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Short communication

Performance of rice (*Oryza sativa*) in response to transplanting time and varieties

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Rice is staple food for South East Asian countries, this region itself is consuming almost 90 per cent of rice production. India is a second largest rice producer in world following by China. Rice, growth development and performance (grain yield) is determined by the number of factors as yield is one of the most complex polygenic traits, which is expected to so higher magnitude of interaction variance. In rice planting time and selection of varieties may be playing the deciding role.

An experiment was conducted during *kharif* seasons of 1998 and 1999 at Student's Instructional Farm, Department of Agronomy, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, to see the effect of planting time and varieties on the growth and performance of rice in sandy loam soil, medium in inherent soil fertility status with pH value of 7.7. Number of days and growing degree-days to reach at tillering, panicle initiation, anthesis and maturity were computed. Yield, panicle weight, thousand seed weight, panicle m^{-2} and rachilae / panicle were measured. Stover yield and vegetative growth index were work out. Growing degree-days and days taken to different phenological stages was computed. Both the parameters could be useful for predicting rate of development, growth, duration and harvesting time. However since number of growing degree days (heat units) is less valuable within the varieties throughout the season, its use is beneficial for predicting duration, developmental stages (phenological stages) as well as harvesting period for particular group of varieties.

Experiment was laid down in split plot design with four replications keeping planting time (P1=15th July, P2=25th July, P3=5th August) as a main plot treatment and varieties (V1=Ashwani, V2=Pant V4 & V3=Mahsoori) as sub plot treatments. Three planting times that is early (1) middle (2) and late (3) were compared with three maturity groups of rice that is early (Ashwani) medium (Pant 4) and late Mahsoori. All the treatments were randomly allocated to main and sub plot in both the years. Recommended dose of nutrients was applied and plant protection measures were taken care as per standard package of practices.

Significant variations were observed in the growing degree days due to planting time from sowing to tillering in 1998 and from

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Table 1: Growing degree days (heat units) required to attain different phenological stages

(a) Transplanting time

	1998					1999				
Phenological stages	P1	P2	P3	Sem+ -	CD (5%)	P1	P2	P3	Sem+ -	Cd(5%)
Tillering	1142.4	1033.2	1004.2	32.8	NS	1060.7	1060.0	977.3	0.5	36.2
Panicle initiation	605.2	595.0	547.7	28.9	NS	542.7	533.0	541.4	18.2	NS
Anthesis	578.0	583.7	566.7	22.6	NS	570.3	542.5	554.1	6.8	NS
Maturity	654.6	600.8	524.6	24.4	84.5	600.2	543.0	486.5	5.1	17.6

(b) Varieties

	1998					1999				
Phenological stages	V1	V2	V3	Sem+ -	CD (5%)	V1	V2	V3	Sem+ -	Cd(5%)
Tillering	1005.1	1063.1	1111.5	16.2	43.3	963.3	1009.9	1070.8	16.9	50.2
Panicle initiation	530.9	572.3	644.6	34.1	NS	439.7	517.2	670.3	17.7	52.7
Anthesis	496.5	562.7	668.9	24.0	71.4	501.2	538.9	626.9	9.3	27.8
Maturity	520.0	620.9	640.0	24.6	73.1	490.6	540.8	598.2	6.9	20.4

Table 2: Days taken to attain different phenological stages

(a) Transplanting time

	1998					1999				
Phenological stages	P1	P2	P3	Sem+ -	CD (5%)	P1	P2	P3	Sem+ -	Cd(5%)
Tillering	42.7	39.6	39.0	0.4	1.4	39.8	36.3	33.1	0.6	1.9
Panicle initiation	66.8	65.7	64.6	0.2	0.8	66.0	61.0	58.4	0.7	2.3
Anthesis	90.0	88.0	86.7	0.7	2.4	87.1	83.7	81.0	0.8	2.5
Maturity	117.0	113.0	110.0	0.9	3.3	114.3	109.6	106.0	1.0	3.4

(b) Varieties

	1998					1999				
Phenological stages	V1	V2	V3	Sem+ -	CD (5%)	V1	V2	V3	Sem+ -	Cd(5%)
Tillering	38.3	40.3	42.6	0.9	2.6	34.3	36.7	40.2	0.7	2.4
Panicle initiation	60.0	64.0	73.2	0.5	1.6	56.1	60.0	68.3	0.9	2.8
Anthesis	79.7	86.7	98.3	0.9	2.6	92.3	83.5	77.6	1.1	3.2
Maturity	100.1	113.0	126.0	1.2	3.6	98.3	109.7	122.0	1.5	5.0

anthesis to maturity in both the years. Crop transplanted on Ist planting date availed more growing degree days than third date from anthesis to maturity and sowing to tillering in 1999 but the thermal time between anthesis and maturity decreased significantly with every delay in transplanting time (Table 1). Time taken to attain the phenological stages was variable and the period was shortened by delay in planting in both the years (Table 2). Delayed transplanting suppressed all the yield attributes but significant differences were noted only in the panicle m^{-2}, rachilae/panicle, and grain weight/panicle in both the years (Table 3). Above ground biomass and stover yield were higher while grain yield and harvest index were lower in the first year than the second year.

