

Effect of crop establishment practices in rice varieties under puddled irrigated conditions

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ABSTRACT

A field experiment conducted during rainy seasons of 1994 and 1995 indicated that wet seeding of sprouted seeds in lines recorded maximum mean grain yield (5.17 t/ha) and net returns (Rs 10095/ha) followed by transplanting. The mean maximum grain yield of 5.26 t/ha was recorded by Vikas followed by IET 9994 (5.19 t/ha), IET 9219 (5.08 t/ha), IET 9978 (4.99 t/ha), Rasi (4.89 t/ha) and IET 10229 (3.63 t/ha). In direct seeding of sprouted seeds in lines, varieties like IET 9994, IET 9978 and Vikas recorded higher grain yield compared to transplanting method.

Key words: Crop establishment practices, Rice

Non-availability of irrigation water, insufficient labour and high wages during the peak period of farm operation invariably delay planting of rice. To mitigate this problem many rice farmers are switching to direct seeding under puddled conditions. Direct seeding can reduce the labour requirement, shorten the duration of crop by seven to 10 days and provide comparable grain yield with transplanting (De Datta, 1986). Considering these facts there is a need to identify appropriate rice varieties, specially suited for direct seeding and also to improve the existing management practices of sowing and weed control in direct seeded crop. Not much information is available on suitable varieties and crop establishment and weed management practices for direct seeding in comparison to transplanting and hence this trial was initiated.

MATERIALS AND METHODS

A field experiment was conducted during rainy seasons of 1994 and 1995 at the experimental farm of Directorate of Rice Research, Rajendranagar, Hyderabad. The experimental site was having clay soil of pH 8.1, organic carbon 0.96%, total N 0.85%, mineralised N 30.2 mg/kg soil, Olsen P 6.1 mg/kg soil and neutral N ammonium acetate K (110 mg/kg soil). Five rice varieties viz., Vikas, IET 9994, IET 9978, IET 9219 and Rasi during 1994 and three varieties viz., Vikas, IET 9994 and IET 10229 during 1995 were tested under four methods of crop establishment i.e. random transplanting + manual weeding + recommended doses of fertilisers (100 N, 60 P_2O_5 , 40 K_2O and 20 $ZnSO_4$ kg/ha) as local practices (T_1); Transplanting in lines (20 × 10 cm spacing) +

weed control with the use of herbicides (Butachlor @ 1.5 kg a.i./ha applied 5th day after transplanting) + recommended doses of fertilisers as per T_1 (T_2); Broadcast of sprouted seeds (100 kg/ha) + manual weeding at 20 and 40 days after sowing + recommended doses of fertilisers (80 N, 40 P_2O_5 , 30 K_2O and 20 kg $ZnSO_4$ as per local practice (T_3); Wet seeding of sprouted seeds (80 kg/ha) in lines at 20×10 cm spacing + weed control with the use of butachlor (1.25 kg a.i./ha at 5th day after sowing followed by one hand weeding at maximum tillering stage) + recommended doses of fertilizers as per T_1 (T_4).

In treatments T_1 and T_2 , half of the N and in T_3 and T_4 one third of the N were applied basal, whereas remaining N was top-dressed in two equal splits at tillering and panicle initiation stages, Full doses of phosphorus, zinc and 75% potash were applied basal and remaining 25% potash was applied at panicle initiation stage. The trial was laid out in split plot design with three replications. Methods of crop establishment were kept in main plots and varieties in subplots. Pre-germinated seeds were sown by broadcast method in treatment (T_3) as farmer's practice while in treatment (T_4), 2-3 germinated seeds/hill were sown in lines. During both the seasons sowing of seeds both for direct seeded and transplanted rice was done on 25th June. Only a thin layer of water was managed and excess water was not allowed to stand in broadcast and in line sowing of wet seeded plots for almost 10 days in order to facilitate proper establishment of seedlings. The water level was gradually raised thereafter and maintained at 3 ± 2 cm, throughout up to the dough stage. In treatment T_1 , 30 days old seedlings were transplanted randomly, while in T_2 seedlings were transplanted in lines keeping 2-3 seedlings/hill. Direct seeded crop was harvested

on 15 November. At the time of harvest, observations were recorded on panicle number, panicle weight and grain yield. Net returns (Rs/ha) were calculated by considering the sale price of paddy at Rs 350/q and cost of cultivation around Rs 8500, Rs 8000, Rs 7200 and Rs 8000/ha for T_1 , T_2 , T_3 and T_4 , respectively.

