Madras Agric. J., 99 (7-9): 563-566, September 2012
https://doi.org/10.29321/MAJ.10.100140

Short Note

Performance of Nursery Methods and Crop Geometry of Rice Varieties Under Rice Low Lands

P. Baskar*, K. Siddeswaran, N. Thavaprakaash and P. Muthukrishnan
Department of Agronomy,
Tamil Nadu Agricultural University, Coimbatore- 641003

A Field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore during *Kharif* 2008 to evaluate the performance of nursery methods and crop geometry for rice varieties. The experiment was conducted with two nursery methods (mat and conventional nursery) to raise seedling for SRI and two varieties (CORH 3 hybrid and ADT 43 variety) with three square crop geometry *viz.,* 25 x 25 cm, 30 x 30 cm and 35 x 35 cm. Nursery methods and varieties form the main plot treatments and crop geometry were allotted to sub-plots in a split plot design replicated thrice. The results revealed that, the growth and yield of rice varieties not affected by nursery methods. The performance of CORH 3 was superior over ADT 43 as it produced 16.9 per cent higher yield (6516 kg ha^{-1} versus 5417 kg ha^{-1}). Planting the crop with 25 x 25 cm geometry registered higher grain yield in ADT 43 and the CORH 3 performed better with 30 x 30 cm geometry level.

Key words: cultivars, crop geometry, nursery techniques and SRI.

The productivity of rice attained a plateau and even started decline in many of the rice growing countries around the world. In India also rice cultivation becomes less remunerative due to increased cost of production. An alternate method of rice production system is very much needed to improve the productivity levels. This is possible only by adopting method that uses land, water and other resources effectively. System of rice intensification (SRI) has constructively reduce the capital, fertilizer, labour and water inputs while increasing crop yields and promoting more abundance diversity and activity of soil biota in and around the plant rhizosphere. Nursery techniques, rice cultivars and planting geometry also influence the performance under SRI. A field experiment was conducted to evaluate the performance of nursery techniques and crop geometry levels for rice cultivars (variety and hybrid) under SRI.

Materials and Methods

A field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore, during *kharif* 2008 in a split plot design with three replications under low land ecosystem. Two factors *viz.,* nursery methods (mat and conventional nursery) to raise seedling for SRI and two cultivars (hybrid CORH 3 and variety ADT 43) in main plots and three different crop geometry (25 x25, 30x30 and 35x35 cm) in sub plot were assigned. The soil of the experimental field was clay loam with organic carbon content of 0.68 and low (252 kg ha^{-1}), medium (21 kg ha^{-1}) and high (482 kg ha^{-1}) in soil available N, P and K respectively. The electrical conductivity of soil was 1.02 dSm^{-1} and the pH was 8.05. Fifteen days young seedling from both mat and conventional nurseries was planted in main field perfectly allocated geometry levels. The recommended dose of nutrients (175:60:60 for hybrid, 150:50:50 for variety) were applied. Hand operated rotary weeder was operated between the rows in both the directions four times at 10, 20, 30 and 40 days after transplanting. The individual plots were irrigated to 2.5 cm depth after the formation of hairline cracks and it was with held 15 days prior to harvest. Growth parameters such as leaf area index (LAI), crop growth rate (CGR) and above, below ground biomass were measured. Yield parameters *viz.,* total tillers, productive tillers, filled, unfilled grains, grain and straw yield were recorded and expressed in their respective unit. The data was subjected to statistical analysis as described by Gomez and Gomez (1984).

*Corresponding author email: agrobaskar@gmail.com

Results and Discussion

Growth characters

The results of the experiment revealed that there was not much difference between mat and conventional nurseries in most of the growth characters of rice. The reason might be that though the seedlings were raised with different type of nurseries, all agronomic practices followed after transplanting were the same which decides the growth characters the most (Table 1).

