Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.1992

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **3 (6):** 76-80 (2015)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Enhancing Rice Productivity by Adopting Different Cultivation Methods

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ABSTRACT

Field experiments were conducted at Agricultural Research Station, Thirupathisaram, Tamil Nadu during kharif (June –Sep) and rabi (Oct-Mar) seasons of 2011-12 to study the different cultivation methods 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 cultivation methods, 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 hil^{-1}*, LAI, dry matter production, number of panicles m*$^{-2}$*, number of grains panicle*$^{-1}$*, panicle length, grain yield, straw yield net return and return per rupee were recorded under SRI machine planting during kharif and rabi. The lowest grain yield and straw yield were recorded under wet seeding during both kharif and rabi.*

Key words*: Rice, Machine planting, System of Rice Intencification(SRI),Drum seeding, Yield*

INTRODUCTION

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[1]. Globally, India stands first in rice area and second in production after china. It is also a staple food for more than 65 per cent of the Indian population and accounts for more than 42 percent of food production[7]. The country has to produce about 130 million tones of rice by 2025 to meet the food requirement of the ever growing population[3]. 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[10]. 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.

Cite this article: Kumar, N.S., Enhancing Rice Productivity by Adopting Different Cultivation Methods, *Int. J. Pure App. Biosci.* **3(6):** 76-80 (2015). doi: http://dx.doi.org/10.18782/2320-7051.1992

Method of establishment is one of the cultural practices, which influences the rice crop through its effect on growth and development[2]. 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 cultivation methods on rice productivity.

MATERIALS AND METHODS

Field experiments were carried out during *kharif* (June-Sep) and *rabi* (Oct-Mar) of 2011-12 at Agricultural Research Station, Thirupathisaram, Kanyakumari District, Tamil Nadu to evaluate the performance of different systems of rice cultivation. The experiment was laid out in a randomized block design with four replications. The treatment structure consisted of Wet seeding (T1), Drum seeding (T2), Random transplanting (T3), Line planting (T4), SRI square planting (T5) and SRI machine planting T6). The variety ASD 16 and TPS 3 were used for *kharif* (May-Sep) and *rabi* (Oct-Mar) seasons, respectively. Fourteen days old seedlings of mat nursery were transplanted with a spacing of 25 x 25 cm in SRI. With respect to machine planting, seedlings of 18 days raised under tray nursery were used for transplanting. For drum seeding the pre germinated seeds were sown by using eight row paddy drum seeder in a puddled soil and soaked seeds were sown for wet seeding method. In random method, 21-24 days old seedlings was used and for line planting with a spacing of 20 x 15 cm.

Data collection of crop characters:

Data were collected from five hills per plot and then averaged. Observations on growth and yield characters were recorded during harvesting stage. Grains obtained from randomly selected five hills were sun dried and weighed carefully. Then it was averaged to get weight hill^{-1}. Straw obtained from randomly selected five sample hills of respective plot was dried in sun and weighed and then averaged. Grains obtained from each unit plot were sun dried and weighed carefully. The dry weight of grains from the panicle of the sample hills was added to the respective plot yield to record the grain yield plot^{-1}. Straw obtained from each unit plot including the straw of five sample hills of respective plot was dried in sun and weighed to record the straw yield plot^{-1}. The grain and straw yields per plot were subsequently converted to ha^{-1}and recorded. Data recorded for different growth and yield parameters were compiled and tabulated in prop[er form for statistical analysis.

STATISTICAL ANALYSIS

The experimental data are statistically analysed by using Fisher's method of analysis of variance as outlined by Panse and Sukhatme (1978). Critical Difference was calculated wherever F-test was found significant. The level of significance used in F-test was five per cent.

ECONOMICS

The cost of cultivation for each treatment was worked out. Similarly gross returns were calculated based on prevailing market price of the produce. The net returns were obtained after deducting the cost of cultivation from gross returns. Later, the return per rupee was calculated using the formula:

$$\text{Return per rupee (Rs.)} = \frac{\text{Net return (Rs.)}}{\text{Total operational cost (Rs.)}}$$

RESULTS AND DISCUSSION

Growth characters:

SRI system of planting influenced the plant height number of tillers, LAI and dry matter production (Table 1). SRI machine planting recorded significantly higher growth characters and which was on par

with SRI square planting. The maximum plant height (101 and 100 cm), No. of tillers (28 and 26), LAI (5.25 and 4.74), dry matter production (8015 and 7780 kg ha^{-1}) were recorded under SRI machine planting. There was a progressive increase in plant height, number of tillers, LAI and DMP under SRI system of planting when compared to random transplanting and other establishment methods. The transplanting of younger seedlings in SRI method which might have established quickly in the field and started growing at a faster might be attributed to higher plant height[4]. Optimum plant population and geometry under SRI system of planting led to availability of more resources to the plants that resulted in increased plant height and more number of tillers. 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, LAI and dry matter production has been reported earlier by Udaykumar[9].

