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Economics of direct seeded and transplanted methods of rice production in Haryana

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ABSTRACT

Direct seeding is becoming an important alternative of rice transplanting and spreading rapidly in Haryana due to labour shortage and escalating cost of production. Present study is an attempt to analyze the economics of direct seeded and transplanted methods of rice cultivation in Haryana. It was revealed that the use of human labour, machine labour and irrigation water were saved by 13.16, 41.34, and 11.88 per cent, respectively, in direct seeded rice as compared to the transplanted method of rice production. The expenditure incurred on machine, irrigation and human labour was substantially lower by 41.34, 22.45 and 6.62 per cent, respectively, in direct seeded rice than transplanted method. Direct seeded rice technology enabled farmers to increase net return and save crucial inputs.

Key words: *direct seeded rice, transplanted, rice, economics*

India is the second largest producer of rice in the world with an average annual production of 94 million tonnes (Government of India, 2011). It accounts for approximately 21% of world's rice production (FAO, 2011). Haryana produces 3.5 million tonnes of rice and contributes approximately 3.7% to India's total rice production with per hectare productivity of 3.03 tonnes (Government of Haryana, 2012a). In Haryana, rice is grown by transplanting during wet season from June to October. Rice production through transplanting is less profitable as production costs have gone up due to shortages of labour, water and escalating fuel prices. One way to overcome these problems is to grow direct-seeded rice instead of transplanted rice (Farooq *et al.*, 2006; Singh *et al.*, 2009). Direct seeded of 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. Direct seeding is a successful method of cultivation in many countries which save labour and is more economical than transplanting and also provides good crop establishment. Although transplanting has been a major traditional method of rice establishment in Asia, economic factors and recent changes in rice production technology have improved the desirability of direct-seeding methods. Similarly, direct seeding is becoming an attractive alternative to transplanting of rice and spreading rapidly in Haryana due to labour shortage and escalating cost of production. Hence, present study was undertaken with the objectives to compare the economics of DSR and TPR methods of rice production and to examine the farmer's perception about the DSR method of rice production in Haryana.

MATERIALS AND METHODS

Haryana state was selected for this study as farmers are rapidly adopting modern methods of crop cultivation. Karnal district was selected purposively due to widespread adoption of modern methods of crop production. Ramba, Shamgarh and Taraori villages were selected for detailed investigation. The primary data were collected from 35 farmers, who adopted DSR technology in reclaimed alkali soils, and practised equal number of farmers were also selected randomly from the same villages TPR method for rice cultivation. Primary data were collected during the years 2009-10 and 2010-11 from 70 farmers with the help of interview schedule using survey method. All input and output parameters pertaining to wheat production are based on two years average values with a view to minimize seasonal fluctuations in the variables. Data were analyzed using percentage, benefit-cost ratio and partial budget analysis techniques.

The modern cost concept was considered for estimation of cost of rice production. The cost included all direct expenses paid in cash and kind for crop production such as hired human labour, machine use, seeds, fertilizers, irrigation, plant protection measures, overhead charges and imputed value of family labour. The overhead charges included land revenue, interest on working capital and fixed capital, charges paid for repair, maintenance and depreciation of fixed assets. The cost of irrigation was calculated by multiplying time required to irrigate the farm with cost of electricity or diesel consumption per hour. The cost of human labour, machine use and diesel were taken as actual expenditure incurred for crop production. Gross income included the total value of main and by-products.

RESULTS AND DISCUSSION

Crop production is a major activity which contributes 80.38% to total household income in the study area. The results show that farmers saved 13.16, 41.34, and 11.88% human labour, machine use and irrigation water, respectively, in DSR than TPR method of rice production (Table 1). Balasubramanian and Hill (2002) also highlighted this fact that DSR is less labour intensive and consume less water.

The shortage of labour is emerging as a major problem in Haryana which is hindering agricultural growth (Government of Haryana, 2012b). In the study area, farmers used tractor for puddling operations before transplanting rice seedlings in the field. The farmers who did not have their own tractors were facing the problem of non availability of tractor in time to carryout puddling operations for rice transplanting as it coincides with similar operations in the neighboring farms. Similarly, farmers in the study area faced the problem of acute labour shortage for rice transplanting. Their main motive for a shift to DSR was to overcome the shortage of human labour and machine power (tractor) during the peak period of transplanting. The DSR method generated significant savings of labour required for land preparation and crop establishment in rice cultivation.

