

PERCEPTION AND ECONOMICS OF DRY DIRECT SEEDED RICE IN TERAJ OF NEPAL

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ABSTRACT

Transplanting is widely practiced methods of rice establishment in puddled soils require large amount of labor and water, which are becoming scarce and expensive in Nepal. A field survey was carried out in six districts of terai region of Nepal during 2010. Sixty farmers, ten from each district were randomly selected. They were interviewed using face-to-face method based on semi-structured questionnaires to know their perception towards constraints, and economics of dry direct seeded rice (DDSR). Farmers were mostly using transplanted rice (TPR) because of less weed infestation and better crop establishment, but they were concerned with high cost of cultivation, higher water requirement and deterioration of soil after puddling operation. Farmers perceived DDSR as a cost reducing and less water requiring technology whereas severe weed infestation, poor crop establishment and reduced grain and straw yield were the major nuisance. Nevertheless, the B:C ratio of DDSR (2.0) was found higher than TPR (1.63). Therefore, DDSR could be an alternative to TPR in reducing cost of cultivation; however weeds are serious problems.

Key words: *cost, dry direct seeded rice, productivity, transplanted rice, weed management*

INTRODUCTION

Rice (*Oryza sativa* L. var. *Indica*) is the staple food of about half of the world's population, the majority of which is located in Asia (Palis *et al.*, 2010). In Nepal, rice is commonly planted by transplanting seedlings of 20-25 days on puddled soil. However, transplanting is becoming increasingly difficult due to shortage and high cost of labour, scarcity of water, loss of soil physical properties and increase in cost of cultivation (Rao, 2010). Whereas DDSR is becoming popular as it is cheaper alternative to transplanting. The direct-seeded area in Asia is about 29 million ha, which is approximately 21% of the total rice area in the region (Pandey and Velasco, 1999). Dry seeding saves labor at transplanting, provide faster and easier crop establishment. It involves less drudgery, provides additional benefit in raising the crop through saving 29% of total cost of production of the transplanted rice (Ho, 1998). DDSR reduces the irrigation requirement by 30% of the total water (1400-1800 mm) required for rice culture (Gopal *et al.*, 2010), and have a high tolerance of water deficit (Yadav *et al.*, 2004). Direct seeding of rice also allows early establishment of the wheat crop because rice crop mature 7-10 days earlier than transplanted crops (Balasubramanian

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and Hill, 2002). Yield in DDSR is often lower than TPR principally owing to poor crop stand and high weed infestation (Singh *et al.*, 2005).

Generally, water availability and the opportunity cost of labor are the major determinants of DDSR adoption. Dynamic labour markets are increasing in Nepal, though foreign labour markets attracted most of the Nepalese youths. Therefore, the transplanting method, although effective in controlling weeds, may not be feasible when labour is scarce and water availability for establishment is low or uncertain. In order to save water and labor and promote conservation agriculture (CA), with no/reduced tillage, it is absolutely essential to replace TPR with DDSR (Mann *et al.*, 2007). It was felt necessary to assess farmer's perception towards DDSR over TPR with respect to its economics, constraints, and the choice of suitable weed management technology by the farmers in three clusters of CSISA (Cereal System Initiative for South Asia) project.

MATERIALS AND METHODS

In 2010, sixty DSR growing farmers, twenty from each cluster were randomly selected from the master list of farmers of CSISA project who adopted the technology in the previous year (In 2009). First cluster include Bara and Parsa districts (B/P), second Chitwan and Makwanpur (C/M) districts of central terai region, and third include Nawalparasi and Rupandehi (N/R) districts of western terai region of Nepal (Figure 1).

The region under study was very important in terms of trade and commerce along with modern agricultural technology. Rice, wheat and maize were the major cereals grown in these districts. Direct seeding of rice was practiced traditionally in Parsa, Bara, and



Figure 1: Map of Nepal showing study area under CSISA project during 2010.

Rupandehi districts by some ethnic groups like Tharu.

Survey was conducted using of face-to-face interview method based on semi-structured questionnaires constituted general demographics, assess to resource, cropping system, perceptions of direct seeding in rice, perception of relative damage to crop yield caused by

different weeds, use of herbicides to control weeds, and cost and return of direct seeded and transplanted rice. Farmer’s perception to constraints and advantages of DDSR and TPR were ranked by using five point scales of variables comprising most, relatively more, moderate, modest, and not at all, using scores of 1.00, 0.75, 0.50, 0.25, and 0.00, respectively. The priority index for each variable was calculated by using formula of Miah (1993).

$$I_{\text{prob}} = \frac{\sum S_i f_i}{N}$$

Where, I_{prob} = Index value for intensity of problem
 I_{prob} = Index value for intensity of problem
 \sum = Summation S_i = Scale value of i^{th} intensity
 f_i = Frequency of i^{th} response N = Total number of respondents

1	0.75	0.50	0.25	0.00

Figure 2: Scale value for intensity of constraints and advantages by farmers in cluster area of CSISA

The information collected from the field was analyzed by using computer software package i.e. Statistical Package for Social Science (SPSS) and Microsoft Excel.

