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Effect of System of Rice Intensification (SRI) on Quality Seed Production in Rice (*Oryza sativa* L.)

K Kanaka Durga, V Bharathi, L V Subba Rao, V R K Murthy and N V Naidu

Seed Research and Technology Centre, Rajendranagar, Hyderabad -500 030, Telangana State

ABSTRACT

Studies on the effect of system of rice intensification of seven rice varieties on quality and productivity was conducted at Seed Research and Technology Centre, Hyderabad during *Rabi,* 2011-12 in comparison with traditional method of seed production. Significant differences were observed among the management practices for yield and yield components. Fourteen per cent yield improvement was noticed with SRI (60.42 q ha^{-1}) over traditional method (53.01 q ha^{-1}). Similarly, 64.29 per cent improvement in productive tillers and 12 per cent improvement in spikelet fertility were noticed with SRI method of cultivation. Among the varieties, MTU 1010 had high potential (76.99 q ha^{-1}) for seed production under SRI besides higher seedling vigour index (1742). The plants in SRI method had high partitioning of dry matter resulting in high density spikelets per panicle (80.3) and higher spikelet fertility (94%). Seed produced under SRI showed significantly higher seedling vigour index I (1450) compared to traditional method (1359) of planting. SRI method with 10-12 days old seedlings, three weedings with cono weeder at 45, 60 and 75 DAS under saturated conditions of water during the entire crop growth period was found to be effective over the traditional method.

Key words: *Seed yield and Seed quality, SRI.*

SRI method of cultivation was said to be useful in producing more seed and also quality seed in rice without depletion of soil nutrients (Kumar *et al.*, 2013**)**. System of rice cultivation (SRI) developed in Madagascar in 1980's, has spread in three years to more than 15 other countries in Asia, Africa and Latin America. Besides increase in rice production under SRI, reduction in cost of production and seed cost and water is the added advantage **(**Ceesay, 2011). In traditional method of cultivation, 25-30 days old seedlings are transplanted for seed production. Innovative soil water – crop management practices results in better phenotypic expression under SRI (Sridevi *et al*. (2011). Phenotypic expression of a plant varies due to G x E interactions (Anas *et al.,* 2011). Hence, there is ample scope for increasing the production of rice by modifying the microclimate. The change in soil ecosystem micro climate may trigger root growth, microbial activity and shoot growth and increase yield component In the present investigation, SRI method was employed to produce quality of seed with resource conservation.

MATERIAL AND METHODS

The present investigation on "Effect of System of Rice Intensification (SRI) on Quality Seed Production in Rice (*Oryza sativa* L.)" was laid out at Seed Research and Technology Centre, Rajendranagar, Hyderabad during *rabi,* 2011–12. The experiment was laid out in a split plot design replicated thrice with both methods of cultivation (SRI and traditional method) as main treatments and seven promising cultivars of rice varieties (MTU 1001, MTU 1010, MTU 7029, BPT 5204, RNR M7, JGL 1798 and RP Bio 226) as sub treatments. All the recommended agronomic practices and plant protection measures were followed as per the recommended schedule. Data were recorded for yield attributing characters like plant height, number of productive tillers / hill, panicle length (cm), per cent spikelet fertility, high density spikelets / panicle, grain yield (q/ha) and test weight (g). Data on seed quality characters v*iz.,* germination, root length, shoot length, total seedling length and seedling vigour index I on length basis were also recorded. Germination percentage was assessed using between paper method of testing

(ISTA, 1985). Three hundred seeds in each replication were selected at random and placed between two layers of rolled paper towels and kept in walk-in germinator in upright position (ISTA, 1985). Normal seedlings were counted and expressed as germination percentage.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds plated}} \times 100$$

Seedling vigour index (SVI) was calculated using the formula formulated by Abdul-Baki and Anderson (1973).

