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Effect of different system of rice intensification on yield, water requirement and water use efficiency

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ABSTRACT

A field experiment was conducted at Agricultural Research Station, Siruguppa,Karnataka, during the *Kharif*, 2005 to study the influence of age of seedlings under different system of rice intensification. Modified SRI method recorded significantly higher grain yield (6342 kg ha^{-1}) and straw yield (7233 kg ha^{-1}) over normal method of planting (5105 and 6180 kg ha^{-1} grain and straw yield, respectively). In present study water requirement was maximum in normal method of planting (124.96 cm) as compared to SRI methods (84.96 cm). While the water use efficiency was higher in modified SRI method (74.66 kg ha^{-1} cm^{-1}) closely followed by recommended SRI method (73.13 kg ha^{-1} cm^{-1}) which were significantly superior over normal SRI method (40.85 kg ha^{-1} cm^{-1}).

Key words : Rice intensification, Water requirement, Water use efficiency, SRI method

INTRODUCTION

Rice (*Oryza sativa*) is an important food crop of the world. With the growing world population, paddy production has to be increased to 810 million tones by the year 2025 (Rosegrant *et al*.,1995). Similarly Indian rice production has to be stepped up to 140 million tones (Mishra, 2004). Increasing the production and productivity of rice with decreasing land and water resources is a herculean task. Agriculture accounts for 80 per cent of the total water consumption in India and about 60 per cent is consumed by paddy alone. Traditionally flooding method of irrigation is used for growing paddy with 2-3 centimetres of water on the field throughout the growing period. Paddy fields are allowed to dry-up only before the harvesting. This practice of irrigation results in large scale evaporation losses and low water use efficiency. In Karnataka, the crop is being grown over an area of 1.45 million hectare with a production and productivity of 3.72 million tonnes and 2699 kg/ha, respectively (Anonymous, 2002) and the productivity is low when compared to developed countries. Appropriate method of planting together with a suitable high yielding variety should be adopted for commercial cultivation to increase the production and productivity.

MATERIALS AND METHODS

A field experiment was carried out during the *Kharif,* 2005 (one year study) at Agricultural Research Station, Siruguppa. The soil was deep black clay in texture, pH (8.22) and low in electrical conductivity (0.28 ds/m). It was low in available nitrogen (265 kg ha^{-1}), high in available phosphorus (30.5 kg ha^{-1}) and medium in available potassium content (365 kg ha^{-1}). There were 15 treatment combinations comprising of three methods of planting (M_1- Normal method, M_2- Recommended SRI method, M_3- Modified SRI method)as main treatments and five age of seedlings (9, 12, 15, 18 and 21 days) as sub treatments and were laid out in split plot design with three replications. The gross plot size was 4 m x 3 m. IET-16933 was used as test variety. The spacing followed was 20 cm x 10 cm (M_1), 25 cm x 25 cm (M_2 and M_3). The crop received a fertilizer dose of 150:75:75 kg NPK ha^{-1}. Full dose of P_2O_5 and K_2O and 50 per cent of nitrogen was applied at the time of transplanting and remaining 50 per cent of nitrogen was applied in two equal splits at 30 and 55 days after transplanting. All the recommended cultivation practices were followed. The crop was harvested after attaining physiological maturity.

RESULTS AND DISCUSSION

The grain yield of rice was significantly higher with modified SRI method (6342 kg ha^{-1}) followed by recommended SRI method (6213 kg ha^{-1}) over the normal method of planting (5105 kg ha^{-1}). This may be attributed to wider spacing, optimum water and sufficient nutrient in root zone to support the tillering. This inturn helped in conversion of more of tillers into panicles. Thus, owing to the integration of all favourable yield components *viz.* number of grains per panicle, panicle length, test weight,

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number of panicles per hill.

Crop grown with 9 and 12 days old seedlings recorded significant higher grain yield of 6071 and 6018 kg ha^{-1}, respectively, over the rest of the treatments. These results are in conformity with the findings of Norman Uphoff (1999) and Caraga (2002). Nine and twelve days old seedlings increased the number of tillers, number of panicles, number of grains per panicle and boldness of seeds thereby increased the 1000 seed weight and also under the planting of 9 and 12 day seedlings the sterility percentage was reduced. This may be due to the fact that seedlings of early age had higher vigour and had greater capacity to absorb soil nutrients to fill higher number of spikelets efficiently (Andrainaivo, 2002)

The decrease in the tiller number with old seedlings (15, 18 and 21days) might be due to concomitant effect on establishment of crop, lesser tillering period and crop duration in the main field when compared with planting of 9 and 21 days old seedlings. The straw yield observed had similar trend to that of grain yield.

