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Assessment of Direct Seeded and Transplanting Methods of Rice Cultivars in the Western Part of Uttar Pradesh

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ABSTRACT

A split plot design experiment based with three replications was conducted to compare differences between direct seeded rice and transplanting methods. Different cultivation methods were transplanting in wet lands, DSR:dry seeding (sowing dry seeds into dry soil),wet seeding (sowing pre-germinated seeds on wet puddle soils) and water seeding (seeds sown into standing water) in the main plots and different cultivars were "Pusa Basmati-1","Pusa Sugendha-4","Pusa Sugendha-5",and"Vallabh 22" in the sub-plots during 2010 to 2012.According to analysis of variance, the effects of cultivars on all yield components (panicle/m^2,seed/panicle, and 1000grain weight),plant height, panicle length, and total tiller were significant, while the effect of cultivation method was significant on the rest of the traits except for grain weight. The largest and least number of seed/panicle was obtained under interaction effect of transplanting method of "Vallabh-22" and direct seeded method as distribution of "Pusa Sugendha-5", respectively. Plant height in wide raised Beds method of "Pusa Sugendha-5"and transplanting method of"Vallabh-22" appeared to be the highest and lowest, respectively. The largest and least number of tillers and fertile tillers were obtained in direct seeded method of "Pusa Basmati-1" and transplanting method of "Pusa Sugendta-4", respectively. The yield across different varieties was not significant, while different cultivation methods were significant. The most and least yield was seen in transplanting and direct seeded methods, respectively. Yield amount was significant between transplanting and dry seeding methods, but because of 20 to 30% reduction in production cost due to the omission of seedling and transplanting operations, as well as reduction in the length of crop cultivation period in direct seeded method that caused conserved water and energy, a little reduction in direct seeded method will be compensating. Thus, direct seeded method as dry seeding is introduced as an economical method for rice production in this area and “Vallabh-22" has the better compatibility to this method than other varieties.

Key words: Oryza sativa L.; wet land; labour saving; cost saving; water saving; time saving

1. INTRODUCTION

Rice (*Oryza sativa* L) is the most important staple food crop of India and is a major source of calories for about 60 per cent of the world population. In India, rice is grown in an area of 44.6 million ha with a production of 109.5 million tonnes and average productivity of 2.62 tonnes per ha. Traditional low land rice grown with continuous flooding in Asia has relatively required high water input. To meet the water crisis head on, valuable gains can be achieved by growing rice with less water (Mahajan *et al*.2004).Therefore, the need of hour is to develop alternative systems that require less water.Now a days, rice cultivation is done indifferent ways in the world. The most important cultivation ways are direct seeded and transplanting methods. Direct seeding of rice (DSR) refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting rice (TPR) seedlings from the nursery. There are three principal methods of DSR:dry seeding (sowing dry seeds into dry soil), wet seeding (sowing pre-germinated seeds on wet puddle soils) and water seeding (seeds sown into standing water).Dry seeding has been the principal method of rice establishment since the 1950s in developing countries (Pandey and Velasco, 2005).At present, rice cultivation is as direct seeded in America, Western Europe such as Italy and French, Russia, Japan, Cuba, India, Korea, and the Philippines and in some parts of Iran, due to high technology, high labour cost and shortage of skilled labour (Akhgari, 2004).

The final rice cultivation system in the world is affected by water deficient, low suitable land, and shortages of worker (Nguyen and Ferrero, 2006).At present, 23% of rice is direct-seeded globally (Rao et al., 2007). Labour saving of DSR method induced by preparation of nursery and TPR, causes the reduction of 11.2% in total production cost. DSR methods have several advantages over TPR (Singh et al.,2005a, Naresh et al.,2010).In addition to higher economic returns, DSR crops are faster and easier to plant, less labour intensive and consume less water (Jehangir et al., 2005).DSR has received much attention because of its low-input demand (Farooq et al.,2011).The development of early-maturing varieties and improved nutrient management techniques along with increased availability of chemical weed control methods has encouraged many farmers in the Philippines, Malaysia, Thailand and India to switch from TPR to DSR culture (Farooq et al., 2011,Naresh et al., 2011).Main method of rice cultivation in western Uttar Pradesh is transplanting. The cost of rice worker is two to three times of the other field crop production. It is important to note that the reduction of worker is necessary for rice production. Thus, it is necessary to change the cultivation system from TPR to DSR (Sanjitha Rani and Jayakiran, 2010).In DSR method such as wet bed, seeds are cultivated as distribution, linear and hill. Also, crop management such as weeds management, water management, production cost, the number of labour, yield potential of varieties and seedling establishment method are assessed. One of the major changes is TPR to DSR method. For extension of the method, there is need for early maturity of rice varieties and better

