

On-farm evaluation of low input rice production system under tank-fed system

R SARITHA and M SRINIVAS

Agricultural Polytechnic, Regional Agricultural Research Station (ANGRAU)

Anakapalle, Visakhapatnam 531001 Andhra Pradesh, India

Email for correspondence: saritha.routu@gmail.com

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ABSTRACT

Low input water saving rice production system was evaluated in the fields of farmers in different Mandals of Visakhapatnam district under District Agro-Advisory and Transfer of Technology Centre. The trials were taken up in well- and tank-irrigated red clayey loams during Kharif season for three consecutive years. System of rice intensification (SRI) recorded more tillers (44.2/m²), higher number of grains per panicle (252.2) and higher grain yield (6540.7 kg/ha) compared to other farmers practicing flood irrigation where the number of productive tillers was 22.4/m, grains per panicle were 195.0 and the yield recorded was 5420.3 kg/ha. On account of water saving too SRI consumed less water (977.0 mm) compared to farmers' practice (1332.0 mm). The water use efficiency in SRI was 6.7 kg/ha/mm which was much higher compared to flood irrigation (4.1 kg/ha/mm). These advantages were reflected in B-C ratio which was higher in SRI (2.05) compared to farmers' practice of rice cultivated under flood irrigation (1.72). Statistically significant and consistent results at different locations over a period of three years proved the advantage of SRI method over flood irrigation in terms of yield and water saving.

Keywords: On-farm evaluation; low input rice; SRI; water saving

INTRODUCTION

In Visakhapatnam district rice is mainly grown under wells and tanks. The level of water in those wells and tanks mostly depends upon the quantum of rainfall before and during the crop season and it is a normal pattern that the crop suffers due to insufficient water especially at critical stages. The present study was undertaken to evaluate the comparative advantages of system of rice intensification (SRI) method over conventional practice of flood irrigation in rice.

MATERIAL and METHODS

Nine on-farm trials were conducted in the fields of farmers of Munagapaka, Yelamanchili, Achyutapuram, Parwada, Bheemili and Chodavaram Mandals of Visakhapatnam district, Andhra Pradesh during Kharif 2009-10, 2010-11 and 2011-12. The soils were red clayey loams with pH of 6.5-8.0, low in nitrogen with phosphorus being low to medium and medium to high in available potassium. At each experimental location two treatments one being SRI

method and the other being farmers' practice of flood irrigation in rice cultivation were made. The cultivated area of each treatment was 2000 m² and the total experimental area was 4000 m² at each location. The rice variety RGL2537 was cultivated at all the locations.

In SRI raised bed nursery was sown with seed rate of 5 kg/ha. Pre-germinated seeds were broadcast uniformly on nursery beds. After broadcasting the seed mixture of soil and FYM (1:1) was spread as a thin layer of one centimeter to cover the seed. The beds were irrigated with a rose can twice a day in the morning and evening. Twelve-day old seedlings were carefully transplanted in the main field in square pattern with spacing of 25 x 25 cm with single seedling per hill.

In farmers' practice seed was broadcast in a normal flat bed nursery at the rate of 50 kg/ha and transplanted after 30 days of sowing at a spacing of 15 x 15 cm with approximately three to four seedlings per hill.

In both the treatments the main field was prepared by ploughing twice followed by thorough puddling. The fertilizers N, P₂O₅ and K₂O @ 180:60:40 kg/ha were applied. The entire phosphorus and half of the recommended potassium were applied as basal dose during transplanting and another half of recommended potassium was applied during panicle initiation stage. Nitrogen was applied in three equal splits as basal, at active tillering and at panicle initiation stage. In SRI the field was irrigated just enough to saturate the soil with moisture. Subsequent irrigations were given when fine cracks were seen in the field during vegetative phase. From panicle initiation to grain hardening a thin film of water was maintained continuously by frequent irrigations. However in farmers' practice of flood irrigation standing water of 2 cm was maintained up to maximum tillering and 5 cm from panicle initiation to grain hardening. Irrigation water was measured by Parshall flumes. Pre-emergence herbicide oxadiargyl (90 g/ha) mixed with sand was applied immediately three days after transplanting in farmers' practice of flood irrigation. In SRI starting from fifteen days after transplantation cono weeder was operated thrice at a fifteen days interval. Plant protection was done as per the requirement. Data on crop yield parameters, yield, rainfall and irrigation water given were recorded. The data were subjected to paired T-test to assess the statistical validity (Gomez and Gomez 1984). The costs, returns and benefit-cost ratio were also calculated.

