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Physiological behavior of rice cultivars under different sowing dates

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Abstract

The investigation was carried out during *kharif* 2021 at Institute of Rice Research, Professor Jayashankar State Agricultural university, Rajendranagar, Hyderabad. The experiment was laid out in split plot design with three replications. Treatments consist of two dates of sowing i.e., July 1st week and July 3rd week. Transplanting was done with respective 25 days old seedling with 2-3 seedlings per hill. Cultures in sub plot consist of KPS 6251, WGL 1246, RDR 1162 and check variety RNR15048 and JGL 24423. At Different dates of sowing the grain yield was non-significant and Among different cultivars, higher grain yield was recorded with JGL24423 (7073) and was at par with KPS6251(6905), WGL1246 (6702) and RNR 15048 (6679). Lowest grain yield was recorded with RDR1162 (5854). Interaction effects were significant.

Keywords: Cultures, rice, dates of sowing and varieties, transplanted rice

Introduction

Rice, a staple food for nearly half the world's population, is cultivated in over 114 countries. Millions of people worldwide are engaged in its production, recognizing its essential role in global food security. This grain provides sustenance and livelihood security to a significant portion of the global population, particularly in India, where it supports over 70% of the population. India is the second largest producer of rice in the world after China. Recently weather variability is considered one of the major factors of inter-annual variability of crop growth and yield in all environments besides rainfall, temperature and bright sun shine hours also have been bearing on crop growth and development as well as yield response of different species to different environments, can be quite different. Shift in the sowing dates directly influences both thermo and photo period, and consequently have great impact on the phasic development and partitioning of dry matter. So dates of sowing is an important parameter. Lee *et al.* (1994) ^[1] found that delaying the transplanting date in southern Alpine regions accelerated the time to maximum tillering. Results of field trials conducted in Wuling mountain area of China revealed that young panicle differentiation and heading dates were delayed at later sowing dates (Xie, *et al.* 1995) ^[2]. (Wani, *et al.* 2016) ^[3] reported the days taken to reach flowering and harvest varied significantly among the sowing dates. Moreover, filled grains production decreased significantly with the delay of transplanting which was due to occurrence of low temperature at anthesis and spikelet primordial formation. (Singh and Singh 2000) ^[4]. The sowing time of the rice crop is important for three major reasons. Firstly, it ensures that vegetative growth occurs during a period of satisfactory temperatures and high levels of solar radiation. Secondly, the optimum sowing time for each cultivar ensures the cold sensitive stage occurs when the minimum night temperatures are historically the warmest. Thirdly, sowing on time guarantees that grain filling occurs when milder autumn temperatures are more likely, hence good grain quality is achieved (Farrell, *et al.* 2003) ^[5]. Rice seeded before the window of optimum dates usually has slow germination and emergence, poor stand establishment, increased damages from soil borne, seedling diseases under cold conditions and seeds lose by birds or mice (Linscombe, *et al.* 1999) ^[6]. Planting rice after the optimum dates can result in low

yield due to higher disease and insect incidence, tropical storm-related lodging and possible heat or cold damage during heading and the grain filling period (Groth and Lee, 2003 and Reza, *et al.* 2011) [7, 8]. Sowing date is most pivotal which describe the rice yield to a major extent.

Materials and Methods

The investigation was carried out during *kharif* 2021 at Institute of Rice Research, Professor Jayashankar State Agricultural university, Rajendranagar, Hyderabad, situated at an altitude of 542.3 m above MSL at 17°19' N latitude and 78°23' E longitude. It is in the Southern Telangana agro-climatic zone of Telangana state. According to Troll's climatic classification, it falls under semi-arid tropics (SAT). The soil of the experiment cites was clay loam in texture, low in available Nitrogen, high in phosphorus and potash content. The experiment was laid out in split plot design with three replications. Treatments consist of two dates of sowing i.e., July 1st week and July 3rd week. Transplanting was done with respective 25 days old seedling with 2-3 seedlings per hill. Cultures in sub plot consist of KPS 6251, WGL 1246, RDR 1162 and check variety RNR15048 and JGL 24423. Row to row distance was 20 cm and plant to plant 15 cm was maintained. Recommended dose of 120-60-40 kg NPK were supplied to the crop. The recommended dose of 60 kg P₂O₅, half of the recommended K₂O and 1/3rd of nitrogen were applied as basal dose. Remaining nitrogen was applied in two equal splits at 20 days after planting and at panicle primordial initiation (PI) stage. Remaining potash was applied at PI stage along with nitrogen. A thin film of water was maintained at the time of transplanting. Later, a submergence depth of 5 ± cm was maintained up to tillering stage later 2+cm maintained upto physiological maturity. Ten days before harvest the water was drained off from the field to facilitate ripening and maturity. Harvesting was done at physiological maturity, judged visually when about 95 per cent grains were turned into golden color. Initially the border rows were harvested. Later the net plot hills were harvested and bundled. The post harvest observations were recorded from the harvest samples. The hills from net plot area were threshed and winnowed. After sun drying, the net plot grain yields and straw were recorded treatment wise and reported in kg ha⁻¹.