RESULTS AND DISCUSSION

Effect of Methods of Crop Establishment

Grain yields were influenced significantly under different methods of crop establishment during both the seasons (Table 2). Averaged over varieties, wet seeding in lines under puddled condition (T_4) recorded the highest mean grain yield of 5.17 t/ha followed by transplanting (5.10 t/ha), broadcast of sprouted seeds (4.58 t/ha) and

Table 1. Yield attributes as influenced by varieties and methods of crop establishment

Treatment	Panicles/ m ²		Panicle weight (g)	
	1994	1995	1994	1995
<i>Varieties</i>				
Vikas	350	319	2.19	2.67
IET 9994	339	326	2.86	2.70
IET 9978	314	—	2.60	—
IET 9219	327	—	2.70	—
IET 10229	—	318	—	2.57
Rasi	320	—	2.71	—
CD (P = 0.05)	NS	6	0.14	0.07
<i>Methods of crop establishment</i>				
T_1	298	308	2.73	2.54
T_2	330	325	2.89	2.69
T_3	351	301	2.76	2.45
T_4	356	331	2.94	2.72
CD (P = 0.05)	31	11	NS	0.05

Table 2. Varietal differences in grain yield and net returns under different methods of stand establishment

Treatment	Grain yield (t/ha) with methods of stand establishment					Net return (Rs/ha) with method of stand establishment				
	T ₁	T ₂	T ₃	T ₄	Mean	T ₁	T ₂	T ₃	T ₄	Mean
<i>Varieties</i>										
Vikas	5.07	5.41	4.81	5.73	5.26	9228	1093	9585	12055	10451
IET 9994	5.19	4.71	5.16	5.69	5.19	9648	8485	10810	11915	10215
IET 9978	3.75	5.50	5.37	5.32	4.99	4625	11250	11545	10620	9510
IET 9219	5.19	5.23	4.49	5.42	5.08	9665	10305	8465	10970	9851
IET 10229	3.33	4.50	3.00	3.67	3.63	3155	7750	3250	4845	4750
Rasi	4.19	5.23	4.63	5.19	4.81	8685	10305	8955	10165	9528
Mean	4.45	5.10	4.58	5.17		7501	9839	8768	10095	
CD (P = 0.05)	0.47	0.24								
Methods of stand establishment	0.29	0.37								
Interaction V at same T	0.94	0.54								
T at same V	0.89	0.59								

random transplanting (4.45 t/ha). The wet seeding in lines recorded 1.37, 12.88 and 16.18% increase in grain yield over the mean grain yield of transplanting, broadcast and random transplanting, respectively. Panicle production and panicle weight differed significantly among methods of crop establishment (Table 1). Mean maximum panicle production (344/m²) and panicle weight (2.83 g) were recorded under wet seeding in lines followed by transplanting, supporting the grain yields. The mean maximum net return of Rs. 10095/ha was recorded by wet seeding in lines followed by transplanting (Rs. 9839/ha), broadcast (Rs. 8768/ha) and random transplanting (Rs. 7501/ha) (Table 2). Similar results were reported by Singh and Pillai (1996).

Effects of varieties

Grain yield differences among different varieties were significant during both the seasons (Table 2). The mean maximum grain yield (over the methods of crop establishment) of 5.26 t/ha was recorded with Vikas followed by IET 9994 (5.19 t/ha), IET 9219 (5.08 t/ha), IET 9978 (4.99 t/ha) and Rasi (4.81 t/ha) while lowest grain yield of 3.63 t/ha was recorded under IET 10229. The increase in grain yield under Vikas was 1.35, 5.41, 3.54, 5.41, 9.36 and 44.90% over the mean grain yield of IET 9994, IET 9219, IET 9978, Rasi and IET 10229, respectively. The mean maximum panicle number (335/m²) and panicle weight (2.79 g) were recorded by Vikas followed by IET 9994 (Table-1). The maximum net returns (over the methods of crop establishment) of Rs 10451/ha was recorded by Vikas followed by IET 9994 (Rs 10215/ha), IET 9219 (Rs 9851/ha), Rasi (Rs 9528/ha), IET 9978 (Rs. 9510 ha)

and lowest net returns of Rs 4750/ha was recorded by IET10229. Similar results were recorded by Singh and Pillai (1996).

Interaction

The interaction effects on grain yield between varieties and methods of stand establishment were significant during both the seasons (Table 2). The maximum grain yield was recorded under transplanting method followed by wet seeding in lines by variety Vikas. Direct seeding (mean of broadcast and wet seeding in lines) recorded maximum mean gain yield of 4.88 t/ha and net returns of Rs. 9432/ha as compared to the mean grain yield (4.78 t/ha) and net returns (Rs 8670/ha) of transplanting (mean of random transplanting and transplanting in lines). The percent increase of 18.73 in grain yield was recorded under direct seeding over transplanting. Among the tested varieties IET 9994 and IET 9978 recorded 9.70 and 15.55% higher grain yield respectively under direct seeding over transplanting while IET 9219 and IET 10229 recorded 5.04 and 17.37% higher grain yield respectively under transplanting than direct seeding. Varieties Vikas and Rasi recorded only 0.50 and 4.25% higher grain yield under direct seeding than transplanting. Thus, it is concluded that varieties IET 9994, IET 9978 and Vikas are suitable for direct seeding.

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