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A Comparative Analysis of DSR Technology Vs. Transplanted Method in Haryana

Ravinder Kumar and S.C. Batra

Department of Economics, Baba Mastnath University, Asthal Bohar, Rohtak, Haryana, India

Corresponding author: ravi.agriecon@gmail.com

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ABSTRACT

The present study was conducted during 2015-16 in two districts namely, Kaithal and Karnal in Haryana with the objective to analyse the economic impact of direct seeded rice (DSR) technology over traditional method of sowing in rice. The study was conducted with the help of a questionnaire, interviewed over 240 farmers (120 farmers per district). The cost of preparatory tillage was reduced by 57.45 per cent in direct seeded rice over traditional method of sowing. The various costs like pre-sowing irrigation, sowing, fertilizer cost, fertilizer application, irrigation, plant protection, miscellaneous, total working capital and total cost were reduced by 22.71, 158.64, 15.87, 7.38, 64.47, 4.84, 8.59, 25.08 and 11.27 per cent in direct seeded rice over traditional method of sowing, respectively. However, DSR technology resulted into reduction in yield by 9.40 per cent per hectare (38.3 q/ha) as compared to transplanted rice (41.9 q/ha). In DSR technology, the cost of seed and weed management were increased by 89.48 and 95.83 per cent, respectively, as compared to traditional method of sowing. A net return of ₹ 87.28 per hectare was estimated in transplanted rice. A net return of ₹ 1803.27 per hectare was estimated in DSR. The cost of production per quintal of paddy was found ₹ 2557.45 and ₹ 2515.38 in transplanted and DSR technology, respectively. The BC ratio in DSR was 1.02. The benefit cost ratio of TPR was 1.00, resulting into no profit any loss.

Keywords: BC ratio, Cost of production, direct seeded rice technology, gross returns, net returns, paddy

Rice (*Oryza sativa* L.) is the staple food of more than half of the world population. The population of the world at present is 7.4 billion. In India the present population (2016) is 1,329 million which will increased to 1,708 million and rank first by 2050 (34 years after) i.e. 11.15 million person per year. India requires increasing rice production by 3 million tonnes every year to ensure food security (Dass, *et al.*, 2015).

Rice-wheat is the major cropping sequence in India and India is the second largest producer of rice preceded by China. It was the largest exporter of rice in 2015-16 followed by Thailand, Vietnam and Pakistan (Commodity Profile, 2015-16). Basmati rice trade was 2.02 million tonnes in 2009-10 which increased to 4.04 million tonnes in 2015-16 (Commodity Profile, 2016). The area under rice cultivation was 427.54 lakh hectare during 2012-13 which increased up to 438.56 lakh hectare during 2014-15. The production was 105.24 million tonnes in 2012-13 and decreased 104.80 million tones. The yield of rice was 2461 kg/ha during 2012-13 which decreased to 2390 kg/ha during 2014-15 (Annual Report, 2015-16).

Rice is grown in 18 districts of Haryana. Out of which seven districts are in high productivity group, that is, yield more than 2,500 kg/ha (RKMP). It is grown by transplanting during wet season from June to October. Direct seeded rice (DSR) refers to the process of growing rice crop from seeds sown in the field rather than by transplanting rice (TPR) seedlings from nursery. To save water, reduce labour

requirement, and mitigate green house gas (GHS) emission, Direct Seeded Rice (DSR) is a feasible alternative to conventional puddle transplanted rice with good potential. Mechanization of the farming practices can overcome the crisis and help in drudgery reduction (Din *et al*., 2012).

Exploring ways to produce more rice with less water is essential for food security and sustaining environmental health in Asia (Tuong and Bouman, 2003). The economics of transplanted rice in comparison to direct seed rice can result into the savings a farmer can make and the efficiency of the cropping system can be enhanced with small changes in the cultivation. The machines used in direct seed rice can also influence the costs as compared to transplanted paddy. DSR is a cost effective alternative leading to similar yields under good weed control and water management practices. Also, the attitude of the farmers has to change for the reason being that the resource like water if available in abundance, must not be used in an inattentive way. Land preparation duration was significantly reduced in direct seeded rice compared to transplanted rice. This led to a significant reduction in irrigation and total water input (rainfall and irrigation) before crop establishment. Keeping in view of the above reasons, the present study was conducted in Haryana in two districts i.e. Kaithal and Karnal.

MATERIALS AND METHODS

The study was conducted in Department of Economics, Baba Mastnath University, Asthal Bohar, Rohtak in Haryana during 2015-16.

Selection of site and respondents

Based on the area and production of paddy crop in the state, two districts namely Kaithal and Karnal were selected purposively for the present study. The data was collected for production of TPR and DSR from selected farmers (240).