Plant height was measured from ten tagged hills by measuring length from the basal node of the plant to the tip of the longest leaf at harvest. Mean height was presented as cm. Four samples of 2×2 hills were ear marked at random at four places in each treatment for tiller count. The wooden peg was fixed at the centre of four hills. Totally, sixteen hills per plot were considered for tiller count. The total number of tillers was presented as number m⁻². Ten panicles were selected randomly from the net plot area for recording the panicle length. It was measured from the base of the primary rachis to top most spikelet and average was calculated to get the mean length of panicle. Weight of ten sampled panicles was recorded and mean values were calculated. Total number of spikelets from same ten panicles was counted and filled grains were separated and counted and then mean values were reported. Dried seed samples were drawn randomly from each treatment and 1000 grains were counted and weight was recorded in grams. The grain yield from each net plot area treatment wise was weighed and expressed as kg ha⁻¹. Data on different characters viz., growth and yield components and yield, were subjected to analysis of variance procedures as outlined for randomized block design, factorial concept (Gomez and Gomez, 1984). Statistical significance was tested by F-value at 0.05 level of

probability and critical difference was worked out where ever the effects were significant.

Results

Plant height (cm) at harvest

At Different dates of sowing the plant height at harvest was non-significant. Among different cultivars highest plant height was recorded with RNR 15048 (103.2) and it was at par with WGL1246 (98.2) followed by KPS6251 (87.4) and was at par with JGL24423 (84.3) and RDR1162 (82.8). The interaction effect was non-significant.

Number of days taken 50% flowering

In different dates of sowing less no of days to 50% flowering was recorded in D2: 20 July.2021 (90) and followed by 05 July.2021 (95). Among different cultivars KPS6251, JGL24423 and RDR1162 (90) followed by RNR 15048 (92), WGL1246 (101). Interaction effect of Rice cultures at same level of D/S was Significant and D/S at same level of variety was also significant. Number of days taken Max tillering was non significant.

Number of days taken Maturity

At Different dates of sowing lower number of days taken Maturity was recorded with D2: 20. July.2021 (120) followed by D1: 05. July.2021 (125). Among different cultivars least number of days taken for maturity was recorded with KPS625, JGL24423 and RDR1162 (120) followed by RNR 15048 (122), WGL1246 (131). Interaction effect of Rice cultures at same level of D/S was Significant and D/S at same level of variety was also significant.

Panicles/m²

At Different dates of sowing Panicles/m² was non-significant. Among different cultivars higher number of panicles/m² was recorded in WGL1246 (323) followed by RNR 15048 (299) and it was at par with KPS6251(289), RDR1162 (287). Least number of Panicles/m² was recorded with JGL24423 (267). Interaction effect of Rice cultures at same level of D/S was Significant and D/S at same level of variety was also significant. Interaction effect among the different sowing dates and rice cultures for no. of panicles/m² was found to be significant among the rice cultures WGL1246 (361) has recorded higher no. of panicles/m² at D1:05. July. 2021. At D2:20. July. 2021 higher no. of panicles/m² was recorded with RNR 15048 (310).

Panicle length (cm)

Different dates of sowing and (Among different cultivars Panicle length was non-significant. Interaction effect at Rice cultures at same level of D/S and D/S at same level of variety were also non-significant.

Panicle weight (g)

At Different dates of sowing and Among different cultivars Panicle weight was non-significant. Interaction effect at Rice cultures at same level of D/S and D/S at same level of variety were also non-significant.

