Original Research Article

Raising of farm friendly mat nursery for machine transplanting of Rice

ABSTRACT

Mechanized rice cultivation can play a vital role in transforming rice production. In the context of labour shortage and growing commercialization of agriculture, mechanization is very important for ensuring timeliness and precision of operation. Mechanized transplanting is a key link to the entire mechanization of paddy cultivation. However, lack of farmer adoptable mat nursery production technologies appears to be one of the major hurdles against the appropriate exploitation of transplanting machineries. The present study entitled "Raising of farm friendly mat nursery for machine transplanting of Rice" was carried out during 2018 at Rice Research Centre, Hyderabad with the objectives of standardization of production technology of mat nursery raising on sheet for mechanical transplanting and evaluation of efficiency of nursery technique under field condition. The nursery raising on polythene sheet with puddled soil is farmer adoptable, suitable for machine transplanting and its cost is cheaper compared to tray method.

Keywords: Mat nursery, Machine transplanting, Rice, Economics

1. INTRODUCTION

Rice is the global grain and principal staple food of the population in Asia. In Telangana state the crop is occupying 103.88 lakh acres during 2020-21 (SEO-2020). Rice crop is relatively labour-intensive crop and acute labour shortage is leading for delay in transplanting, reduced yield and increased cost of cultivation (Sharma and Singh, 2008). A delay in transplanting alone causes about 15 per cent reduction in total rice production (Ponnuswamy *et al*., 1999). However, Islam *et al*. (2008) reported 9 per cent yield reduction due to the delay in transplanting from normal date. In this situation mechanical transplanter using self-propelled engines has been considered as the most promising option. Despite of the availability of machine transplanters since a decade due to cumbersome nursery raising by tray method mechanisation has taken a back seat. Keeping in view present study was carried out with objective of raising farmer adoptable and low-cost mat nursery raising on sheet suitable for machine transplanting of Rice.

2. MATERIAL AND METHODS

The field study was conducted at Rice Research Centre, Hyderabad in *Kharif* 2018. The soil type was clay loam with a pH of 7.3. It was low in available N, medium in P and high in available K. The test variety was RNR 15048. Rice nursery was raised following two methods Viz., Tray method nursery and sheet method nursery. Tray method sowing was done by following standard procedure as described by Tasaka *et al*., (1996) and Sharma (2008). Operation difficulties in the tray nursery is filling of tray with red soil+FYM. Pulverisation of the filling material. Seeding with automatic seeding machine and shifting the tray to field for maintenance. Procedure was evolved after many preliminary attempts and finalised for raising mat nursery on sheets is as detailed below.

2.1 Selection and preparation of nursery bed

A suitable area with water source was selected and land prepared by ploughing twice and puddling with rotovator keeping 5-10 cm water level. After puddling, the field was properly levelled and soil particles were allowed to settle for 24 hours. An area of 50-60 sq. m. was required for raising mat nursery, which was sufficient to plant in one-hectare main field. A shallow raised nursery bed of 1.5 m width of required length was prepared with provision of irrigation / drainage channel around the bed.

2.2 Seed rate and Seeding

Sowing of mat type nursery was done 15-20 days prior to transplanting with a seed rate of 25 kg ha^{-1} for fine grain varieties and 35 kg ha^{-1} for coarse grain varieties. The seed was treated with recommended fungicides, soaked in water for 12-24 hours and incubated for 24 hours. The pre germinated/sprouted seed was kept ready for seeding after shade drying.

On the day of seeding, a white polythene sheet of 60-micron thickness was spread with width of 1.5 m on each bed. For raising 200-250 mats of nursery (sufficient for planting in 1 ha), a polythene sheet weighing 1.5 kg was required. After spreading of polythene sheet one the bed, small holes were made in the sheet with the help of a sharp nail to keep polythene sheet intact on the soil surface.