RESULTS and DISCUSSION

SRI performed better on all the parameters consistently during the three years of study compared to farmers' practice of flood irrigation (Table 1). The number of productive tillers/m² were 44.2 in SRI which was higher than that recorded in farmers' practice of flood irrigation (22.4 tillers/m²). Similarly more number of grains per panicle was recorded in SRI method (252.2) compared to farmers practice (195). These factors in turn resulted in contributing higher grain yield in SRI (6540.7 kg/ha) which was 20.7 per cent higher than yield recorded in farmers' practice (5420.3 kg/ha). Early transplanting in SRI contributes to less transplantation shock and quicker establishment. Wider spacing and running of cono weeder might have lead to better rooting and proper aeration resulting in production of more tillers. These factors in turn contributed more number of filled grains per panicle and thus higher yield over conventional farmers' practice. Similar findings have been reported by Yamah (2002), Subbarao et al (2009) and Pasha et al (2012).

Table 1. Yield parameters and yield in low input SRI compared to flood irrigation

Production Technique	Productive tillers/m ²					Number of grains/panicle					Grain yield (kg/ha)				
	1 st year	2 nd year	3 rd year	Mean	T-value (T _{tab} = 2.91)	1 st year	2 nd year	3 rd year	Mean	T-value (T _{tab} = 2.87)	1 st year	2 nd year	3 rd year	Mean	T-value (T _{tab} = 2.76)
System of rice intensification	48.3	47.3	37.0	44.2	4.03	255.6	270.0	231.0	252.2	4.01	7187.0	7822.0	4613.0	6540.7	3.92
Farmers' practice (flood irrigation)	25.6	21.6	20.0	22.4		213.0	216.6	156.0	195.0		5625.0	6463.0	4173.0	5420.3	

Utilization of water was also less in SRI (977 mm/ha) compared to flood irrigation adopted by farmers (1332 mm/ha) (Table 2). SRI had a better water use efficiency of 6.7 kg/ha/mm compared to farmers' practice of flood irrigation (4.1 kg/ha/mm). Water saving in SRI was about 36 per cent. According to Pasha et al (2012) SRI resulted in water saving up to 38 per cent. Similarly Subbarao et al (2009) reported 47 per cent water saving in SRI than farmers' practice.

A comparison of costs and returns between SRI and conventional method of flood irrigation was

also made (Table 3). The operational cost for SRI was Rs 28100 per ha which was less compared to the cost incurred in farmers' practice (Rs 30303/ha). The higher yield achieved in SRI was reflected in higher returns (Rs 57403/ha) compared to farmers' practice (Rs 52011/ha). The benefit-cost ratio recorded for SRI was 2.05 whereas it was 1.72 in farmers' practice. Pasha et al (2012) and Rama Rao (2011) also observed similar findings.

It is evident that there were three main advantages of adopting SRI viz reduction in operational

Table 2. Water use and water use efficiency in low input SRI compared to flood irrigation

Production technique	Water use (mm)					Water use efficiency (kg/ha/mm)				
	1 st year	2 nd year	3 rd year	Mean	T-value (T _{tab} = 2.79)	1 st year	2 nd year	3 rd year	Mean	T-value (T _{tab} = 2.92)
System of rice intensification	963	996	972	977.0	3.98	7.5	7.9	4.7	6.7	4.02
Farmers' practice (flood irrigation)	1320	1345	1331	1332.0		4.5	4.8	3.1	4.1	

Table 3. Economics of low input SRI compared to flood irrigation

Production technique	Operational costs (Rs)				Total returns (Rs)				B:C ratio			
	1 st year	2 nd year	3 rd year	Mean	1 st year	2 nd year	3 rd year	Mean	1 st year	2 nd year	3 rd year	Mean
System of rice intensification	26450	27350	30500	28100	56075	61540	54594	57403	2.12	2.25	1.79	2.05
Farmers' practice (flood irrigation)	28734	29825	32350	30303	54595	55176	46262	52011	1.90	1.84	1.43	1.72

cost, saving of water as well as higher returns thus manifesting SRI as more viable alternative for conventional method of rice cultivation in Visakhapatnam district.

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