The Andhra Agric. J 61(4):740-743, 2014

Tiller Dynamics, Yield and Yield Attributes of Rice Varieties to the Age of Seedlings

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ABSTRACT

A field experiment was conducted during *kharif* 2011 at Regional Agricultural Research Station, Warangal to find out the response of high yielding rice varieties to the age of seedlings with five ages of seedlings viz., 20, 30, 40, 50 and 60 days and three varieties i.e., BPT 5204, MTU 1001 and JGL 384. Tiller production was reduced by 43% with the advancement in the age of seedlings from 20 to 60 days. The age of seedlings also significantly influenced the yield attributes and yield except 1000-grain weight. The seedlings of 20 days old recorded higher yield attributes, grain yield, straw yield and net returns which was on a par with 30 days old seedlings, whereas lower values were recorded with 60 days old seedlings. The cultivar, MTU 1001 recorded higher panicles m^{-2} and 1000-grain weight, where as tillers $hill^{-1}$ were maximum in BPT 5204 and number of filled grains $panicle^{-1}$ were maximum in JGL 384 with all the ages of seedlings.

Key words : Grain Yield, Net Returns, Tillers, Yield Attributes.

Rice (*Oryza sativa* L.) is an important food crop in India grown in an area of 44.8 m ha with a production of 99.2 m t and productivity of 2.2 t ha^{-1} (CMIE, 2010). Crop yield is the product of genotype interaction with environment and adoption of improved practices such as timely planting of young and healthy seedlings, maintenance of optimum plant population and timely supply of balanced nutrients. An ideal age of seedlings for transplanting is governed by the duration of the variety and field conditions (Nandini and Singh, 2000). Timely planting and use of appropriate aged seedlings for transplanting are important non cash inputs for realizing the higher productivity in rice (Pattar *et al.,* 2001). Tillering is an important agronomic trait which finally determines the number of panicles, grains and grain yield per unit land area. Tillering dynamics of the rice plant greatly depends on the age of seedling at transplanting (Pasuquin *et al.*, 2008). Of late, due to delay in the onset of monsoons and frequent drought, filling of reservoirs and tanks is delayed. This situation forces the farmers to wait for the water which leads to delayed transplanting of over aged seedlings. Labour scarcity during the peak season of transplanting is another reason for late planting with overaged seedlings resulting in drastic reduction in grain yields. All the varieties will not perform equally, when transplanted with aged seedlings. Under these circumstances, suitable variety is required for getting higher yields. Hence, the present study was carried to know the influence of age of seedlings on growth and yield of different high yielding rice varieties during *kharif* season in sandy loam soils.

MATERIAL AND METHODS

A field experiment was carried out during *kharif* 2011 at Regional Agricultural Research Station, Warangal, Andhra Pradesh. The site is situated at 18^0 00' 42.1'' N latitude and 79^0 36' 04.5'' E longitude and 262 m altitude. The soil was sandy loam in texture, medium in organic carbon (0.58 %), neutral in reaction (pH 7.4), low in available nitrogen (225.8 kg ha^{-1}), medium in available phosphorus (21.0 kg ha^{-1}) and low in available potassium (95.5 kg ha^{-1}). The weekly mean temperature ranged between 22.6 to 28.6 ^{0}C. A total rainfall of 349.4 mm was received during the crop growth period spread over 26 rainy days. The experiment was laid out in a randomized block design (factorial concept) with 15 treatments replicated thrice. Factor A consisted of age of seedlings at ten days interval starting from 20 days i.e., 20, 30, 40, 50 and 60 days old seedlings and factor B consisted of three varieties i.e., BPT 5204, MTU 1001 and JGL 384. The plot size was 50.4 m x 4.2 m. A uniform dose of 60, 40, 50 kg ha^{-1} P_2O_5, K_2O and $ZnSO_4$ were applied basally to all the treatments. Nitrogen @ 120 kg ha^{-1} was applied in three equal split doses each at basal, active tillering and panicle initiation stages. Need based plant protection measures were taken up, whenever the incidence was more than economic threshold level. All other recommended cultural practices were followed for raising the crop.

RESULTS AND DISCUSSION

The number of tillers hill^{-1} was maximum in crop planted with 20 days seedlings than the other four ages of seedlings (Table 1). There was 43 % reduction in maximum tillering capacity with the delay of transplanting from 20 to 60 days old seedlings. The tillering period was also extended upto 60 days when young seedlings (20 or 30 days old seedlings) were transplanted, while maximum tillering was reached by 45 DAT when overaged seedlings were transplanted (40, 50 or 60 days) after which there was reduction in number of tillers due to death. About 36, 77, 91 and 100 per cent of the maximum number of tillers were produced by 15, 30, 45 and 60 DAT when 20 days old seedlings were transplanted, while it was 39, 77, 90 and 100 per cent in 30 days; 47, 72 and 100 per cent in 40 days; 33, 63 and 100 percent in 50 days and 2, 55 and 100 percent in 60 days old seedlings, respectively. These results are in close conformity with that obtained by Hasan *et al.,* (2008) and Alam *et al.,* (2009). The reason for reduction in tillering with overaged seedlings attributed is due to *phyllochron* effect. Berkelaar (2001) reported that for maximum tillering, the plant has to complete as many *phyllochrons* as possible during its vegetative phase. Each tiller produces another two *phyllochrons* later under favourable growing conditions. When a seedling is transplanted carefully at the initial growth stage, the trauma of root damage caused during uprooting is minimized following a rapid growth with short *phyllochrons*. Mobasser *et al.,*(2007) observed that when seedlings stay for a longer period of time in the nursery beds, primary tiller buds on the lower nodes of the main culm become degenerated leading to reduced tiller production. Among the three tested varieties, tillers hill^{-1} were maximum in BPT 5204 followed by MTU 1001 and JGL 384 at all the stages of observation (Table 1).