Water requirement:

In SRI method of rice cultivation, generally alternate wetting and drying method was followed. This brought down the water requirement by 47 per cent over normal method. In present study water requirement was maximum in normal method of planting (124.96 cm) when compared to SRI methods (84.96 cm). While the water

Table 1 : Grain yield and straw yield as influenced by methods of planting and age of seedlings

Treatments	Grain yield (kg ha^{-1})						Straw yield (kg ha^{-1})					
	S_1	S_2	S_3	S_4	S_5	Mean	S_1	S_2	S_3	S_4	S_5	Mean
M_1	5397	5327	4997	4910	4893	5105	6433	6263	5990	5950	5903	6108
M_2	6377	6313	6153	6143	6080	6213	7240	7216	7093	7100	7073	7144
M_3	6440	6416	6226	6260	6370	6342	7383	7327	7143	7140	7173	7233
Mean	6071	6018	5792	5771	5781		7019	6935	6742	6730	6716	
			S.E.±		C.D. (P=0.05)			S.E.±			C.D. (P=0.05)	
Main treatments (M)			3.9		15.3			5.1			20.2	
Sub treatments (s)			5.2		15.2			5.4			15.9	
S at same M			9.0		NS			9.4			NS	
M at same or different S			8.9		NS			9.9			NS	

M_1 – Normal method (Application of RDF through inorganics with FYM @ 10 t ha^{-1} and transplanting at 20 cm x 10 cm spacing)
M_2 – Recommended SRI (Application of RDN through organics and transplanting at 25 cm x 25 cm spacing)
M_3 – Modified SRI (Application of RDF through inorganics with FYM @ 10 t ha^{-1} and transplanting at 25 cm x 25 cm spacing)
S_1 – 9 Days old seedlings, S_2 – 12 Days old seedlings, S_3 – 15 Days old seedlings, S_4 – 18 Days old seedlings,
S_5 – 21 Days old seedlings, DAT – Days after transplanting , NS-Non significant

Table 2 : Water requirement, and water use efficiency as influenced by methods of planting and age of seedlings

Treatments	Water requirement (cm)						Water use efficiency (kg ha^{-1}cm^{-1})					
	S_1	S_2	S_3	S_4	S_5	Mean	S_1	S_2	S_3	S_4	S_5	Mean
M_1	124.96	124.96	124.96	124.96	124.96	124.96	43.18	42.62	39.98	39.29	39.16	40.85
M_2	84.96	84.96	84.96	84.96	84.96	84.96	75.05	74.31	72.43	72.31	71.56	73.13
M_3	84.96	84.96	84.96	84.96	84.96	84.96	75.80	75.52	73.28	73.68	74.98	74.66
Mean	98.29	98.29	98.29	98.29	98.29		64.68	64.15	61.90	61.76	61.90	
								S.E.±			C.D. (P=0.05)	
Main treatments (M)								0.30			1.19	
Sub treatments (s)								0.53			1.56	
S at same M								0.92			NS	
M at same or different S								0.88			NS	

M_1 – Normal method (Application of RDF through inorganics with FYM @ 10 t ha^{-1} and transplanting at 20 cm x 10 cm spacing)
M_2 – Recommended SRI (Application of RDN through organics and transplanting at 25 cm x 25 cm spacing)
M_3 – Modified SRI (Application of RDF through inorganics with FYM @ 10 t ha^{-1} and transplanting at 25 cm x 25 cm spacing)
S_1 – 9 Days old seedlings, S_2 – 12 Days old seedlings, S_3 – 15 Days old seedlings, S_4 – 18 Days old seedlings,
S_5 – 21 Days old seedlings, DAT – Days after transplanting , NS-Non significant

use efficiency was higher in modified SRI method (74.66 kg ha^{-1} cm^{-1}) closely followed by recommended SRI method (73.13 kg ha^{-1} cm^{-1}) and these were significantly superior over normal SRI method (40.85 kg ha^{-1} cm^{-1}).

Thus, modified SRI method and recommended SRI method here lowered water requirement and higher water use efficiencies when compared to normal method, these results are in conformity with the findings of Thiygarajan (2003).

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