Greater LAI in the early stages of hybrid rice than the varieties was attributed as the main explanation

for higher biomass accumulation during the vegetative phase. This may be due to the consequence of higher early vigour of hybrids with larger leaves and higher specific leaf area and hybrid vigour (Laza *et al*., 2001). Leaf area index was significant at closer crop geometry level (25 x 25 cm) due to higher population unit area^{-1}. Even though plant stature was better with wider spacing, it might not have compensated the cumulative leaf area obtained with more number of plants in closer spacing.

Higher CGR during the late reproductive phase was a key process to increase yield potential. It was observed that hybrid CORH 3 during flowering to maturity contributed to faster increase of dry matter with time compared to that of variety and finally led to higher dry matter at maturity and significantly related to grain yield as documented by Sheehy *et al*. (2001). Crop growth rate was significantly higher with closer crop geometry of 25 x 25 cm at all growth stages, it was mainly due to more population per unit area. The hybrid CORH 3 produced higher dry matter compared to the variety (ADT 43) at all growth stages (Table 1).

The vigorous growing nature of hybrid to produce more dry matter than variety due to its potential to harness resources more efficiently. With the ability to absorb adequate nutrients and larger photosynthesising surface, the dry matter accumulation proceeds at a rapid rate. Similar findings were also reported by Jayakumar *et al*. (2005). Dry matter production was found to be more with closer spacing of 25 x 25 cm which could be attributed to higher plant population and accumulation of more nutrients unit area^{-1} compared to wider crop geometry levels of 30 x 30 cm and 35 x 35 cm. This is in accordance with the findings of Vijayakumar (2006).

Table 1. Nursery methods and crop geometry on growth parameters of rice varieties

Treatment	Leaf Area Index		Crop Growth Rate (g m^{-2} day^{-1})		Root biomass (kg ha^{-1})		Above ground biomass (kg ha^{-1})	
	Tillering	Maturity	Tillering-PI	FL-Maturity	Tillering	FL	Tillering	Maturity
Nursery techniques								
N_1 (Mat nursery)	1.51	2.53	28.52	12.15	326	1311	1085	9382
N_2(Conventional)	1.47	2.42	28.42	12.32	284	1169	1033	8991
CD (P=0.05)	0.04	NS	NS	NS	19	70	NS	NS
Cultivars								
C_1 (CORH 3)	1.55	2.79	28.96	13.41	352	1384	1089	9804
C_2 (ADT 43)	1.42	2.16	27.98	11.06	258	1096	1030	8569
CD (P=0.05)	0.04	0.15	NS	1.4	19	70	NS	480
Crop Geometry								
S_1 (25x25 cm)	1.59	2.77	30.04	13.44	336	1485	1239	9961
S_2 (30x30 cm)	1.49	2.36	27.71	12.71	309	1210	1023	9438
S_3 (35x35 cm)	1.38	2.29	27.66	10.56	268	1024	916	8161
CD (P=0.05)	0.05	0.30	1.94	1.10	19	94	71	545

PI- Panicle initiation, FL- Flowering

Higher root biomass was recorded at tillering stage with mat nursery than the conventional nursery. The results were, similar during flowering stages also. Root biomass was higher with CORH 3 hybrid at tillering stage than these with ADT 43 variety. It was mainly due to the root activity of hybrid vigour. The structure of rice plants changed with wider crop geometry both above and below ground because of planting rice seedlings widely apart. Closer plant density (S_1) produced significantly higher root biomass during tillering, flowering than S_2 and S_3. Among three spacing levels, the lower root biomass was recorded under S_3 (35 x 35 cm) due to less population per unit area.

Yield attributes and yield

The results of the experiment revealed that there was not much difference between mat and conventional nurseries on yield attributes like total and productive tillers, grain filling and yields of grain and straw. The reason might be that both nursery methods produced quality seedling at the age of 15 days for planting with one seedling per hill.