No. of filled grains/panicles

At Different dates of sowing the no. of filled grains/panicles was non-significant. Among different cultivars higher no. of filled grains/panicles was recorded in RNR 15048 (261) and was followed by WGL1246 (226) and it was at par with KPS6251(225) and RDR1162 (215). Least no. of filled grains/panicles was recorded in JGL24423 (159).

No. of chaffy grains/panicles

At Different dates of sowing no. of chaffy grains/panicles were non-significant. Among different cultivars lower no. of chaffy grains/panicles were recorded with RNR 15048 (21) and it was at par with JGL24423 (22), RDR1162 (22) and KPS6251 (27). Higher no. of chaffy grains/panicles were recorded with WGL1246 (31). Interaction effect at Rice cultures at same level of D/S and D/S at same level of variety were also significant. Interaction effect among the different sowing dates and rice cultures for no. of chaffy grains/panicle was found to be significant among the rice cultures WGL1246 (16) has recorded lower no. of panicles/m² at D1:05. July. 2021. At D2:20. July. 2021 lower no. of panicles/m² was recorded with RNR 15048 (19).

Test weight (g)

At Different dates of sowing the test weight was non-significant. Among different cultivars higher test weight was recorded in JGL24423 (25.6) followed by WGL1246 (15.7) and was at par with KPS6251 (15.2) followed by RDR1162 (13.9). Lowest test weight was recorded with RNR 15048 (11.7). Interaction effects were non-significant.

Grain Yield (kg/ha)

At Different dates of sowing the grain yield was non-significant and Among different cultivars higher grain yield was recorded with JGL24423 (7073) and was at par with KPS6251(6905), WGL1246 (6702) and RNR 15048 (6679). Lowest grain yield was recorded with RDR1162 (5854). Interaction effects were significant.

Interaction effect among the different sowing dates and rice cultures for grain yield was found to be significant among the rice cultures WGL1246 (7493) has recorded higher no. of panicles/m² at D1:05.July.2021. At D2:20.July.2021 higher grain yield was recorded with JGL24423 (7120).

Straw yield (kg/ha)

At Different dates of sowing the straw yield was non-significant and Among different cultivars higher straw yield was recorded with WGL1246 (10527) followed by JGL24423 (9692) and was at par with RNR 15048 (9489) and KPS6251 (8979). Lowest straw yield was recorded with RDR1162 (8280). Interaction effects were non-significant.

Table 1: Plant height (cm) and phenology of pre released rice cultures as influenced by different dates of sowing during *kharif*, 2021

Treatments	Plant height (cm) at harvest	Number of days taken Maxi tillering	Number of days taken 50% flowering	Number of days taken Maturity	Panicles/m ²
Main plots: Dates of sowing					
D1: July 1 st week	92.9	62	95	125	294
D2: July 3 rd week	89.4	60	90	120	292
S.Em±	1.00	0.41	0.24	0.26	0.89
CD (P=0.05)	NS	NS	2	2	NS
Subplots: pre released cultures					
RNR 15048	103.2	61	92	122	299
KPS6251	87.4	61	90	120	289
JGL24423	84.3	61	90	120	267
WGL1246	98.2	62	101	131	323
RDR1162	82.8	60	90	120	287
S.Em±	2.01	0.61	0.42	0.42	7.08
CD (P=0.05)	6.1	NS	1	1	21
Interaction					
Rice cultures at same level of D/S					
S.Em±	2.24	0.93	0.55	0.59	2.00
CD (P=0.05)	NS	NS	2.13	2.1	30.3
D/S at same level of variety					
S.Em±	2.74	0.88	0.59	0.59	9.0
CD (P=0.05)	NS	NS	2	2	27

Table 2: Interaction effect of days to 50% flowering of pre released rice cultures under different dates of sowing during *kharif*, 2021

	RNR 15048	KPS6251	JGL24423	WGL1246	RDR1162	Mean
D1: July 1 st week	96	93	92	102	92	95
D2: July 3 rd week	88	88	89	101	88	91
Mean	92	90	90	102	90	
Rice cultures at same level of D/S			D/S at same level of cultures			
S.Em±	0.55			S.Em±	0.59	
CD (P=0.05)	2			CD(P=0.05)	2	

Table 3: Interaction effect of days to maturity of pre released rice cultures under different dates of sowing during *kharif*, 2021