Table 1. Physical units of important farm inputs used in TPR and DSR methods of rice production

Particulars	TPR method	DSR method	Saving in DSR (%)
Human labour (man days ha^{-1})	65.98	57.30	13.16
Machine labour (hrs ha^{-1})	12.63	7.41	41.34
Seeds (kg ha^{-1})	12.35	23.78	-92.57
Fertilizers (kg ha^{-1})	407.20	378.97	6.93
Herbicides (gm ha^{-1})	780.52	926.60	-18.72
Plant protection chemicals (ml ha^{-1})	1891.31	1552.57	17.91
Irrigation water use (m^3 ha^{-1})	16250.00	14319.00	11.88

TPR - transplanted rice, DSR - direct seeded rice

Water for use in agriculture is becoming scarce and the problem of water shortage expected to be more serious in the future. Declining water table in Indo-Gangetic Plains has been reported due to over exploitation of ground water (Government of India, 2008). Furthermore, due to drastic depletion of ground water table in rice-wheat areas, electricity demand is increasing for irrigating the rice crop and it undermines the viability of the power sector as power for agricultural use is highly subsidized particularly in Punjab and Haryana (Government of India, 2007). In TPR, water is required for raising rice seedlings in nurseries, puddling and transplanting operations. It also requires continues submergence of water in the field. The DSR does not require raising seedlings in nursery, puddling, transplanting operations and continued water submergence. Hence, DSR reduces overall water requirement for rice cultivation. The use of DSR method is not only reduces the water use, but also means that farmers can continue to grow rice in regions experiencing declining water availability.

Gross returns in DSR and TPR were Rs. 90418 and ₹ 93564 ha^{-1}, respectively. Similarly, net return accounted to ₹ 59424 in DSR and ₹ 57754 ha^{-1} in TPR. The net income was higher in DSR due to lower cost of cultivation. The total cost of cultivation amounted to ₹ 30994 ha^{-1} in DSR method and ₹ 35810 ha^{-1} in TPR method. The lower cost of cultivation was mainly due to lower expenses on human labour (6.62%), machine use (41.34%) and irrigation (22.45%). The benefit-cost ratio of 2.92 was observed in DSR as against 2.61 in TPR method.

Table 2. Cost and return pattern of rice produced using TPR and DSR methods

Particulars	TPR method (₹ ha^{-1})	DSR method (₹ ha^{-1})	Saving in DSR (%)
Human labour charges	12802	11955	6.62
Machine use charges	7579	4446	41.34
Cost of seeds	549	1163	-111.69
Cost of fertilizers	3557	3624	-1.88
Cost of weedicides	1964	2465	-25.51
Cost of plant protection chemicals	2802	2276	18.77
Irrigation charges	3458	2682	22.45
Overhead cost	3100	2384	23.10
Total cost	35810	30994	13.45
Gross income	93564	90418	-3.36
Net income over cost	57754	59424	2.89
Benefit-cost ratio over cost	2.61	2.92	11.66

The rice yield with DSR was lower by 3.36% than TPR method (Table 3). Most of the farmers opined that weed management is a challenging task in DSR. Several studies conducted in this aspect revealed that lower yield was obtained in DSR as compared to the TPR due to high weed manifestation (Singh *et al*, 2010). Therefore, the major challenge for farmers in direct seeded rice is effective weed management and as the failure to eliminate weeds may result in very low yield (Moody and Mukhopadhyay, 1982; Moody, 1983). Many studies have indicated that direct seeded rice has potential as a replacement of transplanted rice, if weeds are controlled effectively (Singh, *et al*., 2001; Singh, 2005). The gross return was higher in TPR by 3.36%. But higher net return was obtained in DSR by 2.89% than TPR method. This was mainly due to reduction in the cost of cultivation by 13.45% in DSR

Table 3. Yield, cost and return in tpr and dsr methods of rice production

Particulars	TPR method	DSR method	Advantage in DSR (%)
Yield (t ha^{-1})	5.65	5.46	-3.36
Total Cost (₹ ha^{-1})	35810	30994	13.45
Gross Income (₹ ha^{-1})	93564	90418	-3.36
Net Income (₹ ha^{-1})	57754	59424	2.89
Cost of grain production (₹ kg^{-1})	6.34	5.68	10.44

method. Similar studies also revealed that profitability is higher in DSR than TPR due to considerable reduction in the cost of tillage operations (Pandey *et al*., 2002). The cost incurred to produce a kilogram of rice was ₹ 5.68 and ₹ 6.34 in DSR and TPR, respectively. The cost of grain production was lower by 10.44% in DSR as compared to TPR method. The farmers of the study region started adopting DSR as an alternative method of cost saving in rice production.

The comparative economics of DSR and TPR methods present a case for promoting DSR technology of rice production as it results in higher profit margin to the farmers even if output is marginally lower than TPR. Farmers preferred to adopt direct seeding in rice cultivation due to high labour requirement in TPR method. During transplanting of rice, farmers faced acute labour shortage. Although there was slightly lower yield in DSR, farmers in the study area showed keen interest in shifting from TPR to DSR method of crop production. According to their opinion, DSR requires less labour and provides more economical gain in rice production. Nearly 90% farmers expressed the view that there was high weed infestation with DSR, which is a major limitation to adopt this technology as risk of yield loss was higher. The other constraints expressed by farmers were limited availability and high cost of seed drill machine in the study area.

In the present scenario of rising inputs cost and labour shortage in agriculture, farmers need input saving alternative technologies to sustain crop production. The results indicated that DSR technology has potential to increase farmer's income and save scarce resources. Hence, DSR technology is a viable alternative to overcome the problems of rising cost of cultivation, labour and water shortages for sustainable rice production. However, problems of seed drill availability and weed infestation need to be addressed to accelerate wider adoption of DSR technology.

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