chemical technology for weed control in rice fields (Akhgari, 2004).Basically, trend to DSR and TPR depends on the region and the type of dominant ecosystem.

There is therefore the need to determine the most appropriate planting method in an upland condition for irrigated agro-ecology of western Uttar Pradesh and its surrounding areas. Now a days, production cost has been decreased using DSR. Weather, economical and society conditions are effective factors for this dominant (Kim et al., 2000;Gill etal., 2008 and Oyewole et al., 2010).Yield in DSR is often lower than TPR principally owing to poor crop stand and high weed infestation (Singh et al., 2005a,Naresh et al.,2010). Moreover, cost for weed control is usually higher than TPR. High weed infestation is a major constraint for broader adoption of DSR (Rao et al., 2007).Based on the researches, the future progress in increasing of the yield of irrigated rice in DSR will be highly more than TPR, and this value will reach to 10 to 15 tons/ha (IRRI, 1991).The aim of this study was to evaluate of potential in main cultivars in the region and assessment of the best method of DSR in comparison to conventional TPR method.

2. MATERIALS AND METHODS

Experimental design and materials

The experiments were done as split plot design in the 1000 m^2 of rice land at crop research centre of university. Cultivation method in main plot (15 × 6 m) and cultivars in sub-plot (3 × 4 m) were considered. Cultivation methods (factor A) were transplanting in wet land 'D_1',DSR:dry seeding (sowing dry seeds into dry soil) D_2,wet seeding (sowing pre-germinated seeds on wet puddle soils) D_3 and water seeding (seeds sown into standing water) D_4.Desired varieties (factor B) were named "Pusa Basmati-1 V_1","Pusa Sugendha-4 V_2","Pusa Sugendha-5 V_3",and"Vallabh-22 V_4",the main varieties in the region. In all methods and based on the varieties features, seedling density was 150 to 200/m^2.

Measurements

In addition to exerting the different managements related to irrigation, weeds, nutrition, pests and diseases, some traits such as growth and development process, seed germination, the number of effective and non-effective tillers, plant height, panicle length, spikelet number/panicle, sterility percentage, 1000 grain weight, assessment of lodging and yield were evaluated. Grain yield, sterility percentage and total tillers were calculated using following equations:

Grain yield = Spikelet number/panicle × grain weight × number of effective tillers × sterility percentage.

Sterility percentage = Total seed number/number of sterile seeds ×100.

Total tillers = The number of effective tillers + non-effective tillers.

Mean 1000 grain weight was recorded by counting of 5 samples (each sample containing 1000 grain). Mean effective tiller was recorded by counting the number of tillers per each plot to become

changed into complete panicle. Plant height was calculated to take the measurement of crown to the top of the panicle.

Evaluation of some traits in each experimental plot was performed as randomly selection of 10 panicles or hills or surface unit (based on the kind of trait).

3. RESULTS AND DISCUSSION

Analysis of data showed that the effect of variety (factor B) on 1000 grain weight, sterility percentage, grain number/panicle, fertile tiller number, plant height, panicle length, and total panicle number were significant at level of 0.05% (Table 1).The effect of variety on grain yield was not significant (Table 1).The effect of cultivation method (factor A) was significant on the aforementioned traits except for 1000 grain weight, and fertile tiller number. Effect of these factors showed that the 1000 grain weight, panicle length, total tiller number, and fertile tiller number were not influenced by interaction between variety and cultivation method. Interaction effect of cultivar and cultivation method was significant (0.05%) on grain yield, sterility percentage, and seed number/panicle and plant height (Table 1).Mean comparison of the effect of variety on the traits showed that the most and least yield were obtained in "Vallabh 22" and "Pusa Basmati-1"cultivars,respectively.However,this difference was not significant (Table 2).The highest grain number/panicle, total tillers number and fertile tillers number was obtained from" Vallabh 22".Least amount of grain number/panicle, total tillers number and fertile tillers number were observed in "Pusa Sugandha-5",Pusa Sungdha 4"and "Pusa Basmati 1,respectively.Plant height was observed in two levels (Table 2).Totally,investigation of the effect of cultivar on measured components revealed that" Vallabh 22" was the best cultivar in most components. Mean comparison of cultivation methods on the measured traits showed that the TPR was the most effective method due to its effect on some yield components such as grain number/panicle, plant height and panicle length, while this method was not proper on some other components such as sterility percentage, total tillers number and fertile tillers number. DSR method as distribution had the best effect on total tillers number and fertile tillers number, while its effect on other components was not suitable (Table 2).

