default.aspx
6. Kumar R, Batra SC. A Comparative Analysis of DSR Technology Vs. Transplanted Method in Haryana. Economic Affairs. 2017; 62(1):169-174.
7. Pathak H, Tewari AN, Sankhyan S, Dubey DS, Mina U, Singh VK *et al*. Direct-seeded rice: Potential, performance and problems- A review. Current Advances in Agricultural Sciences. 2011; 3(2):77-88.
8. Rao AN, Johnson DE, Sivaprasad B, Ladha JK, Mortimer AM. Weed management in direct-seeded rice. Advances in Agronomy. 2007; 93:153-255.