SVI – I (on length basis) = Average seedling length x G %

Mean data were computed and analysis of variance was done as per the procedure suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Significant variation was observed between both methods of planting for plant height and other characters. Grain yield is a complex product of a number of yield attributing traits. SRI method (60.42 q ha^{-1}) resulted in 14 per cent yield increase over the traditional method (53.01 q ha^{-1}) of planting and was found significantly superior (Table 1). In the present study, taller plants were observed with SRI method of cultivation (74.0 cm) compared to traditional planting (67.0 cm). JGL 1798 (89.0 cm) and MTU 1001 (78.6 cm) produced taller plants under SRI method of planting whereas RP Bio 226 produced short statured plants in both traditional and SRI (57.4 cm and 67.1 cm, respectively) methods of planting. In SRI method of cultivation, better tillering ability over traditional method was observed (64.29 per cent). Planting in square method with wider spacing of 25 x 25 cm with better utilization of resources (Kumar *et al*., 2013) under SRI cultivation might have resulted in profuse tillering (Raj *et. al*., 2008). The increase in the productive tillers might be due to higher levels of enzyme activity in SRI plants rhizosphere and microbial activity (Anas *et al*., 2011).

Panicle length, number of panicles/hill, total number of grains/panicle were significantly high in the SRI compared to traditional method.

All the varieties recorded more number of productive tillers/hill in SRI method of cultivation in contrast to traditional method of planting indicating that the varieties showed differential response for productive tillers production. RNR M7 recorded more number of productive tillers / hill (22.1). While, JGL 1798 (16.2) and BPT 5204 (16.4) recorded less number of tillers / hill. However, BPT 5204 produced less number of productive tillers/hill both in traditional (9.1) and SRI (16.4) method of planting and was significantly different from other varieties. The increase in the productive tillers in other varieties compared to BPT 5204 might be due to favourable micro-climate and more light intensity. This might have facilitated better utilization of resources by the plants and in production of more number of productive tillers (Gani *et al*., 2002; Sarath and Tilak, 2004).

Length of the panicle was not much influenced due to the methods of cultivation. Among the varieties, MTU 1010 (20.4 and 22.9), JGL 1798 (22.0) and MTU 1001 (22.1 and 21.9) recorded higher panicle length in both traditional as well as SRI methods of cultivation

SRI method has recorded significantly higher grain yield (60.42 q/ha) as compared to the traditional method (53.01 q/ha). The per cent increase in grain yield/ha under SRI method was 14 % over traditional method. Similar results were recorded by Krupakar Reddy (2004), Uday Kumar (2005) and Krishna *et al*. (2008). Irrespective of upland or low land cultivation SRI method was found to improve rice yields in the coastal delta region by 1.2 t/ha, while in the interior Rayalseema region, the yield advantage with SRI management was 4.7 t/ha (Satyanarayana *et al.,* 2007). SRI method produced 0.68 g of rice/kilogram of water, while traditional practice produced 0.36 g (Thakur *et al.*, 2011). Highest grain yield was observed in MTU 1010 with SRI (76.99 q/ha) than traditional (65.05 q/ha) method of planting. SRI method provides better aeration, more spacing and less competition. The plants in SRI method had better partitioning of dry matter, which led to increase in the number of high density spikelets (80.3)/panicle and spikelet fertility per cent (94). Further, SRI method of cultivation did not show any significant effect on test weight of rice varieties.

Table 1. Grain yield and yield component characters for different varieties of rice under traditional vs. SRI planting.

Treatments	Plant height (cm)		Productive tillers/hill		Panicle length (cm)		Spikelet fertility (%)		Grain yield (q/ha)		Test weight (g)		Density of spike-lets/panicle	
	T.M.	SRI	T.M.	SRI	T.M.	SRI	T.M.	SRI	T.M.	SRI	T.M.	SRI	T.M.	SRI
BPT 5204	61.5	69.8	9.1	16.4	19.8	21.3	75.0	86.3	46.62	52.40	1.31	1.44	69.7	76.0
MTU 7029	65.8	72.3	12.2	19.2	19.2	20.7	76.1	77.1	54.60	58.11	1.63	1.65	67.3	68.0
MTU 1010	65.6	71.1	11.7	20.7	20.4	22.9	78.8	89.9	65.05	76.99	2.21	2.11	74.3	80.3
MTU 1001	76.4	78.6	11.9	17.3	22.1	21.9	82.7	94.0	54.42	64.85	2.01	2.11	66.7	72.3
RP Bio 226	57.4	67.1	12.0	20.5	18.5	19.8	72.9	82.1	49.16	60.38	1.18	1.12	65.0	72.0
JGL 1798	74.8	89.0	12.3	16.2	22.0	22.0	76.3	89.7	50.91	55.43	1.14	1.20	68.0	72.7
RNR M 7	67.6	70.4	11.4	22.1	21.0	19.0	73.9	81.6	50.30	54.76	1.20	1.11	65.7	67.3
Mean	67.01	74.04	11.51	18.90	20.43	20.86	76.59	85.80	53.01	60.42	1.53	1.53	68.10	72.66
C.D. (5%) – M				0.70		NS		4.52		1.79				
C.D. (5%) – S				1.30		1.38		NS		3.34				
C.D. (5%) - I				2.19		2.33		NS		5.63				
C. V (%)				7.20		5.64		8.77		4.96				