RESULTS AND DISCUSSION

I) LAND HOLDING OF FARMERS

Most of the households in the clusters were small land holders i.e. less than 2 ha (60%) (Figure 3). Besides cultivation their own land, farmers were found to be involved in share cropping. The average size of own land holding was slightly higher in B/P (1.95 ha) than M/C (1.39 ha) and N/R (1.54 ha). The study revealed that, the average size of total own land holding was 1.32 ha, which is greater than the national average size of land holding 0.83 ha (MoAD, 2013).

II) LAND USE ARRANGEMENT

By the surveyed farmers most of the area cultivated was under TPR (58.63 ha) as compared to DDSR (27.62 ha). This is because most of the farmers in all clusters preferred TPR under irrigated condition and DDSR under less irrigated condition. Unirrigated medium land and rainfed lowland condition due to shortage of water. Pandey and Velasco (1999) also reported higher adaptation of DSR by smallholder farmers mainly under unirrigated condition. Mann *et al.* (2006) reported that the rice in Punjab province in India has recently

expanded to 0.65 million hectares of non-traditional belt, where puddling is not much practiced due to severe shortage of water.

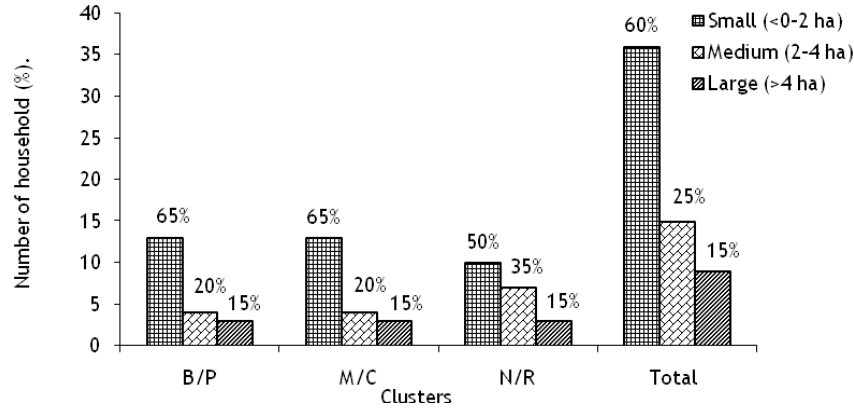


Figure 3. Distribution of land landholding by clusters of the field survey in Bara/Parsa (B/P), Makwanpur/Chitwan (M/C), and Nawalparasi/Rupandehi (N/R) districts in 2010

III) CROPPING SYSTEM

Rice-wheat was the pre dominant cropping system in surveyed area. In total, this was followed by Rice- fallow- maize, Rice-fallow-fallow and Rice-lentil-maize cropping system. Rice-wheat was followed by Rice-lentil-maize in B/P, Rice-wheat-maize and Rice-fallow-maize in M/C, and Rice-fallow-maize in N/R (Table 1). The dominant rice based cropping system might be due to food habit of Nepalese farmers and tradition. Rice meets more than 50% of the total calories requirement of the Nepalese people (NARC, 2007).

IV) ADOPTION OF DDSR BY FARMERS

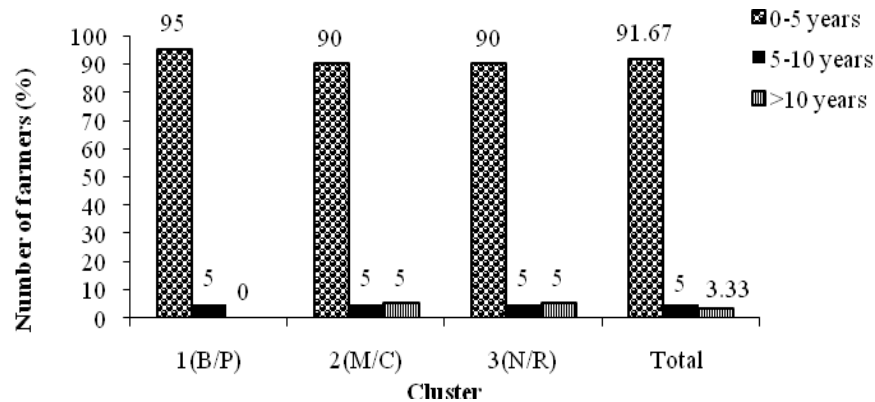


Figure 4. Adoption of DDSR by cluster in Bara/Parsa (B/P), Makwanpur/Chitwan (M/C), and Nawalparasi/Rupandehi (N/R) districts in 2010