	RNR 15048	KPS6251	JGL24423	WGL1246	RDR1162	Mean
D1: July 1 st week	126	123	122	132	122	125
D2: July 3 rd week	118	118	119	131	118	121
Mean	122	120	120	132	120	
Rice cultures at same level of D/S			D/S at same level of cultures			
S.Em±	0.59			S.Em±	0.59	
CD (P=0.05)	2			CD(P=0.05)	2	

Table 4: Interaction effect of No. of panicles/m² of pre released rice cultures under different dates of sowing during *kharif*, 2021

	RNR 15048	KPS6251	JGL24423	WGL1246	RDR1162	Mean
D1: July 1 st week	288	287	261	361	274	294
D2: July 3 rd week	310	291	274	285	301	292
Mean	299	289	267.5	323	287.5	
Rice cultures at same level of D/S				D/S at same level of cultures		
S.Em _±	2.00			S.Em _±	9.0	
CD (P=0.05)	30			CD(P=0.05)	27	

Table 5: Yield attributes of pre released rice cultures as influenced by different dates of sowing during *kharif*, 2021

Treatments	Panicle length (cm)	Panicle weight(g)	No. of filled grains/panicles	No. of chaffy grains/panicles	Test weight (g)
Main plots: Dates of sowing					
D1: July 1 st week	23.6	1.6	207	22	16.4
D2: July 3 rd week	24.4	1.8	227	28	16.5
S.Em _±	0.28	0.04	7.1	1.51	0.24
CD (P=0.05)	NS	NS	NS	NS	NS
Subplots: pre released cultures					
RNR 15048	24.4	1.7	261	21	11.7
KPS6251	24.0	1.5	225	27	15.2
JGL24423	24.7	1.9	159	22	25.6
WGL1246	24.0	1.8	226	31	15.7
RDR1162	22.9	1.6	215	22	13.9
S.Em _±	0.39	0.13	11.5	2.29	0.51
CD (P=0.05)	NS	NS	33	6.8	1.55
Interaction					
Rice cultures at same level of D/S					
S.Em _±	0.64	0.1	15.8	3.39	0.55
CD (P=0.05)	NS	NS	NS	12	NS
D/S at same level of variety					
S.Em _±	0.58	0.17	15.8	3.2	0.7
CD (P=0.05)	NS	NS	NS	12	NS

Table 6: Interaction effect of No. of chaffy grains/panicle of pre released rice cultures under different dates of sowing during *kharif*, 2021

	RNR 15048	KPS6251	JGL24423	WGL1246	RDR1162	Mean
D1: July 1 st week	22	27	21	16	21	21
D2: July 3 rd week	19	27	23	46	23	28
Mean	21	27	22	31	22	
Rice cultures at same level of D/S				D/S at same level of cultures		
S.Em _±	3.39			S.Em _±	3.2	
CD (P=0.05)	12			CD (P=0.05)	12	

Table 7: Yield of pre released rice cultures as influenced by different dates of sowing during *kharif*, 2021

Treatments	Grain Yield (kg/ha)	Straw Yield (kg/ha)	Harvest Index
Main plots: Dates of sowing			
D1: July 1 st week	6652	9267	41.8
D2: July 3 rd week	6633	9520	41.0
S.Em _±	64.6	300.3	
CD (P=0.05)	NS	NS	
Subplots: pre released cultures			
RNR 15048	6679	9489	41.3
KPS6251	6905	8979	43.4
JGL24423	7073	9692	42.2
WGL1246	6702	10527	38.8
RDR1162	5854	8280	41.4
S.Em _±	216.8	291	
CD (P=0.05)	650	873	
Interaction			
Rice cultures at same level of D/S			
S.Em _±	144.4	671	
CD (P=0.05)	971	NS	
D/S at same level of variety			
S.Em _±	281.7	475	
CD (P=0.05)	892	NS	

Table 8: Interaction effect of grain yield (kg/ha) of pre released rice cultures under different dates of sowing during *kharif*, 2021

	RNR 15048	KPS6251	JGL24423	WGL1246	RDR1162	Mean
D1: July 1 st week	6402	6843	7026	7493	5496	6652
D2: July 3 rd week	6957	6968	7120	5910	6212	6633
Mean	6680	6906	7073	6702	5854	
Rice cultures at same level of D/S				D/S at same level of cultures		
S.Em±	144.4			S.Em±	281.7	
CD (P=0.05)	971			CD (P=0.05)	892	

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