Variety Ashwani attended phenological stages earlier and Mahsoori later than the Pant 4 in both the years (Table 2). The all yield attributes of Ashwani were better than Pant 4 and of the variety over Mahsoori. Variations becomes significant in panicle m^{-2}, grain weight/panicle and thousand seed weight in both the years. The difference in performance of varieties with respect to above ground biomass and yield was observed the significant in both the years (Table 4). All varieties produced more above ground biomass and stover yield in first year but grain yield and harvest index is lesser than the second year. Variety Ashwani yielded higher (37.4 & 39.39 qha^{-1}) in the first and second year, respectively.

Days taken to different phenological stages have shown increase with delay in transplanting in both the years. With very few exception there was decreasing in the growing degree-days with delay in transplanting. (Gururani 1997)

Delay in planting caused reduction in yield parameter as well as in above ground biomass grain yield and stover yield in both the year with few exception of modified trends specially in case of non significant differences. It was noticed that the crop produced high above around biomass in first year (105.2 q ha^{-1}) yielded lesser (36.1 q ha^{-1}) then 39.6qha^{-1} with above ground biomass of 98.5qha^{-1} in the second year of first date of planting, for second date grain yield was same in both the year (33.8 & 33.4 q ha^{-1}) but above ground biomass was higher in second year. It is also worth mentioning that in third date of planting the grain yield was slightly higher in second year with less above ground biomass than first year. Their results are supported by the non-significant variation in the harvest index in all the planting dates in both the years. The work of babu (1988), Paul (1994), Hariom et al (1997) and Singh e tal (1997) also supported the finding of present study up to greater extent.

Thermal time requirement was found positively associated with the duration of variety confirming the fact that longer duration varieties availed maximum thermal time and thermal time between phenological stages decreased with the shortening of duration of variety in the both the years. (Gururani 1999, Singh *et al* 1997). Longer and shorter duration varieties have taken maximum and minimum days in attaining different phenological stages while medium time was recorded in case of medium

Table3: Yield attributes as influence by planting time and variets

(a) Transplanting time

	1998					1999				
Yield attributes	P1	P2	P3	Sem+ -	CD (5%)	P1	P2	P3	Sem+ -	Cd(5%)
Panicle /m2	236.3	228	216.7	1.8	6.2	245	233.2	223.8	2.83	9.8
Rachilae/Panicle	10/21	10.11	9.67	0.11	0.37	11.28	10.70	9.92	0.36	1.25
Grain weight/pancil	2.48	2.40	2.29	0.02	0.07	2.63	2.55	2.48	0.05	0.15
1000seed weight(g)	24.9	24.7	24.5	0.1	NS	25.11	24.89	24.21	0.7	NS

(b) Varieties

	1998					1999				
Yield attributes	V1	V2	V3	Sem+ -	CD (5%)	V1	V2	V3	Sem+ -	Cd(5%)
Panicle /m2	238.4	235.5	211.7	3.5	10.4	251.8	239.4	221.5	4.38	13.01
Rachilae/Panicle	10.15	9.98	9.60	0.4	NS	11.18	10.68	10.04	0.41	1.01
Grain weight/panicl	2.51	2.38	2.28	0.03	0.10	2.73	2.58	2.42	0.04	0.14
1000seed weight(g)	28.0	26.8	19.4	0.2	0.7	28.4	26.9	20.6	0.9	2.6

Table 4: above ground bio mass and yields

(a) Transplanting time

	1998					1999				
yield	P1	P2	P3	Sem+ -	CD (5%)	P1	P2	P3	Sem+ -	Cd(5%)
Above ground bio mass	105.2	97.1	82.9	0.8	2.8	98.5	87.0	78.8	1.5	5.3
Grain yield	36.1	33.8	28.0	0.5	1.8	39.6	33.4	30.1	0.9	3.2
Stover yield	69.1	63.1	54.1	1.3	4.4	58.8	53.6	48.7	1.8	6.4
Harvest index	34.3	34.7	34.0	0.7	NS	40.7	38.8	40.0	1.4	NS

(b) Varieties

	1998					1999				
Phenological stages	V1	V2	V3	Sem+ -	CD (5%)	V1	V2	V3	Sem+ -	Cd(5%)
Tillering	94.4	84.3	106.4	0.2	6.0	89.4	77.7	97.1	3.6	10.8
Panicle initiation	37.4	32.9	27.6	0.8	2.4	39.3	35.2	28.7	1.0	3.4
Anthesis	61.5	56.6	68.7	0.9	2.8	50.1	42.6	68.5	3.5	10.6
Maturity	39.6	39.0	25.9	0.7	2.2	44.1	46.3	29.9	2.1	6.3

duration variety Pant 4 in both the years. A perusal of data on growth and development indicated that the superiority of variety varied differently with individual parameters of growth and development. Longer duration variety Mahsoori was proved greater producer of biomass in both the years. The yield attributes of Ashwani were in support of higher grain yield may be due to more dry matter in roots. as compared to other tested varieties. The work of Jand *et al* (1994); Bali *et al* (1993) and Singh & Pillai (1995) support these finding.

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