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Influence of Crop Establishment Techniques on Growth and Yield of Rice

N. Senthil kumar*
Tamil Nadu Agricultural University
Agricultural Research Station, Thirupathisaram-629 901

Field experiments were conducted at Agricultural Research Station, Thirupathisaram, Tamil Nadu during *kharif* and *rabi* of 2011-12 to study the different establishment techniques on growth and yield of rice. The experiment was laid out in a randomized block design with four replications. The treatment structure comprises of wet seeding, drum seeding, random transplanting, line planting, SRI square planting and SRI machine planting. Among the different crop establishment techniques, SRI machine planting significantly influenced the growth and yield characters and yield and was on par with SRI square planting. The maximum plant height, number of tillers, number of panicles/m_2, number of grains/panicle, panicle length, grain yield, straw yield, gross return, net returns and BC ratio were recorded under SRI machine planting during *kharif* and *rabi*. The lowest grain yield, straw yield, gross return, net returns and BC ratio were recorded under wet seeding during both *kharif* and *rabi*.

Key words : Rice, establishment techniques, SRI, yield, economics

Rice is one of the most important cereal crops, which plays a key role for food security. In India, rice is cultivated in an area of 44.1 m ha with a production of 103.4 million tones (USDA, 2012). The country has to produce about 130 million tones of rice by 2025 to meet the food requirement of the ever growing population (Hugar *et al*., 2009). Meeting the targeted demands of rice is a challenging task. Increasing water scarcity is becoming real threat for rice cultivation. Hence water saving technology which also maintains soil health and sustainability and as well as economically beneficial needs to be developed (Uphoff and Erick Fernandes, 2002). Manual transplanting is the most common practice of rice cultivation in south and south-east Asia. In recent years water table is running down at a very rapid rate throughout the globe, thus sending an alarming threat and limiting the scope for cultivation of high water requiring crops very seriously. Rice being a crop having high water requirement, there is a need to search for alternative methods to reduce water requirement of rice without reduction in yield. Establishment techniques, plant density, nutrient requirement and management, water management etc., need to be standardized to achieve the reported yield potential of rice under different duration in various environments. Method of establishment is one of the cultural practices, which influences the rice crop through its effect on growth and development (Gopi *et al*., 2006). In recent years, the area under rice crop is decreasing year by year due to less profitability. Non availability of irrigation water and shortage of labour during peak periods, increased labour wages make transplanting and manual weeding costly, invariably causing delays in farm operations. Because of the need to develop appropriate crop establishment methods to improve rice yield, this study was undertaken to assess the effect of different establishment methods on rice productivity.

*Corresponding author

Materials and Methods

Field experiments were conducted during *kharif* (June-Sep) and *rabi* (Oct-Mar) of 2011-12 at Agricultural Research Station, Thirupathisaram, Tamil Nadu with the aim of sustaining rice production under different crop establishment methods. The experiment was laid out in a randomized block design with four replications. The treatment structure comprised of wet seeding, drum seeding, random transplanting, line planting, SRI square planting and SRI machine planting. The variety ASD 16 and TPS 3 were used for *kharif* (May-Sep) and and *rabi* (Oct-Mar) seasons, respectively. Regarding drum seeding and wet seeding soaked seeds were used for sowing. With respect to random and line planting, 21-24 days old seedlings were used for transplanting. For SRI manual and machine planting, seedlings of 14 and 18 days raised under mat nursery were used for transplanting. The growth, yield characters, grain and straw yield were recorded and economics was worked out.

Results and Discussion

Growth characters

SRI system of planting influenced the plant height and number of tillers (Table 1). SRI machine planting

Table 1. Effect of different establishment methods on growth characters of rice ASD 16 and TPS 3 during 2011-12

