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IMPACT OF DIFFERENT CROP ESTABLISHMENT TECHNIQUES AND VARIETIES ON CGR, RGR, NAR AND YIELD OF HYBRID RICE

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ABSTRACT

Rice is the most important staple food crop in the world and a major food grain for more than a third of world's population (Prasertsak and Fukai, 1997). About 40% of world population uses rice as a major source of calories. The use of hybrid rice is a new development in India. Hybrid rice is the commercial rice crop from F1 seeds of cross between two genetically dissimilar parents. A field experiment was conducted during *boro* season of 2013-14 and 2014-15 in Agricultural Farm, Palli Siksha Bhavana (Institute of Agriculture) at Visva-Bharati, Sriniketan, India which lies in the sub-humid sub-tropical lateritic belt of West Bengal to study the effect of different crop establishment techniques and varieties on growth parameters and yield of hybrid rice. The results showed that between the crop establishment techniques, SRI method showed best results in growth parameters like plant height, CGR, RGR and NAR and also the grain and straw yield of hybrid rice was superior in SRI technique than that of conventional method of rice cultivation in both the years. Among the varieties, Tej variety showed good results in almost all the parameters than that of other varieties but variety NK 6302 also showed good results in case of CGR and RGR than that of Tej variety.

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INTRODUCTION

Rice is the most important staple food crop in the world and a major food grain for more than a third of world's population (Prasertsak and Fukai, 1997). The crop occupies one third of world's total area planted to cereals and provides 35-60% of the calories intake more than two billion people every day (Guerra *et al*., 1998). Hybrid rice cultivation is a technology which was fully utilized in countries like China where its exploitation has paid rich dividend to alleviate hunger and poverty (Peng *et al.*, 1994). The use of hybrid rice is a new development in India. Hybrid rice is the commercial rice crop from F1 seeds of cross between two genetically dissimilar parents. System of rice intensification (SRI) is the method, developed in Madagascar in the early 1980's , where, it has been shown that yields can be enhanced by suitably modifying certain management practices such as controlled supply of water, planting of younger seedling and providing wider spacing (Laulanie,1993). The main of objective of SRI is to enhance the productivity by better utilization of resources viz. land, labour, capital and water. By adopting this system of cultivation we could save water, protect soil productivity, save environment by checking methane gas from water submerged water paddy cultivation practices, and bring down the input cost, besides increasing the production.

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MATERIALS AND METHODS

A field experiment was conducted during the *boro* season of 2013-14 and 2014-15. The experimental site was situated in the Agricultural Farm of Palli Siksha Bhavana (Institute of Agriculture) at Visva-Bharati, Sriniketan, India which lies in the sub-humid sub-tropical lateritic belt of West Bengal. The experiment was laid out in factorial randomized block design with three replications. Total number of plots was 24 each with gross size of 5m×4 m. Recommended dose of fertilizers were applied through urea, single super phosphate and muriate of potash @ 150 kg N ha^{-1}, 75 kg P_2O_5 ha^{-1} and 75 kg K_2O ha^{-1}. The nursery field and main field of SRI and Conventional method were prepared by following the recommended package

Table 1. Effect of crop establishment methods and hybrid varieties on CGR, RGR and NAR at different growth stages of rice plant

Treatments	CGR						RGR						NAR					
	30-45 DAT			60-75 DAT			30-45 DAT			60-75 DAT			30-45 DAT			60-75 DAT		
	2014	2015	P.M.	2014	2015	P.M.	2014	2015	P.M.	2014	2015	P.M.	2014	2015	P.M.	2014	2015	P.M.
Crop Establishment Methods																		
SRI	12.85	16.41	14.13	13.63	12.77	13.20	0.040	0.044	0.042	0.018	0.017	0.017	3.81	4.05	3.93	2.62	2.31	2.46
Conventional	10.27	12.24	11.26	9.60	10.29	9.94	0.037	0.041	0.040	0.015	0.016	0.016	3.74	4.10	3.91	2.16	2.25	2.21
S. Em (±)	0.40	0.28	0.29	0.83	0.72	0.66	0.001	0.0009	0.0006	0.001	0.001	0.0009	0.14	0.22	13	0.18	0.13	0.13
C.D. at 5%	1.21	0.44	0.90	2.53	2.21	2.00	NS	NS	0.002	NS	NS	NS	0.42	0.68	0.40	NS	NS	NS
Variety																		
Tej	12.15	15.41	14.14	12.31	12.05	12.18	0.039	0.044	0.042	0.017	0.016	0.0166	3.67	4.66	4.16	2.40	2.30	2.35
NK6302	11.78	12.68	12.23	11.51	11.84	11.68	0.040	0.041	0.041	0.016	0.017	0.0169	3.91	3.93	3.92	2.55	2.44	2.50
RAJALAXMI	11.40	13.25	12.32	12.04	11.62	11.83	0.038	0.042	0.040	0.018	0.016	0.0170	3.74	3.86	3.80	2.46	2.27	2.36
AJAY	10.93	13.20	12.06	10.58	10.60	10.60	0.037	0.043	0.040	0.015	0.015	0.0157	3.77	3.85	3.81	2.15	2.11	2.13
S. Em (±)	0.56	0.62	0.42	1.17	1.03	0.93	0.001	0.001	0.0009	0.0016	0.0015	0.001	0.20	0.32	0.18	0.26	0.18	0.18
C.D. at 5%	NS	1.34	1.28	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
A X B interaction																		
S. Em (±)	0.80	0.88	0.59	1.66	1.45	1.32	0.002	0.001	0.001	0.002	0.0021	0.0014	0.27	0.30	0.20	0.37	0.26	0.26
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	5.78	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	12.00	11.10	8.15	24.88	21.92	19.83	10.97	7.60	5.80	23.81	22.88	19.72	12.81	19.24	11.76	27.10	20.10	19.80