There was not much difference between the rice hybrid (CORH 3) and the variety (ADT 43) in the production of total and productive tillers per unit area (Table 2). However CORH 3 hybrid produced significantly more number of grains per panicle and filled grains than the variety. The hybrid vigour is an added advantage in the performance compared with variety. Accordingly the grain and straw yield of hybrid was significantly higher than the variety. Similar result was reported by Yang *et al*. (2007). As the spacing increased the total and productive tillers per unit area decreased; but the effect was not phenomenal with progressive increase in crop geometry. Decrease in number of panicles per hill was observed under closer spacing might be due to tillering and mortality caused by mutual shading during pre flowering stage of the crop (Kewat *et al.,* 2002). A reverse trend in total and filled grains per

Table 2. Nursery methods and crop geometry on yield attributes and yield of rice varieties

Treatment	Total tillers (No.m^{-2})	Productive tillers (No.m^{-2})	Total grains panicle^{-1}	Filled grains panicle^{-1}	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
Nursery techniques						
N_1 (Mat nursery)	327	303	143	131	6013	7144
N_2(Conventional)	318	290	142	129	5921	7111
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Cultivars						
C_1 (CORH 3)	327	303	150	139	6516	7566
C_2 (ADT 43)	317	289	135	122	5417	6689
CD (P=0.05)	NS	NS	7.2	4.9	379	432
Crop Geometry						
S_1 (25x25 cm)	347	312	133	119	6321	7981
S_2 (30x30 cm)	303	294	143	130	6212	7197
S_3 (35x35 cm)	316	284	152	141	5368	6204
CD (P=0.05)	23	22	3	3	256	323

Interaction of rice varieties with crop geometry on yield attributes and yield

Treatment	DMP (kg ha^{-1}) at Flowering			Total grains panicle^{-1}			Filled grains panicle^{-1}			Grain yield (kg ha^{-1})			Straw yield (kg ha^{-1})		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
S_1	10210	9712	9961	138	127	133	126	113	119	6797	5845	6320	8187	7776	7981
S_2	10461	8417	9438	152	133	143	141	119	130	6976	5448	6212	7894	6501	7197
S_3	8743	7579	8162	160	144	152	150	132	141	5777	4959	5368	6617	5792	6204
Mean	9805	8569		150	135		139	122		6516	5417		7566	6689	
C at SCD (P= 0.05)			791			7			6			480			569

panicle was observed when the population per unit area is reduced by altering geometry. Higher number of total grains and filled grains was achieved with higher crop geometry of 35x35 cm compared to other spacings. Wider spacing might be one of the reasons for reduced competition (nutrients, water and micro climatic factors) for better grain filling, higher grain weight and number of filled grains and panicle m^{-2}. Less number of tillers and filled grains per unit area with wider spacing of 35x35 cm, showed that the plant population was not sufficient compared to 25 x 25 cm.