The wooden frame having 8 partitions was kept on the polythene sheet which was spread on the raised bed. It required two labour standing in opposite direction in irrigation channels and filled the frame with soil. Due care was taken to separate out stones and small pebbles from the puddled soil and filled into the individual partitions of the frame up to a mat thickness of 2.0 cm. The functioning of machine fingers in transplanting portion will be affected and work will be hampered if pebbles/ stones were present. At the same time if the thickness of the mat increases beyond 2.5 cm, it may increase mat weight and does not fit into the machine and also the mats may break down when rolled while transporting to main field.

The pre-germinated seed @ 120 g for fine grain varieties and 150 g for coarse grain varieties per tray/mat was uniformly broadcasted manually or by seeding machine so that a density of 1 seed/cm^2 was maintained. After seeding, applied a thin layer of vermicompost/ well-ground FYM @ 40 – 50 g /each mat and covered with straw of the same variety for 4-5 days. In case, the straw of same variety is not available, nursery bed may be covered with gunny bags. Shade net can also be used for protection from birds. After 4 to 5 days, the straw or gunny bags was removed and seedlings were allowed to grow freely.

2.3 Water management

Initially for a week, watered the nursery mats with rose can to keep the soil moist for better germination. After one leaf stage (7 days after sowing), the nursery was irrigated as and when required in order to maintain 1cm water level on polythene sheet. If this water level was not maintained, the sheet got heated up and seedlings die. Drained out water a day before lifting of mats for transplanting.

2.4 Nutrient management

vermicompost @ 40 g was applied / each mat as basal application at the time of seeding. Later on, as top-dressing spray of fertilizer grade 19-19-19 @ 10g l^{-1} based on the growth of nursery.

Observation on seedling height was recorded at 6, 12 and 15 days after sowing in two types of nurseries. And economics was calculated based on the inputs used for maintain the nursery. When the nurseries attained optimum height, transplanting was done using machine transplanter and recorded observations like time required for feeding the nursery, transplanting and turning, clogged machine fingers (%). At harvest of the crop growth and yield attributes and yield was recorded and economics was calculated.

3. RESULTS AND DISCUSSION

3.1 Seedling growth parameters as influenced by different mat type nurseries

Seedling characters like shoot and root length were recorded and noticed that seedling characters did not differ with methods and seedlings attained optimum shoot length of > 15 cm by 15-18 DAS (Table-1).

Information on Seedling shoot length (cm) unveiled that, with headway of growth, shoot length (cm) expanded dynamically, independent of the treatments. Different methods of nurseries viz., tray nursery and mat nursery on sheet didn't show any significant difference on seedling shoot length. Seedlings attained optimum shoot length of 14.65 and 14.94 cm in tray and sheet nursery respectively at 15 DAS. (Behera *et al*., 2007)

Table 1. Shoot length (cm) as influenced by different nursery raising methods

Treatments	6 DAS	12 DAS	15 DAS
Tray nursery	5.52	11.48	14.65
Mat nursery on sheet	5.14	11.57	14.94
t-test	NS	NS	NS

3.2 Economics of raising different mat type nurseries

The economics (Table 2) of raising different types of nurseries sufficient to plant 1.0 ha main field revealed that, the production of nursery in trays with dry red soil and manure mixture was expensive (Rs.6707) in view of cost involved in purchase of trays, red soil and manure compared to that produced on polythene sheet with puddled soil (Rs.3060) as medium for machine planting. Raising mat nursery on polythene sheet saved an amount of Rs.3600 over tray method.