Estimations of various costs

Variable cost includes preparatory tillage, pre-sowing irrigation charges, seed, manures and fertilizer, hoeing/weeding, plant protection, harvesting, threshing, interest on working capital, etc and fixed costs include rental value.

RESULTS

Working capital

The working capital of transplanted rice (TPR) was ₹ 43369.97 and ₹ 34673.93 per hectare for direct seeded rice (DSR). The expenditure incurred on preparatory tillage was ₹ 7129.69 per hectare in TPR as compared to ₹ 4528.13 per hectare in DSR, likewise, sowing cost was ₹ 5060.94 per hectare in TPR as compared to ₹ 1956.77 per hectare in DSR, irrigation cost ₹ 9227.50 per hectare as compared to ₹ 5610.52 per hectare in DSR; and chemical fertilizer cost ₹ 3519.29 per hectare as compared to ₹ 2960.80 per hectare in DSR. The weed management costs were lower in TPR (₹ 1387.24/ha) as compared to DSR (₹ 2716.67/ha). Likewise, the seed cost in TPR were ₹ 532.60 per hectare as compared to higher seed cost in DSR i.e. ₹ 1009.17 per hectare. The cost of farm yard manure, harvesting and threshing, there was no difference. Also, the cost of fertilizers application, plant protection cost and pre-sowing irrigation were almost same in both the methods of sowing.

Total cost

Total cost incurred on TPR was ₹ 107156.97 per hectare while it was ₹ 96338.98 per ha in case of DSR. Total costs includes variable cost (₹ 45104.77/ ha for TPR, ₹ 36060.88/ha for DSR), management charges (₹ 4510.48/ha for TPR and ₹ 3623.43/ha for DSR), risk factor (₹ 4510.48/ha for TPR and ₹ 3623.43/ha for DSR), transportation (₹ 1375/ha for both TPR and DSR) and rental value of land (₹ 51656.25/ha for both TPR and DSR).

Gross and net returns analysis

The yield of TPR was 41.90 quintal per hectare and 38.30 quintal in case of DSR. The gross return from TPR was ₹ 107244.25 per hectare and ₹ 98142.25 per hectare in DSR. The net returns of TPR and DSR was ₹ 87.28 and ₹ 1803.27 per ha. The return over variable cost of DSR was lower than TPR i.e. ₹ 58.11 per hectare. On the contrary the net return DSR was ₹ 1715.99 higher than TPR. The cost of production of TPR was ₹ 2557.45 and ₹ 2515.38 per ha in DSR.

Impact analysis of TPR and DSR

Working capital and total cost of TPR was higher than DSR by 25.08 and 11.23 per cent i.e. ₹ 8696.04

Table 1: Economics of DSR and TPR in Haryana (₹/ha)

Sl. No.	Particulars	Qty	TPR	Qty	DSR
1	Preparatory Tillage	4.70	7129.69	4.40	4528.13
2	Pre-Sowing Irrigation	1.00	1151.67	1.00	938.54
3	Sowing	1.00	5060.94	1.00	1956.77
5	Seed Cost	8.85	532.60	16.90	1009.17
6	FYM (q)	112.50	4129.17	112.50	4129.17
	Chemical nutrients				
7	(A) Nitrogen		1428.95		1262.38
	(B) Phosphate		1469.47		1114.50
	(C) Potassic		0.00		0.00
	(D) Zinc sulphate		620.88		583.93
	Total fertilizer investment		3519.29		2960.80
8	Fertilizer application		484.38		448.65
9	Irrigation	13.00	9227.50	7.60	5610.52
10	Hoeing/weeding	1.40	1387.24	3.20	2716.67
11	Plant protection	2.60	5884.11	2.50	5612.24
12	Harvesting/threshing	1.00	3597.92	1.00	3597.92
13	Miscellaneous		1265.47		1165.36
	Working capital (1 to 13)		43369.97		34673.93
14	Interest on working capital		1734.80		1386.96
15	Variable cost		45104.77		36060.88
16	Management charges		4510.48		3623.43
17	Risk factors		4510.48		3623.43
18	Transportation		1375.00		1375.00
19	Rental value of land		51656.25		51656.25
20	Total cost		107156.97		96338.98
21	Production (q)		**41.90**		**38.30**
	(a) Main		105588.00		96516.00
	(b) By Product		1656.25		1626.25
22	Gross Return		107244.25		98142.25
23	Return over variable cost		62139.48		62081.37
24	Net Return		87.28		1803.27
25	Cost of Production (₹/q)				
	(a) Without By Product		2557.45		2515.38
	(b) With By Product		2517.95		2472.94
26.	B:C ratio		1.00		1.02

TPR: *Transplanted Rice;* **DSR:** *Direct Seed Rice*

and ₹ 10817.99 per ha. The gross returns were higher in transplanted method of sowing of rice than DSR i.e., by ₹ 9102.00 per ha. However, the net returns of ₹ 1803.27 per ha were obtained in DSR than ₹ 87.28 per ha in TPR.