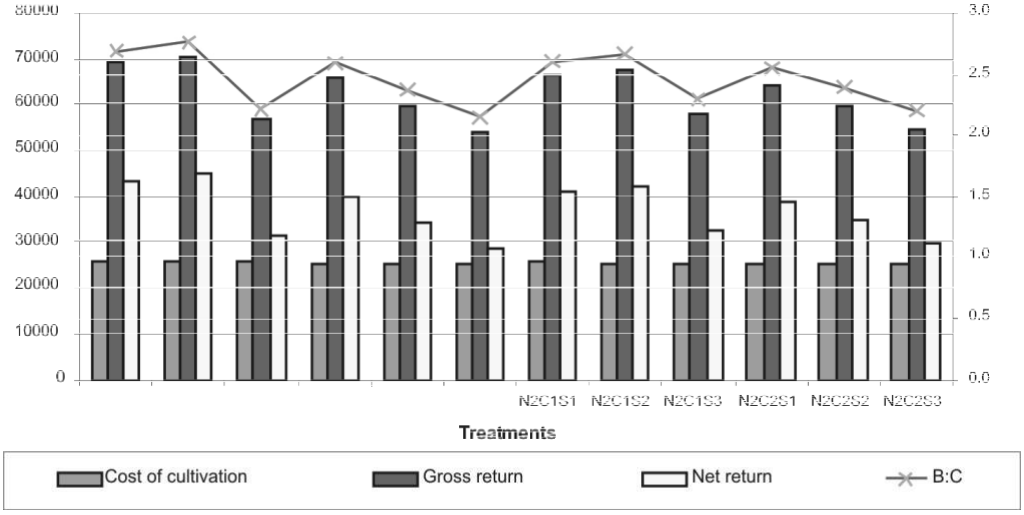

Fig. 1. Nursery techniques, cultivars and crop geometry on economics of rice hybrid and variety under low lands

Yields of rice varieties did not change when planting distance was maintained below 35x35 cm (IRRI, 1967). Planting geometry of 25x25 cm produced higher grain and straw yield closely followed by 30x30 cm. The interaction effect of varieties and crop geometry revealed that the hybrid (CORH 3) produced the highest grain yield of 6976 kg ha^{-1} at 30x30 cm and was closely followed by 25x25 cm (6797 kg ha^{-1}). For the variety, ADT 43, the planting geometry of 25x25 cm was found to be the

best for achieving higher level of productivity (5845 kg ha^{-1}). Under wider spacing in case of SRI, the growth potential of the hybrid is fully expressed. The straw yield was higher under 25x25 cm spacing compared to wider spacing. More population per unit area at closer spacing resulted in more biomass which would have contributed to higher straw yield.

Economics

Higher grain productivity of CORH 3 increased the gross and net returns (Fig 1). With the treatment combination of CORH 3 planted at 30 x 30 cm spacing, higher gross and net returns were realized.

The net return was higher by 3.7 and 10.4 percent over hybrid rice planted at 25x25 cm and variety at 25x25 cm, respectively. Among the different crop geometries, 25 x 25 cm was found to be the best in terms of economic returns (B:C) for the variety ADT 43.

Conclusion

The results revealed that under System of Rice Intensification (SRI), there was not much variation between mat and conventional nurseries to produce rice seedling. Hybrid performed better than variety under SRI. Planting geometry of 25x25 cm for variety (ADT 43) and 30x30 cm for hybrid (CORH 3) is optimum for obtaining higher grain yield.

References

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2nd Edn. John Wiley and Sons, New York. p. 680.

IRRI, 1967. IRRI Reporter. International Rice Research Institute, Manila, Philippines.

Jayakumar, B., Subatra, C., Velu, V. and Ramanathan, S. 2005. Effect of integrated crop management practices on rice (*Oryza sativa* L.) root volume and rhizosphere redox potential. *J. Agron.,* **4**: 311-314.

Kewat, M.L., Agrawal, S.B., Agrawal, K.K. and Sharma, R.S. 2002. Effect of divergent plant spacings and age of seedlings on yield and economics of hybrid rice (*Oryza sativa*). *Indian J. Agron.,* **47** : 367-371.

Laza, R.C., Peng, S., Sanico, A.L., Visperas, R.M. and Akita, S. 2001. Higher leaf area growth rate contributes to greater vegetative growth of F1 rice hybrids in the tropics**.** *Plant Prod. Sci.,* **4**: 184-188

Sheehy, J.E., Dionora, M.J.A. and Mitchell, P.L. 2001. Spikelet numbers, sink size and potential yield in rice. *Field Crops Res.,* **71**: 77–85.

Vijayakumar, M., Ramesh, S., Chandrasekaran, B. and Thiyagarajan, T.M. 2006. Effect of System of Rice Intensification (SRI) practices on yield attributes, yield and water productivity of rice (*Oryza sativa* L.). *Res. J. Agric. Biol. Sci.,* **2:** 236-242

Yang, W., Peng, S., Laza, R.C., Visperas, R.M. and Dionisip-Sese, M.L. 2007. Grain yield and yield attributributes of new plant type and hybrid rice. *Crop Sci.,* **47**: 1393-1400.

Received: March 9, 2012; Accepted: May 15, 2012