Table 2. Effect of crop establishment methods and hybrid varieties on grain yield, straw yield and harvest index of rice

Treatments	Grain yield (kg/ha)			Straw yield (kg/ha)			Harvest index %		
	2014	2015	P.M.	2014	2015	P.M.	2014	2015	P.M.
Crop Establishment methods									
SRI	6361.80	6560.20	6461.00	7175.42	7490.814	7333.18	46.95	46.67	46.81
Conventional	5330.03	5351.52	5340.77	6284.06	6397.61	6340.84	45.96	45.56	45.76
S.Em(±)	126.34	118.20	99.47	154.98	118.91	108.15	0.90	0.70	0.68
CD at 5%	383.19	358.51	301.70	470.08	360.68	328.05	2.75	2.09	2.07
Varieties									
TEJ	6034.66	6109.23	6071.94	6813.63	7156.093	6984.86	46.86	46.00	46.43
NK 6302	5816.54	5894.77	5855.66	6781.62	7017.69	6899.68	46.15	45.56	45.85
RAJALAXMI	5858.17	5976.37	5917.27	6685.68	6805.57	6745.63	46.74	46.64	46.70
AJAY	5674.29	5843.08	5758.68	6637.98	6797.50	6717.76	46.07	46.24	46.17
S.Em(±)	178.67	167.16	140.67	219.18	168.17	152.95	1.28	1.00	0.96
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
A X B interaction									
S.Em(±)	252.68	236.40	198.94	310.00	237.83	216.31	1.81	1.38	1.37
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	7.48	6.87	5.83	7.98	5.93	5.48	6.76	5.18	5.12

and practices. The observations were recorded on crop growth rate, relative growth rate, net assimilation ratio, grain yield, straw yield and harvest index of rice and were analyzed statistically.

RESULTS AND DISCUSSIONS

Crop Growth Rate (CGR)

The crop growth rate was found significantly higher in case of SRI method of crop establishment than that of conventional method of crop establishment in both the years at 30- 45 DAT and at 60-75 DAT. The pooled mean value was also found significantly higher in case of SRI method of crop establishment. Singh *et al*. (2008) reported on similar lines stating that tillers m^{-2}, LAI, dry matter production and CGR are all inter-dependent factors. Among the varieties, crop growth rate of Tej variety was found significantly higher at 30-45 DAT during the year 2015 than that of other varieties. But at 60-75 DAT, though the value of CGR was higher in case of Tej variety in both the years, yet there was no significant difference among the varieties. The value of pooled mean was found higher in case of Tej variety among all the varieties. Siddiq *et al.,* 1996 and Wang *et al.,* 2002 reported high crop growth rate during vegetative periods encouraged tillering, and LAI development that helped in maintaining higher crop growth rate during reproductive period leading to greater spikelet formation grain development and high crop productivity.

Relative Growth Rate (RGR)

No significant difference was found in RGR value in between the crop establishment methods but the growth rate was found higher in case of SRI method of crop establishment. In case of pooled mean value, a significant difference was observed at 30-45 DAT in between the crop establishment techniques. Among the varieties, no such significant difference was found during both the years in case of RGR.

Net Assimilation Ratio (NAR)

The NAR value of rice plants grown under SRI method of crop establishment technique was found significantly higher in both the years than that of conventional technique. In case of pooled mean, same trend was observed in crop establishment techniques. Similar finding was found by Devasenamma *et al*. (1999). Among the varieties, NAR value was found higher in case of Tej variety at 30-45 DAT during both the years but there was no significant difference among the varieties. But at 60-75 DAT, the value of NAR was found higher in case of variety NK6302 than that of other varieties.

Grain yield (kg/ha)

Grain yield was found significantly higher in case of SRI method of crop establishment technique than that of conventional technique in both the years. The pooled mean value was also found to be higher in case of SRI technique than that of conventional method. Budhar *et al*. (2006), Narendra Pandey and Om Prakash (2007) also suggested improved soil quality, stronger root and canopy growth with increased grain yield 7). Among the varieties, Tej variety gave highest grain yield than that of other varieties but there was no significant difference among them. The pooled mean value of grain yield was also higher in case of Tej variety. Nissanka and Bandara (2004) reported that grain yield was in the SRI technique greater than the traditional transplanting.

Straw yield (kg/ha)

Straw yield also followed the same trend as that of grain yield. SRI method recorded higher straw yield than that of conventional technique of crop establishment and there was significant difference between the crop establishment techniques. The pooled mean value of straw yield was also higher in SRI method of crop establishment technique than that of conventional method. Husain *et al*. (2003) found higher straw yield in SRI technique compared to traditional technique. Among the varieties, Tej variety gave highest straw yield than that of other varieties but there was no significant difference among them. The pooled mean value of straw yield was also higher in case of Tej variety.

Harvest Index (%)

The harvest index of rice plants grown under SRI method of crop establishment technique was significantly higher than that of conventional method in both the years. The pooled mean value of harvest index also followed the same trend. Yoshida, (1981), reported that Efficient assimilate supply to the grain from the source and the capacity of the sink to receive it determines the higher yield and these processes depend highly upon varietal feature, environmental conditions and management factors. Tej variety has the highest harvest index value in 2014 among the varieties but in 2015 Rajalaxmi variety showed the higher value in harvest index. Also the pooled mean value of harvest index was found higher in case of Rajalaxmi variety. Uphoff., (2004) reported that rice hybrids produced around 15 t ha^{-1} while HYV's had a yield potential of 6.2 t ha^{-1} of grain when grown under SRI in Madagascar.

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