Treatment	Plant height (cm)		Number of tillers/hill	
	kharif	*rabi*	*kharif*	*rabi*
Wet seeding	84.0	80.4	10	9
Drum seeding	87.1	86.0	14	12
Random planting	92.2	89.3	19	15
Line planting	95.1	93.6	22	19
SRI Square Planting	99.7	98.0	27	24
SRI Machine planting	101.0	100.0	28	26
SEd	1.2	1.0	0.9	1.1
CD (P=0.05)	2.4	2.2	2.0	2.3

recorded significantly higher growth characters and was on par with SRI square planting. Higher plant height (101 and 100 cm), number of tillers (28 and 26) were recorded in SRI machine planting. There was a progressive increase in plant height and number of tillers under SRI system of planting when compared to random transplanting and other establishment techniques. The transplanting of younger seedlings in SRI method might have established quickly in the field and started growing at a faster rate leading to higher plant height (Krishna *et al*., 2008) . The number of tillers per plant was significantly higher in SRI method of cultivation. Planting in square method with wider spacing might have resulted in profused tillering under SRI cultivation, which might have facilitated plants for better utilization of the resources. This advantage of SRI method in enhancing tiller numbers has been reported earlier by Udaykumar (2005).

Yield characters and Yield

SRI system of planting had significantly influenced the yield characters and yield (Table 2).

Table 2. Effect of different establishment methods on yield characters and yield of rice ASD 16 and TPS 3 during 2011-12

Treatment	No. of panicles/m_2		No. of grains /panicle		Panicle length (cm)		Grain yield (kg/ha)		Straw yield (kg/ha)	
	kharif	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*
Wet seeding	164.3	152.7	145.2	140.4	16.2	14.5	4710	4650	4825	4750
Drum seeding	172.8	167.5	156.5	154.2	18.0	18.1	4900	4780	4980	5150
Random planting	188.2	178.3	170.3	165.1	20.1	20.2	5125	5100	5215	5300
Line planting	196.1	188.2	180.4	173.6	22.3	22.5	5305	5250	5390	5410
SRI Square planting	233.4	221.3	212.5	199.9	25.4	26.3	5520	5470	5610	5650
SRI Machine planting	238.2	224.1	218.6	204.0	26.1	27.0	5650	5520	5720	5725
SEd	3.1	3.2	3.2	2.5	0.6	0.6	72	42	66	45
CD(P=0.05)	6.3	6.5	7.5	5.2	1.2	1.2	148	85	135	90

SRI machine planting recorded significantly better yield characters and was on par with SRI square planting. Among the different methods of establishment, SRI machine planting recorded the maximum yield characters *viz*., number of panicles/ m_2 (238.2 and 224.1), number of grains/panicle (218.6 and 204.0) and panicle length (26.1 and 27.0 cm) of ASD 16 and TPS 3 during *kharif* and *rabi* seasons, respectively followed by SRI square planting. The least yield characters *viz*., number of panicles/m_2 (164.3 and 152.7), number of grains/ panicle (145.2 and 140.4) and panicle length (16.2 and 14.5 cm) were recorded in wet seeding method. SRI machine planting recorded higher grain yield during both *kharif* (5650 kg ha_{-1}) and *rabi* (5520 kg ha_{-1}) followed by SRI square planting (5520 and 5720 kg ha_{-1}, respectively). The per cent increase in grain yield ha_{-1} under SRI machine planting was 9.25 per cent over random planting (traditional) method. Mahender Kumar (2012) obtained 7-20% more yields in SRI over normal method, irrespective of soils and locations across the years in the country. Bhowmick *et al*. (2013) obtained comparatively lower yields under normal transplanting due to gradual degeneration of rice roots with the progress of crop growth stages due to continuous submergence. SRI method provided better aeration, more spacing, and less competition, which enabled the plants to grow vigorously. The increase in the grain yield of SRI method was attributed to large root volume, profuse and strong tillers with big panicles, more and well filled spikelets with higher grain weight (Satyanarayana and Babu, 2004). Similar findings were recorded by Jayadeva *et al.* (2008). The lowest grain yield was noticed in case of wet seeding method (4710 and 4650 kg ha_{-1}, respectively). Higher straw yield (5720 and 5725 kg ha_{-1}) also showed the same trend like grain yield.