Yield characters and Yield:

SRI system of planting had significantly influenced the yield characters and yield (Table 2). SRI machine planting recorded significantly better yield characters and was on par with SRI square planting. Among the different rice production methods, the maximum yield characters viz., numer of panicles per square meter (238 and 224), number of grains per panicle (218 and 204) and panicle length (26 and 27 cm) were recorded under SRI machine planting during *kharif* and *rabi* seasons, respectively. The least yield characters *viz.*, number of panicles m^{-2} (164 and 152), number of grains panicle-^{1} (145 and 140) and panicle length (16 and 14 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}) and was at par with SRI square planting (5520 and 5720 kg ha^{-1}, respectively). The per cent increase in seed yield ha^{-1} under SRI machine planting was 9.25 per cent over random planting method. Mahender Kumar[6] obtained 7-20% more yields in SRI over normal method, irrespective of soils and locations across the years in the country. Increased grain yield under SRI is mainly due to the synergistic effects of modification in the cultivation practices such as use of young limited irrigation and frequent loosening of the top soil to stimulate aerobic soil conditions. Bhowmick *et al.*[1] 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. The higher yield realized with SRI method might be due to the use of younger seedlings, which preserved a potential for more tillering and rooting. 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[8]. Similar findings were recorded by Jayadeva *et al.*[5]. 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 during *kharif* and *rabi* .

Economics:

SRI machine planting proved to be the most profitable treatment in terms of net income and benefit cost ratio during *kharif* and *rabi*, respectively (Table 2). The maximum net income (Rs.40765 and Rs.39473 ha^{-1}) and return per rupee (2.90 and 2.84) were recorded highest in SRI machine planting. This might be due to lower cost of cultivation and owing to production of highest grain yield and net return were found to be maximum under SRI machine planting. Higher net 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.

From this experiment, 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 net returns and return per rupee than that of random planting, line planting, drum and wet seeding. Hence, SRI machine planting is the best establishment method of rice in enhancing higher productivity and economic returns.

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

Treatment	Plant height (cm)		No. of tillers hill^{-1}		LAI		DMP (kg ha^{-1})	
	kharif	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*
Wet seeding	84	80	10	9	3.90	3.45	6045	6012
Drum seeding	87	86	14	12	4.20	3.71	6355	6314
Random planting	92	89	19	15	4.49	3.98	6847	6720
Line planting	95	93	22	19	4.80	4.35	7205	7124
SRI Square Planting	99	98	27	24	5.10	4.60	7790	7610
SRI Machine planting	101	100	28	26	5.25	4.74	8015	7780
CD (P=0.05)	2.4	2.2	2.0	2.3	0.25	0.22	302	294

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

Treatment	No. of panicles m^{-2}		No. of grains Panicle^{-1}		Panicle length (cm)		Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})		Net return (Rs.ha^{-1})		Return per Rupee	
	kharif	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*	*kharif*	*rabi*
Wet seeding	164	152	145	140	16	14	4710	4650	4825	4750	30290	29442	2.40	2.35
Drum seeding	172	167	156	154	18	18	4900	4780	4980	5150	31948	30888	2.45	2.40
Random planting	188	178	170	165	20	20	5125	5100	5215	5300	34830	33959	2.61	2.52
Line planting	196	188	180	173	22	22	5305	5250	5390	5410	36796	35289	2.70	2.56
SRI Square planting	233	221	212	199	25	26	5520	5470	5610	5650	39398	37999	2.84	2.70
SRI Machine planting	238	224	218	204	26	27	5650	5520	5720	5725	40765	39473	2.90	2.84
CD(P=0.05)	6.3	6.5	7.5	5.2	1.2	1.2	148	85	135	90				

REFERENCES

1. Bhowmick, M.K., Duary, B., Kundu, C., Dhara, M.C. and Biswas, P.K. 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*. New Delhi Publishers. 401-417 (2013)
2. Gopi, R., Ramesh, S., Pandian, B.J., chandrasekaran,B. and Sampathkumar,T. Evaluation of Cropestablishments and Split application of N and K on Growth, Yield attributes, Yield and Economics of Hybrid Rice Co RH2. *Asian J. of Plant Sci*., **5 (6) :** 1022-1026 (2006)
3. Hugar, A.Y.,Chandrappa,H., Jayadeva, H.M., Satish,A. and Mallikarjun,G.B. Comparative Performance of different rice establishment methods in Badra command area. *Karnataka J Agric. Sci*., **22:** 992-994 (2009)
4. Krishna, A., Biradarpatil, N.K. and Channappagoudar, B.B. Influence of System of Rice Intensification (SRI) Cultivation on Seed Yield and Quality. *Karnataka J. Agric. Sci.*,**21(3):** 369-372 (2008)
5. Jayadeva, H.M., Prabhakar Setty, T.K. and Bhandi, A.G. 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. 33-35 (2008)
6. Mahender Kumar, R. System of Rice Intensification - A potential method for water saving 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. 124-135 (2012).
7. Sandeep Nayak, B.N., Mujeeb Khan,M., Mosha, K. and Prasauna Rani,P. Effect of plant density and weed management practices on economic performance of direct drum seeded and transplanted rice. *Int. J. Pure App. Biosci*. **2(2):** 153-157 (2014)

8. Satyanarayana, A. and Babu, K. S. A revolutionary method of rice cultivation. In : Manual of System of Rice Intensification (SRI), Acharya N.G. Ranga Agric. Univ., (A.P). 1 (2004)
9. 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).
10. Uphoff, N. and Erick Fernandes. System of Rice Intensification gains momentum. LEISA, India. 22-27 (2002)
11. USDA. India Grain and Feed Update (Quarterly Update- May 2012). Global Agricultural Information Network. USDA Foreign Agricultural Service. 5 (2012)