DSR method as wet seeding (sowing pre-germinated seeds on wet puddle soils) had higher effect on the 1000 grain weight, sterility percentage, and panicle length than DSR method as dry seeding (sowing dry seeds into dry soil) and water seeding (seeds sown into standing water).It is noteworthy that the most yield after the final cultivation methods belong to the DSR method as wet seeding (sowing pre-germinated seeds on wet puddle soils).Statistically, the rate of grain yield was the same in TPR method and DSR method as wet seeding (sowing pre-germinated seeds on wet puddle soils).Grain yield in direct cultivation method as wet seeding (sowing pre-germinated seeds on wet puddle soils) was 20% higher than that of DSR method as dry seeding (sowing dry seeds into dry soil). The lowest yield and highest sterility percentage were obtained in DSR method as dry seeding

(sowing dry seeds into dry soil) (Table 2). According to the mean comparison of interaction effect of the factors on the components, the highest grain yield was achieved in combination of "Vallabh 22"×DSR method as wet seeding (sowing pre-germinated seeds on wet puddle soils) and "Pusa Sugandha 4"×TPR method (Table 2).The lowest grain yield was obtained in combination of"Pusa Sugandha 5"×DSR method as dry seeding (sowing dry seeds into dry soil).

DSR is both cost- and labour-saving, although grain yield in DSR is comparatively less than that of TPR. Bhuiyan et al.(1995) showed that the rice growth duration decreased for 7 to 10 days by direct cultivation. Also, land occupation decreased, thus it saves water and labour for 25 to 30%. Evaluation of panicle sterility percentage of grain/panicle showed that this trait in all DSR methods was higher than that of TPR method. This can result from high plant density and unsuitable cultivation arrangement of plant in DSR method that cause compacting canopy and decreasing the air flow around the plant, especially in irregular broadcasting method at the end of growth period

Investigation of grain number/panicle revealed that there is significant difference between all forms of DSR and TPR methods. It indicates the effects of environmental competition such as seed density and cultivation arrangement. More studies are needed to improve the seed potential in different methods of DSR which have much effect on grain yield. Finally, investigation of grain yield in different cultivation methods and cultivars showed that there is significant difference between different cultivars used in this research, which has the same growth duration. Similar to our results, Kukal and Aggrawal (2002) showed that with respect to yield, both DSR (wet, dry or water seeding) and TPR had similar results. Regarding the results obtained from varieties and mean comparison tables in which transplanting method and wet seeding (sowing pre-germinated seeds on wet puddle soils) had the best conditions; we propose to consider the varieties in subplots, carefully.

Table 1: Mean comparison for the effect of planting methods and cultivar type on different traits of rice varieties

Treatments	Plant Height (cm)	Total tiller per (m2)	Effective tiller / (m^2)	Panicle Length (cm)	Sterile grain /panicle	Grain /panicle	Sterility (%)	1000 grain weight (g)	Grain yield (g/m^2)
Planting method Factor A									
D_1 TPR	140.86	338.957	272.89	27.67	9.25	121.74	7.91	25.91	496.16
D_2 DSR	128.11	499.273	372.248	26.11	12.81	96.71	11.87	25.80	412.29
D_3DSR	132.82	428.523	336.765	27.12	14.42	101.82	12.62	26.62	461.99
D_4 DSR	122.70	435.912	328.9	27.06	13.58	101.79	12.06	26.26	167.12
C D 5%				**NS**				**NS**	
Cultivars Factor B									
Pusa Basmati-1 V_1	143.0	248.19	349.1	24.9	11.27	87.65	12.65	24.43	403.9
Pusa Sugendha-4 V_2	147.7	402.8	311.5	29.7	5.99	86.22	7.48	24.68	437.5
Pusa Sugendha-5 V_3	146.1	389.8	270.5	27.6	7.56	82.18	0.30	27.89	434.6
Vallabh-22 V_4	98.6	525.5	379.6	25.6	25.34	168.90	16.05	28.71	461.5
C D 5%				**NS**				**NS**	