Economics

It is evident from the Table 3 that SRI machine planting proved to be the most profitable treatment in terms of highest gross income (Rs. 62220 and 60925/ha), net income (Rs.40765 and Rs.39473/ ha) and benefit cost ratio (2.90 and 2.84) during *kharif* and *rabi*, respectively. This might be due to lower cost of cultivation and owing to production of highest grain yield, the gross and net returns were found maximum under SRI machine planting. Higher gross returns were due to higher grain yield, consequently resulting better return for every rupee invested on cost of cultivation. The lowest returns were fetched from wet seeding which was the result of lowest grain yield under this treatment.

Table 3. Effect of different establishment methods on economics of rice ASD 16 and TPS 3 during 2011-12

Treatment	Cost of cultivation (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		BC ratio	
	kharif	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*
Wet seeding	21635	21808	51925	51250	30290	29442	2.40	2.35
Drum seeding	22032	22062	53980	52950	31948	30888	2.45	2.40
Random planting	21634	22341	56465	56300	34830	33959	2.61	2.52
Line planting	21644	22621	58440	57910	36796	35289	2.70	2.56
SRI Square Planting	21411	22351	60810	60350	39398	37999	2.84	2.70
SRI Machine planting	21455	21452	62220	60925	40765	39473	2.90	2.84

From this study, it can be concluded that SRI system of planting was found to be superior in rice ASD 16 and TPS 3 during *kharif* and *rabi*, respectively. SRI machine planting resulted in better growth, yield characters, yield with additional gross, net returns and benefit cost ratio than that of random planting, line planting, drum and wet seeding. Hence, SRI machine planting is more promising establishment method of rice in enhancing higher productivity and economic returns.

References

Bhowmick, M.K., Duary, B., Kundu, C., Dhara, M.C. and Biswas, P.K. 2013. Rice production technologies for sustaining self-sufficiency and strengthening rural economy in West Bengal. (in) *Challenges of Livelihood and Inclusive Rural Development in the Era of Globalization* (Chattopadhyay, P. K. and Bhattacharya, S., eds.). New Delhi Publishers. p. 401-417.

Gobi, R., Ramesh, S., Pandian, B.J., Chandrasekaran,B. and Sampathkumar,T. 2006. Evaluation of Crop establishments and Split application of N and K on Growth, Yield attributes, Yield and Economics of Hybrid Rice Co RH2. *Asian J. Plant Sci*., **5(6)** : 1022-1026.

Hugar, A.Y., Chandrappa,H., Jayadeva, H.M., Satish, A. and Mallikarjun,G.B. 2009. Comparative Performance of different rice establishment methods in Badra command area. *Karnataka J. Agric. Sci*., **22**:992-994.

Krishna, A., Biradarpatil, N.K. and Channappagoudar, B.B. 2008. Influence of System of Rice Intensification (SRI) Cultivation on Seed Yield and Quality. *Karnataka J. Agric. Sci.,***21(3)** *:* 369-372

Jayadeva, H.M., Prabhakar Setty, T.K. and Bhandi, A.G. 2008. Performance of SRI method of rice establishment under Bhadra command of Karnataka. Proc. of *3rd Nation. Symp. SRI India. Policies, Institutions Strat. Scaling up* Coimbatore,Tamil Nadu Agric. Univ., Dec, 1-3 pp. 33-35.

Mahender Kumar, R. 2012. System of Rice Intensification - A potential method for watersaving in rice. *Training Manual of ICAR-Sponsored Short Course on "Water management and water saving technologies in rice"*, Oct. 30 - Nov. 08, Directorate of Rice Research (ICAR), Rajendranagar, Hyderabad. pp. 124-135.

Satyanarayana, A. and Babu, K.S. 2004. A revolutionary method of rice cultivation. In : Manual of System of Rice Intensification (SRI), Acharya N.G. Ranga Agric. Univ., (A.P). p.1.

Udyakumar, 2005. Studies on System of Rice Intensification (SRI) for seed yield and seed quality. *M.Sc. (Agri.) Thesis*, Acharya N.G. Ranga Agric. Univ., Hyderabad (India).

Uphoff, N. and Erick Fernandes 2002. System of Rice Intensification gains momentum. LEISA, India. pp. 22-27.

USDA, 2012. India Grain and Feed Update (Quarterly Update-May 20120). Global Agricultural Information Network. USDA. USDA Foreign agricultural service. P.5.

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