Since 5 years the number of DDSR grower is increasing rapidly in all clusters (Figure 4). In B/P, 95% farmers were new comers, while 5% adopted DDSR since 5-10 years. Similarly, in M/C and N/R, 90% farmers adopted DSR since 0-5 years, 5% of the farmers were adopted since 5-10 years and remaining 5% growers adopted this method of cultivation since more than 10 years. Dry-seeded rice is a traditional practice developed by farmers to suit the agro-ecological conditions in systems ranging from shifting cultivation in the humid forest zones to intensive cultivation in the rainfed lowlands (Johnson *et al.*, 1991; My *et al.*, 1995) in Asia, Africa, and Central and South America. In India, dry-seeding is extensively practiced in rainfed lowlands, uplands, and flood-prone areas, while wet-seeding remains a common practice in irrigated areas (Misra *et al.*, 2005).

V) WILLINGNESS TO ADOPT DRY DIRECT SEEDED RICE

The result showed high willingness of farmers to adopt DDSR in cluster regions. Generally, 95 % farmers in N/R, 90 % farmers in B/P and 85 % farmers in M/C under study will continue to practice DDSR in next year. In general 90% farmers will adopt DDSR in next year (Figure 5). The high willingness of adoption of this method could be due to advantages of reduced labor requirements and drudgery, earlier crop maturity, more efficient water use and higher tolerance of water deficit, and often higher profit in areas with an assured water supply (Balasubramanian and Hill, 2002).

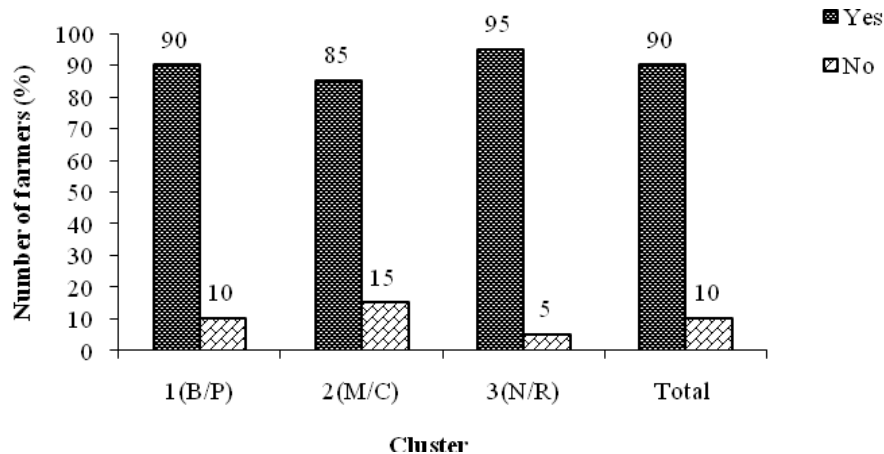


Figure 5. Willingness of farmers adopting DSR in next year by cluster in Bara/Parsa (B/P), Makwanpur /Chitwan (M/C), and Nawalparasi/Rupandehi (N/R) districts in 2010

VI) PERCEPTION OF FARMERS ON MERITS AND DEMERITS OF DDSR and TPR

Rank order index showed that low cost of cultivation was the strength of DDSR followed by less irrigation requirement (Table 1), while farmers ranked increased weed infestation,

poor crop establishment, and reduced grain and straw yield in DDSR as the major problems (Table 2). Farmers ranked less weed infestation, and better crop establishment in TPR as the major advantage over DDSR (Table 3). High cost of cultivation, higher irrigation requirement in puddling, and deterioration of soil physical properties due to puddling were the major problems of TPR ranked by farmers (Table 4). In a study of farmer's perceptions on DSR, benefits perceived by farmers included increased cropping intensity and productivity, the efficient use of early season rainfall and available soil nitrate, reduced water use (700-900 mm rainfall per crop), and lower risk of drought at maturity (Rao and Moody, 1994).

Table 1. Rank order index for merits of direct seeded rice by clusters of the field survey in Bara/Parsa, Makwanpur/Chitwan, and Nawalparasi/Rupandehi districts in 2010

S.N.	Cluster	Bara/Parsa		Makwanpur/Chitwan		Nawalparasi/Rupandehi		Total	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Reduced cost of cultivation	0.95	I	0.91	I	0.90	I	0.92	I
2	Less irrigation requirement	0.57	II	0.58	II	0.65	II	0.61	II
3	Increased fertilizer efficiency	0.31	IV	0.35	IV	0.43	III	0.36	IV
4	Timely crop establishment	0.30	V	0.33	V	0.37	V	0.33	V
5	Increased soil health condition	0.48	III	0.46	III	0.38	IV	0.44	III