Yield attributes were also significantly influenced by the age of seedling and varieties (Table 2). The number of panicles m^{-2}, number of filled grains panicle^{-1} were significantly higher in crop planted with 20 days seedlings than 40 or 50 or 60 days old seedlings but was on a par with 30 days old seedlings, whereas the number of chaffy grains panicle^{-1} was lower in 20 days seedlings. The test weight was not significantly influenced by age of seedlings. Among the three tested varieties, the yield attributes like number of panicles m^{-2} and test weight were significantly higher in cultivar MTU 1001 followed by JGL 384 and BPT 5204. Number of chaffy grains were also minimum in MTU 1001 followed by JGL 384 and BPT 5204, whereas, number of filled grains panicle^{-1} were more in JGL 384 followed by BPT 5204 and MTU 1001.

The age of seedlings significantly influenced the grain yield and straw yield (Table 2). Among the different aged seedlings, 20 followed by 30 days seedlings recorded significantly higher grain yield and straw yield than the other four age of seedlings. Delay in transplanting beyond 30 days after sowing caused 24, 36 and 42 per cent reduction in grain yield with 40, 50 and 60 days old seedlings, respectively. The better initial growth coupled with superior yield attributes (panicles m^{-2}, panicle length and filled grains panicle^{-1}) besides less chaffy grains panicle^{-1} might be ascribed as the reasons for higher grain and straw yield under 20 day old seedlings. Pasuquin *et al.,* (2008) and Manjunatha *et al.,* (2010) also found the superior performance of younger seedlings of rice over the aged seedlings. The cultivar MTU 1001 recorded significantly higher yield compared with JGL 384 and BPT 5204. The net returns were higher in 20 followed by 30 days seedlings compared to other aged seedlings. Similarly, higher returns were recorded in MTU 1001 followed by JGL 384 and BPT 5204.

From this study, it can be concluded that transplanting of younger seedlings i.e., 20 or 30 days old seedlings is better to realize higher yield and returns of rice. The performance of the cultivar MTU 1001 was found to be superior to BPT 5204 and JGL 384 with respect to yield and net returns.

Table 1. Tiller dynamics of rice varieties with different aged seedlings.

Treatment	15 DAT	30 DAT	45 DAT	60 DAT
Age of seedlings (A)				
A_1: 20 days	7.6	16.3	19.2	21.2
A_2: 30 days	6.4	12.7	14.7	16.4
A_3: 40 days	4.9	8.4	13.2	11.6
A_4: 50 days	3.9	7.6	12.0	10.8
A_5: 60 days	3.1	6.6	12.0	10.1
SEm±	0.3	0.6	0.6	0.7
CD(P=0.05)	1.0	1.6	1.6	2.0
Varieties (V)				
V_1: BPT 5204	5.9	12.4	16.2	16.1
V_2: MTU 1001	5.1	10.3	13.9	13.3
V_3: JGL 384	4.5	8.3	12.5	12.6
SEm±	0.3	0.4	0.4	0.5
CD(P=0.05)	0.8	1.2	1.3	1.5
Interaction (A×V)				
SEm±	0.6	1.0	01.0	1.2
CD(P=0.05)	NS	NS	NS	NS

DAT : Day after transplanting

Table 2. Yield attributes, yield and economics of rice as influenced by age of seedlings and varieties.

Treatment	Filled grains panicle^{-1}	Chaffy grains panicle^{-1}	Panicles m^{-2}	1000-grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Net returns (Rs ha^{-1})
Age of seedlings (days) (A)							
20	240	19	347	17.8	6140	7464	53,580
30	218	24	316	17.3	5620	7006	46,950
40	205	31	286	17.7	4260	5913	36,377
50	190	40	238	17.5	3570	5093	28,015
60	145	52	196	17.0	3250	4837	26,438
SEm±	13	3	13	0.3	233	234	-
CD (P=0.05)	39	9	40	NS	676	678	-
Varieties (V)							
BPT 5204	185	42	253	13.3	3664	5137	30,273
MTU 1001	157	25	300	24.4	5576	7107	46,013
JGL 384	257	33	276	14.7	4464	5945	36,130
SEm±	10	2	10	0.2	181	181	-
CD (P=0.05)	30	6	29	0.7	523	525	-
Interaction (A×V)							
SEm±	23	5	22	0.5	404	405	-
CD (P=0.05)	NS	NS	NS	NS	NS	NS	-

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(Received on 16.01.2013 and revised on 08.02.2013)