DISCUSSION

The working capital was 128.46 per cent higher in TPR over DSR. The preparatory tillage was 57.45 per cent higher in TPR over DSR. The sowing cost was 158.64 per cent higher; irrigation cost was 64.47 per cent higher, chemical fertilizer cost was 15.87 per cent higher in TPR as compared to DSR. The weed management cost was 95.83 per cent lower in case of TPR as compared to DSR. The management of weeds was found more costly in DSR due the

Table 2: Impact of direct seeded rice over transplanted method in Haryana

Sl. No.	Particulars	TPR	DSR	Impact analysis	
				Difference	(%)
		(A)	(B)	(C=A-B)	[(C/B)*100]
1	Working capital (₹/ha)	43369.97	34673.93	8696.04	25.08
2	Total cost (₹/ha)	107156.97	96338.98	10817.99	11.27
3	Gross return (₹/ha)	107244.25	98142.25	9102.00	9.27
4	Net return (₹/ha)	87.28	1803.27	1715.99*	95.16

TPR: *Transplanted Rice;* **DSR:** *Direct Seed Rice; *(C=B-A)*

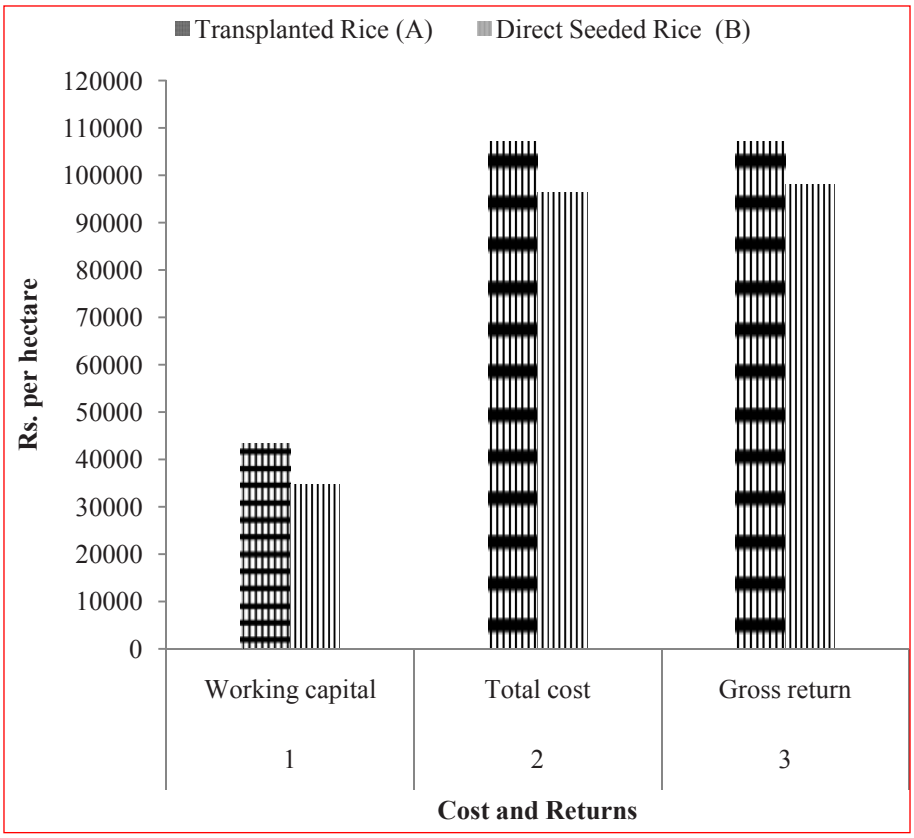

Fig. 1: Cost and returns of TPR and DSR in Haryana

reasons that weed flora composition changed drastically with a shift from CT-TPR to some form of alternative tillage and rice establishment methods (Singh *et al.,* 2009). Tomita *et al.* (2003) observed more species-rich vegetation and diverse weed flora in Dry-DSR than in CT-TPR. Some new grass and broadleaf species that were not adapted to CT-TPR appeared in Dry-DSR. Higher numbers and more diverse flora in Dry-DSR could result in lower efficacy of weed management strategies, including herbicides (Singh *et al.* (2009). Also, Direct seeding also favors sedges such as *Cyperus difformis*, *C. iria*, *C. rotundus*, and *F. miliacea* (Yaduraju and Mishra, 2005).

Likewise, seed cost was also higher by 89.48 per cent in case of DSR as compared to TPR. The reasons were higher seed rate per hectare in case of DSR. The higher seed rates may be beneficial in conditions with no or partial weed control (Castin and Moody, 1989) and for lower germination due to damage by birds, insects, rats, etc. or the germination per cent of seed itself may be low.