Table 2:Mean comparison for the interaction effect of planting methods and cultivar type on different traits of rice varieties

AxB	Plant Height (cm)	Total tiller per (m2)	Effective tiller / (m^2)	Panicle Length (cm)	Sterile grain /panicle	Grain /panicle	Sterility (%)	1000 grain weight (g)	Grain yield (g/m^2)
$D_1 \times V_1$	147.3	338	313	25.1	13	93	42.85	27.16	481.55
$D_1 \times V_2$	154.1	355	264	29.7	4	90	14.49	26.93	505.28
$D_1 \times V_3$	157.4	306	241	28.4	5	93	17.22	24.46	482.00
$D_1 \times V_4$	104.6	353	374	27.5	14	212	20.45	25.08	515.82
$D_2 \times V_1$	137.6	369	338	24.3	7	78	26.71	26.90	378.29
$D_2 \times V_2$	138.8	480	302	28.9	8	78	31.77	27.67	373.61
$D_2 \times V_3$	136.6	519	349	25.7	7	67	29.46	25.14	378.09
$D_2 \times V_4$	99.3	629	501	25.7	29	164	54.59	23.5	519.06
$D_3 \times V_1$	142.0	397	379	24.8	14	89	45.32	29.93	417.10
$D_3 \times V_2$	149.9	374	228	30.8	7	84	27.12	29.47	491.61
$D_3 \times V_3$	142.6	386	343	25.0	10	81	39.54	24.45	449.67
$D_3 \times V_4$	96.7	558	397	24.9	27	153	54.62	22.67	489.58
$D_4 \times V_1$	145.0	433	367	25.5	11	91	36.95	27.58	338.61
$D_4 \times V_2$	148.0	400	288	29.5	4	81	16.48	30.75	379.49
$D_4 \times V_3$	147.8	348	313	28.6	8.	88.	28.41	24.66	428.79
$D_4 \times V_4$	93.9	562	348	24.6	3	147	62.96	22.46	321.59

Table 3 Gross returns (Rs. ha^{-1}), net returns (Rs. ha^{-1}) and benefit cost ratio of rice varieties as influenced by method of planting

Table 3: Rice grain yield (t ha^{-1}), input costs (Rs ha^{-1}), and net income (Rs ha^{-1}) under different tillage and crop establishment methods.

Treatment	Grain yield	Crop establishment cost	Seed cost	Irrigation cost	Fertilizer cost	Herbicide cost	Net income
CT-TPR	5.78	2835	900	2055	2565	425	15870
CT-BCR	5.74	2205	900	1885	2565	425	16695
ZT-DSR	4.45	1035	900	1250	2475	990	21320
ZT-TPR	4.65	1350	900	1350	2475	750	20550
ZT-DSR+Ses	4.55	1485	900	1425	2430	925	20125
RT-DSR	4.35	1845	900	1485	2350	650	19225
RT-TPR	4.85	2025	900	1630	2350	600	19750
CT-DSR	4.60	2135	900	1690	2300	675	18650
NBed-DSR	4.25	2175	675	1250	2275	1050	13500
NBed-TPR	4.50	2275	675	1315	2275	850	14575
WBed-DSR	4.65	2250	675	1150	2275	550	19750
WBed-TPR	5.45	2325	675	1215	2275	450	21650
C D at 5%	0.43	44.36	17.52	23.62	33.70	11.65	-

4. CONCLUSION

There is no significant difference between varieties, but regarding the mean comparison, the best interaction and seedling establishment belong to "Vallabh 22".Researches have to concentrate on the better genotype and management factors to obtain a new method containing reduction of water consumption, reduced production costs, reduction of duration time and higher seed function.