Table 2 : Cost of Production of different types of nurseries sufficient to plant 1.0 hectare main field

S. No	Particulars	Tray nursery		Mat nursery on sheet	
		Quantity	Cost (Rs.)	Quantity	Cost (Rs.)
1	Area (m^2)	50		50	

2	Inputs				
	Seed(kg) Fine grain	25.0	875	25.0	875
	Red soil	1200	800	Native puddled soil	
	FYM/Vermicompost (Kg)	4	32	10	60
	Urea, SSP, MOP and 19-19-19		50		50
	Trays (No)	250	2500		
	Polythene sheet	-	-	1	175
	Wooden frame			1	150
			4257		1310
3	**Labour**				
	Pulverising	1	350	-	-
	Sieving	1	350	-	-
	Shifting of trays	2	700	1	350
	Bed preparation	1	350	1	350
	Seeding/sowing	1	350	2	700
	Maintenance	1	350	1	350
			2450		1750
	Total		**6707**		**3060**

Table 3. % distribution of time during transplanting as influenced by different nursery raising methods

Particulars	Tray method	Mat nursery on Sheet
Transplanting time (%)	71%	71%
Mat feeding and adjustment (%)	25%	25%
Turning (%)	2.5%	2.5%
Clogged fingers, cleaning, engine shutdown (%)	0.5%	1.5%

The nursery raised in the tray and on sheet was fed to the transplanter and recorded time required for the mat feeding to the machine, transplanting time and turning was observed to be same with using two types of nursery i.e 71%,25% and 2.5% respectively. Clogged fingers (1.5%) were higher in the mat nursery raised on sheet method than in tray method. In signifies the importance of separating out stones and small pebbles from the puddled soil. (Goel *et al*., 2008)

3.3 Yield and economics of machine transplanted rice

The data regarding grain yield ha^{-1} are given in table 5. Higher grain yield was recorded with transplanting with tray nursery (7234 kg ha^{-1}) compare to mat nursery on sheet (7006 kg ha^{-1}) owing to its higher yield attributing characters *i.e* panicle m^{-2}. Economics of cultivation (Table 4.) revealed that higher cost of cultivation incurred in tray type nursery (56312/ha) compared to mat nursery on sheet (50915/ha) with B:C ratio of 2.18 and 2.34 in respectively in tray type and mat type nursery. The treatments selected did not produce significant variation under field condition with respect to the yield and performance of mechanical transplanter. The treatments can be assessed at nursery level itself based on seedling characteristics and ease of nursery production at farm level. When economics of nursery as well as cultivation were considered mat nursery on sheet was more economical and feasible to farmers for large scale adoption of machine transplanting. These results are in accordance with Rajesh (2003), Dhananchezhiyan (2013).

Table 4. Cost of cultivation of machine transplanted rice (Rs ha^{-1}) as influenced by different nursery raising methods

Cost of cultivation ha^{-1}	Tray nursery	Mat nursery on sheet
Nursery raising cost	6707	3060
Nursery transportation and loading	3500	1750
Operator charges	1250	1250
Field preparation	12500	12500
Machine Transplanting cost	6250	6250
Fertilizer and application	6855	6855
Plant protection (herbicides & pesticides)	8750	8750
Weeding	3000	3000
Harvesting and threshing	7500	7500
Cost of cultivation ha^{-1}	56312	50915

Table 5. Growth, Yield attributes Yield and economics as influenced by different nursery raising methods

Particulars	Tray nursery	Mat nursery on sheet
Hills m^{-2}	25	24
Seedlings $hill^{-1}$	6.5	6.8
Plant height (cm)at harvest	104.3	101.3
Tillers m^{-2} at harvest	449	426
Panicles m^{-2}	415	401
Panicle length	22.9	21.5
Panicle weight (g)	3.6	3.5
Grain yield kg ha^{-1}	7234	7006
Cost of cultivation (Rs ha^{-1})	56312	50915
Gross returns (Rs ha^{-1})	122978	119102
Net returns (Rs ha^{-1})	70373	68247
B:C	2.18	2.34

4. CONCLUSION

The nursery raising on polythene sheet with puddled soil is farmer adoptable, suitable for machine transplanting and its cost is cheaper compared to tray method. Raising on polythene sheet for machine transplanting will remove all the operation difficulties.

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