The total cost of TPR was 11.23 per cent higher over DSR. The variable cost was 25.08 per cent higher in

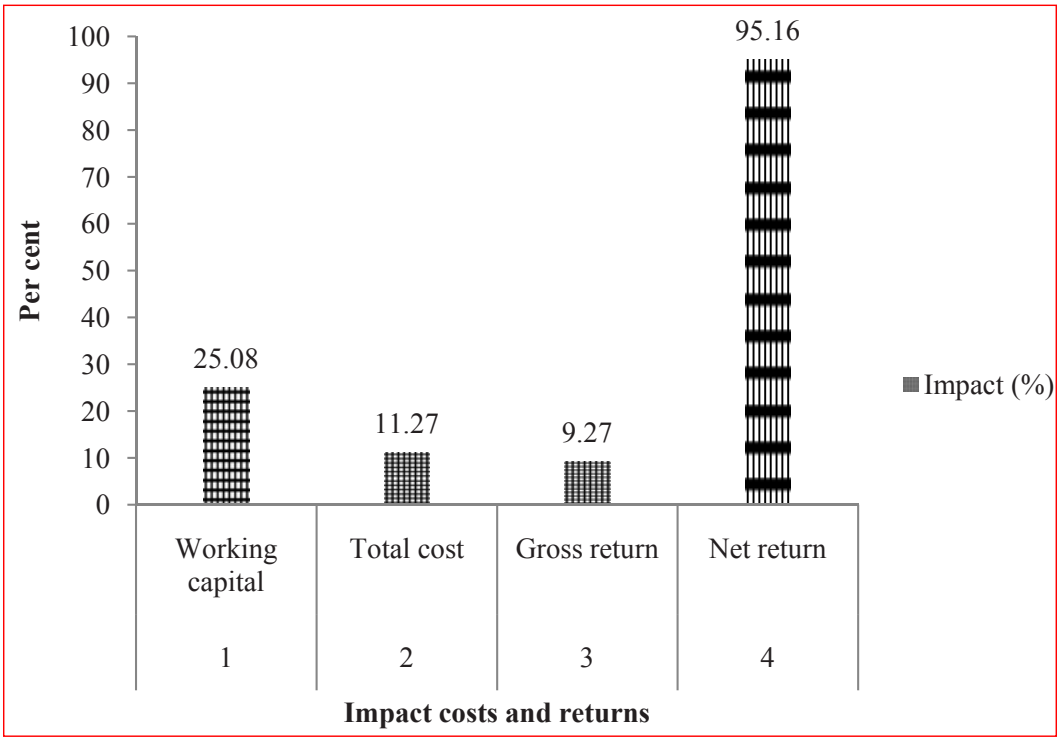

Fig. 2: Per cent impact analysis of cost and returns of DSR over TPR

TPR over DSR. Management charges and risk factor cost was 24.48 per cent higher in TPR over DSR.

Gross and net returns analysis

The yield of TPR was 41.90 quintal per hectare and 38.30 quintal in case of DSR. The gross returns from TPR were higher by 9.27 per cent over DSR. The main reasons of lower gross returns in DSR were lower yield per hectare. The yield of DSR was 9.40 per cent lower as compared to TPR. The main reasons could be (1) uneven or poor crop establishment (Rickman *et al.*, 2001), (2) inadequate weed control (Johnson and Mortimer, 2005; Kumar *et al.*, 2008; Rao *et al.*, 2007; Singh *et al.*, 2005), (3) higher spikelet sterility than in puddled transplanting (Bhushan *et al.*, 2007; Choudhury *et al.*, 2007).

The net returns of TPR were lower due to higher total cost as compared to DSR, and the main cost which decreased the net returns were preparatory tillage, sowing and irrigation cost (Table 1 and Fig. 1). Sowing of transplanted rice required higher manual labour as compared to DSR in which DSR seed drill was used for sowing. The BC ratio in DSR was 1.02. The benefit cost ratio of TPR was 1.00, resulting into no profit any loss.

Impact analysis of TPR and DSR

Working capital and total costs were higher in TPR as compared to DSR. The gross returns were higher in transplanted method of sowing of rice than DSR but finally the net returns per hectare were found higher in DSR. In addition of this, the saving of irrigation water up to 41.38 per cent per hectare in DSR as compared to TPR (Table 2 and Fig. 2). It was also predicted that farmers used irrigation water without pre-judicious use in TPR due to lower rates of canal water and electricity charges.

CONCLUSION

DSR technology is better than transplanted method of rice cultivation by reducing irrigation and human labour requirement per unit area and found more profitable in terms of net returns per hectare. However, better weed management practices in DSR can decrease the weed management costs with continuous awareness programmes among the farmers.

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