REFERENCES

1) Akhgari H.2004. Rice(Agronomy,Fertilization, and Nutrition).Islamic Azad University Press, Rasht, Iran, p. 376 (In Persian).Direct Seeding: *Research Strategies and Opportunities*. Inter. Rice Res. Inst. Los Baňos, Philippines, pp. 15-42.
2) Akhgari Hassan and Kaviani Behzad.2011.Assessment of direct seeded and transplanting methods of rice cultivars in the northern part of Iran. *African Journal of Agricultural Research*,6 **(31):** 6492-6498
3) Farooq M,Siddique KHM,Rehman H,Aziz T,Lee DJ,Wahid A.2011.Rice direct seeding: Experiments, challenges and opportunities. *Soil.Till. Res*. 111: 87-98.
4) Gill M.S., Ashwini K. and Pardeep K. 2008. Growth and yield of rice (*Oryza sativa*) cultivars under various methods and times of sowing. *Indian Journal of Agronomy*. 51**(2):** 123-127.
5) IRRI.1991.Direct seeded rice in tropics. Selected papers from the international rice research conference. Seoul, South Korea.
6) Jehangir WA, Masih I, Ahmed S, Gill MA, Ahmad M, Mann RA, Chaudhary MR, Turral H.2005. Sustaining crop water productivity in rice-wheat systems of South Asia: a case study from Punjab Pakistan. In: Draft Working Paper. *Inter. Water Management, Ins.* Lahore, Pakistan.
7) Kim JK, Lee MH, Kim YS.2000.Labour saving cultivation technologies of rice in Korea- direct seeding and machine transplanting- national crop experimental station, Rural Development Administration (RDA),Republic of Korea.
8) Mahajan G, Saradana V, Brar A S and Gill M S. 2004. Grain yield comparison among rice (*Oryza sativa* L.) varieties under direct seeding and transplanting. *Haryana Journal of Agronomy* 20 **(1):** 68-70.
9) Naresh R.K.; Gupta Raj K.; Singh B.; Kumar Ashok; Shahi U.P.; Pal Gajendra;Singh,Adesh; Yadav Ashok Kumar;and Tomar S.S.2010.Assesment of No-Tillage and Direct Seeding Technologies in rice-wheat rotation for Saving of Water and Labour in Western IGP.*Progressive Agriculture an International Journal*10 **(2):** 205-218.
10) Naresh R.K.;Gupta RajK.;Kumar Ashok;Singh B.;Prakash Satya;Kumar Satish & Rathi R.C.2011. Direct-seeding and reduced-tillage options in the rice-wheat system of the Western Indo-Gangetic Plains. *International Journal of Agricultural Sciences*,7**(1):**197-208.

11) Nguyen NV, Ferrero A.2006.Meeting the challenges of global rice production. *Paddy Water Environ.,* 4: 1-9.

12) Oyewole C. I., Ajayi O. and Ojuekaiye R. O. 2010.Evaluation of yields of seven upland rice (*Oryza sativa*) cultivars sown by three methods in Anyigba, Kogi State,Nigeria. *African Journal of Agricultural Research*, 5 **(16):**2089-2096.

13) Pandey S, Velasco L.2005. Trends in crop establishment methods in Asia and research issues. In:Rice is Life:Scientific Perspectives for the 21st Century, *Proceeding of the Word Rice Research Conference,*4-7 November 2004, Tsukuba, Japan, pp. 178-181.

14) Rao A.N.,Johnson D.E.,Sivaprasad B., Ladha J.K.and Mortimer A.M.2007.Weed management in direct-seeded rice. *Adv. Agron*., 93: 153-255.

15) Sanjitha Rani T. and Jayakiran K.2010.Evaluation of different planting techniques for economic feasibility in Rice.*Electronic Journal of Environmental Agricultural and Food Chemistry (EJEAFChe)*.9 **(1):**150-153.

16) Singh Y,Singh G,Johnson D,Mortimer M.2005a.Changing from transplanted rice to direct seeding in the rice-wheat cropping system in India. In: Rice is Life: Scientific Perspectives for the 21st Century,Tsukuba,Japan:*Proceeding of the Word Rice Research Conference*,4-7 November 2004; pp. 198-201.