Table 2. Rank order index for demerits of direct seeded rice by clusters of the field survey in Bara/Parsa, Makwanpur/Chitwan, and Nawalparasi/Rupandehi districts in 2010

S.N.	Cluster	Bara/Parsa		Makwanpur/Chitwan		Nawalparasi/Rupandehi		Total	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Increased weed infestation	0.95	I	0.97	I	0.97	I	0.96	I
2	Reduced grain and straw yield	0.51	III	0.48	III	0.53	III	0.51	III
3	Increased disease infestation	0.35	IV	0.33	IV	0.33	IV	0.34	IV
4	Poor crop establishment	0.62	II	0.67	II	0.58	II	0.62	II
5	Difficult to fertilizer management	0.05	V	0.02	V	0.06	V	0.04	V

Table 3. Rank order index for merits of transplanted rice by clusters of the field survey in Bara/Parsa, Makwanpur/Chitwan, and Nawalparasi/Rupandehi districts in 2010

S.N.	Cluster	Bara/Parsa		Makwanpur/Chitwan		Nawalparasi/Rupandehi		Total	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	Increased grain and straw yield	0.50	II	0.31	V	0.28	V	0.36	IV
2	Water stagnation	0.38	IV	0.40	III	0.46	III	0.41	III

3	Less weed infestation	0.85	I	0.88	I	0.93	I	0.89	I
4	Less disease and pest infestation	0.30	V	0.32	IV	0.31	IV	0.31	V
5	Better crop establishment	0.42	III	0.57	II	0.50	II	0.50	II

Table 4. Rank order index for demerits of transplanted rice by clusters of the field survey in Bara/Parsa, Makwanpur/Chitwan, and Nawalparasi/Rupandehi districts in 2010

S.N.	Cluster Demerits	Bara/ Parsa		Makwanpur/ Chitwan		Nawalparasi/ Rupandehi		Total	
		Index	Rank	Index	Rank	Index	Rank	Index	Rank
1	High cost of cultivation	0.9	I	0.887	I	0.875	I	0.887	I
2	High irrigation requirement	0.75	II	0.737	II	0.725	II	0.737	II
3	Deteriorates soil	0.55	III	0.587	III	0.6	III	0.579	III
4	Delay harvesting	0.225	IV	0.225	IV	0.237	IV	0.204	IV
5	Low fertilization efficiency	0.075	V	0.062	V	0.062	V	0.066	V

VII) ECONOMICS OF PRODUCTION

Transplanted rice required more cost to cultivate as compared to direct seeded rice. Net return per hectare was higher in DDSR than in TPR in all clusters (Table 5). On an average B:C ratio was higher in the DDSR (2.00) as compared to the TPR (1.63). Labour saving and low irrigation requirement were the major components contributed for low cost of cultivation, and higher farm-gate price of paddy at earlier harvest of DDSR were the main reasons for this profitability as compared to TPR. Sah (2006) observed low cost DDSR technologies in farmer's field, and concluded that DDSR was superior to farmers practice (TPR). Several researches showed that, DDSR can reduce up to 50% labor requirements for rice cultivation (Singh *et al.*, 1994). Direct seeding reduced labor wages about US \$29-36 compared with transplanted rice (\$177-183) (Rashid *et al.*, 2009), and DDSR required 13% less irrigation water than TPR. This was due to the lower amount of water applied during land preparation.

Table 5. Benefit and cost analysis of DDSR and TPR by clusters of the field survey in Bara/Parsa, Makwanpur/Chitwan, and Nawalparasi/Rupandehi districts in 2010

Particulars	Bara/ Parsa		Makwanpur/ Chitwan		Nawalparasi/ Rupandehi		Total	
	DSR	TPR	DSR	TPR	DSR	TPR	DSR	TPR
Cost of cultivation (Rs.,000)/ha	49.10	64.40	54.04	71.34	53.93	70.23	52.53	68.65
Gross return ha ⁻¹ (Rs.,000)	99.05	102.95	114.13	124.13	101.07	109.57	104.75	112.22
Net benefit ha ⁻¹ (Rs.,000)	49.95	38.55	60.09	52.79	47.13	39.33	39.29	32.66
B:C ratio	2.02	1.59	2.11	1.74	1.87	1.56	2.00	1.63

Note: DSR- direct seeded rice, TPR- transplanted rice

CONCLUSION

Increased weed infestation, poor crop establishment and reduced grain yield were major constraints of DDSR, whereas high cost of cultivation and higher water requirement were major constraints of TPR. In spite of realizing the lower yield in DDSR as compared to TPR, the net benefit and B:C ratio were higher in DDSR because of lower cost of cultivation as compared to TPR. Thus DDSR is preferred for better return, less irrigation requirement, low cost of cultivation, and less drudgery.

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