T.M.: Traditional method SRI: System of Rice Intensification

Seed quality is maintained in SRI as the insect pest and disease incidence at grain formation stage is less (Chaudhary *et al.*, 2013) compared to traditional method of cultivation (Sridevi *et al.*, 2011).

Seed quality characters *viz.,* germination and seedling vigour also play an important role in adjudging the quality of seed. The differences were not significant for germination, shoot length, total seedling length and seedling vigor index between the methods of cultivation (Table 2). However, root length differed significantly in both the methods of cultivation. Rice varieties showed varied response for seed quality characters in both the methods of cultivation. The variety, MTU 1010 showed high seedling vigour in both the methods of cultivation *viz.,* SRI (1712) and traditional method (1698), respectively. Higher seedling vigour index in SRI method might be due to application of farm yard manure and incorporation of green matter (weeds) which inturn favours C:N ratio in soil and microbial population (Krishna *et al.,* 2008).

Root length did not differ with both the methods of cultivation. MTU 1010 showed higher shoot length (5.7 cm), total seedling length (17.6 cm) and seedling vigour index I (1742) in traditional method of planting.

CONCLUSION

Among the two management practices 14 per cent improvement in yield was noticed with SRI (60.42 q/ha) over conventional method (53.01 q/ha). Similarly, 64.29 per cent improvement in productive tillers and 12 per cent improvement in spikelet fertility were noticed with SRI. Among the varieties, MTU 1010 had great potential for seed production under SRI followed by MTU 1001 and MTU 7029 with respect to yield both under conventional as well as SRI methods of seed production. Seed obtained by SRI method recorded superior germination (100%) and seedling vigour index I (1450) as

Table 2. Seed quality characters for different varieties of rice under traditional vs. SRI planting.

Treatments	Germination (%)		Root length (cm)		Shoot length (cm)		Total seedling length (cm)		Seedling Vigour Index I	
	T.M.	SRI	T.M.	SRI	T.M.	SRI	T.M.	SRI	T.M.	SRI
BPT 5204	94.8	100	6.9	8.27	3.7	4.2	10.6	12.4	1006	1243
MTU 7029	98.6	100	12.1	12.21	4.5	4.4	16.6	16.6	1638	1657
MTU 1010	98.8	100	11.9	11.62	5.7	4.9	17.6	16.5	1742	1698
MTU 1001	97.4	100	11.6	10.88	3.9	4.1	15.5	15.0	1514	1496
RP Bio 226	99.1	100	7.3	9.70	3.9	4.0	11.2	13.7	1111	1367
JGL 1798	98.3	100	9.0	9.30	4.1	3.7	13.2	13.0	1296	1298
RNR M 7	99.1	100	8.0	9.85	3.9	3.9	11.9	13.8	1178	1379
Mean	98.0	100	9.54	10.26	4.26	4.18	13.81	14.50	1359	1450
C.D. (5%) -M		NS		0.47		NS		0.85		101.56
C.D. (5%) -S		NS		0.67		0.39		0.93		56.44
C.D. (5%) -I		NS		0.67		0.39		0.93		56.44
C. V (%)		1.3		4.00		5.50		3.90		2.40

T.M.: Traditional method SRI: System of Rice Intensification

compared to the control (98% and 1359, respectively). Therefore under SRI method, use of 10-12 days old seedlings, 3 weedings with cono weeder at 45, 60 and 75 DAS and maintaining saturated conditions of water during the entire crop growth period was found to be effective over the conventional method. The increase in yield in SRI plants is due to rhizosphere and microbial activity with high C & N ratio which improves the nutrient pool from soil to both plants and microbes.

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