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Original Research Article

Productivity and Economics of Direct Seeded Rice, Samba District in J&K

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A B S T R A C T

Transplanting after repeated puddling is the conventional method of rice (*Oryza sativa*) growing which is not only intensive water user but also cumbersome and laborious. Different problems like lowering water table, scarcity of labour during peak periods, deteriorating soil health demands some alternative establishment method to sustain productivity of rice as well as natural resources. Direct seeding is becoming an important alternative of rice transplanting. A field study was conducted during *Kharif* season of 2018, 2019 and 2020, to evaluate DSR with an objective to improve farm productivity and efficiency in Samba district, Jammu. Tillage and crop establishment methods had a significant effect on rice yields. Yield of TPR was significantly higher (2.46 percent) than DSR. Labour and cost saving of 18.45 and 15.56 percent were observed in DSR as compared to TPR. It was revealed that the use of machine labour and irrigation water were saved by 37.88 and 13.77 percent respectively in direct seeded rice as compared to the TPR method of rice production. The B:C ratio was higher in DSR (2.44) as compared to TPR (1.95). The study showed that the TPR could be replaced with DSR to save labour and water.

Keywords

Direct seeded rice, Transplanted rice Tractor, Water use efficiency, Yield, Benefit cost ratio

Introduction

Jammu and Kashmir is basically an agrarian economy. The dependence of rural labour force on agriculture and allied activities is quite substantial as it directly or indirectly, supports about 70 percent of population. Paddy is the most important food crop of India covering about one – fourth of the total cropped area and providing food to about half of the Indian population. This is the staple food of the people in the country. The current production of paddy in Jammu& Kashmir is about 538 thousand tons during 2010-2011 and occupies about 38 percent of the total gross cropped area. Rice production through transplanting is less profitable as production costs have gone up due to shortage of labour, water and escalating fuel prices. Rice is grown traditionally in the first fortnight of July in puddle soil (wet tillage) and kept under continuous sub-mergence. Rice transplanted after puddling leads to weed suppression, reduction in percolation losses and creation of anaerobic conditions, however, repeated puddling destroys soil structure and creates shallow hard pan and delays planting of a succeeding wheat crop, which in-turn adversely affect not only the performance of crop but also emits large quantity of methane, which is one of the major green house gas contributing to global

warming (Hobbs and Moris, 1996). The way to overcome these problems is to grow direct–seeded rice instead of transplanted rice(Farooq *et al.*, 2006;Singh *et al.*, 2009; Tripathi *et al.*, 2014)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 India. An economic factors and recent changes in rice production technology have improved the desirability of direct-seeding methods. Similarly direct seeding is becoming an attractive to transplanting of rice and spreading rapidly in Samba district, Jammu 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 farmers' perception about the DSR method of rice production in Samba district, Jammu.

Materials and Methods

The experiment was conducted at farmer's field in villages Ramgarh, Chachwal, Challyari, Paloora, Kotli Matkalian, Khor Salarian, Rakh Barothian and Harsath in Samba district of Jammu during *Kharif* season of 2018, 2019 and 2020. Conventional rice-wheat rotation was being followed on the field from several years. A field survey was conducted in selected villages to collected desired information. The primary data were selected for detailed investigation. The primary data were collected from 20 farmers per year, who adopted DSR technology and practiced equal number of farmers were also selected randomly from the same villages TPR method for rice cultivation. Primary data were collected during the years 2018-19, 2019-20 and 2020-21 from 60 farmers with the help of interview schedule using survey method. The data were collected on the basis of objectives of the study. The schedules were developed to provide necessary information regarding hired human labour, machine use, seeds, fertilizers, irrigation and plant production measures.

All input and output parameters pertaining to rice production are based on three years average values with a view to minimize seasonal fluctuations in the variables data where analyzed using percentage, benefit-cost ratio and partial budget analysis techniques.

The modern cost concept was consider 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 production 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 where taken as actual expenditure incurred for crop production. Gross income included the total value of main and by-products.

Results and Discussion

The results show that farmers saved 22.22, 37.88, and 12.21percentage human labour, machine use and irrigation water,

respectively, in DSR as compared to TPR method of rice production(Table1). Balasubramaniam 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 Samba district, Jammu which is hindering agriculture growth.. In the study area, farmers used tractor for puddling operations before transplanting rice seedling in the field. The farmers who did not have their own tractors were facing the problem of none availability of tractor in time to carry out 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 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.

Water for use in agriculture is becoming scare and the problem of water shortage expected to be more serious in the future. Declining water table in Indo-Gangetic Plains has been required 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 agriculture 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, 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. 120534 and Rs. 122125/ ha, respectively. Similarly, net return accounted to Rs 85580 in DSR and Rs.80728/ha in TPR. The net income was higher in DSR due to lower cost of cultivation. The total cost of cultivation amounted to Rs. 34954/ha in DSR method Rs 41397/ha in TPR method. The lower cost of cultivation was mainly due to lower expenses on human labour(18.45percent), machine use(37.88percent) and irrigation (13.77percent). The benefit-cost ratio of 2.44 was observed in DSR as against 1.95in TPR method.

The rice yield with DSR was lower by 2.46 percent than TPR method(Table 3).Most of farmers opinioned that more weed infestation in DSR field. 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 4.30 percent. But higher net return was obtained in DSR by 6.01 percent than TPR method. This is mainly due to reduction in the cost of cultivation by 15.56 percent in DSR method.

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(percentage)
Human labour (man days/ha)	68.72	53.45	22.22
Machine labour (hrs/ha)	13.65	8.48	37.88
Seeds (kg/ha)	20.00	24.00	-20.00
Fertilizers(kg/ha)	402.80	362.58	9.98
Herbicides(gm/ha)	750.50	925.60	-23.33
Plant protection chemicals (ml/ha)	1780.25	1470.55	17.40
Irrigation water use (m3/ha)	17450.00	15320.00	12.21

TRP- transplanted rice, DSR- direct seeded rice

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

Particulars	TPR method (Rs/ha)	DSR method (Rs/ha)	Saving in DSR (Percentage)
Human labour charges	15885	12955	18.45
Machine use charges	7998	4968	37.88
Cost of seeds	800	900	-12.5
Cost of fertilizer	4356	4424	-1.56
Cost of weedicides	2265	2865	-26.50
Cost of plant protection	3285	2776	15.49
Irrigation charges	3458	2982	13.77
Overhead cost	3350	3084	7.94
Total cost	41397	34954	15.56
Gross income	122125	120534	-1.30
Net income over cost	80728	85580	6.01
Benefit-cost ratio over cost	1.95	2.44	25.13

Table.3 Yield cost and return in TPR and DSR methods of rice production

Particular	TPR method	DSR method	Advantage in DSR (percentage)
Yield (t/ha)	5.70	5.56	-2.46
Total Cost (Rs/ha)	41397	34954	15.56
Gross Income (Rs/ha)	122125	120534	-1.30
Net Income (Rs/ha)	80728	85580	6.01
Cost of grain production (Rs/kg)	7.26	6.28	13.50

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 Rs 6.28 and 7.26 in DSR and TPR, respectively. The cost of grain production was lower by 13.50 percent 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 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 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 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 option of DSR technology.

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