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Stability of rice genotypes for yield and yield components over extended dates of sowing under Cauvery command area in Karnataka

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ABSTRACT

The stability of twelve rice genotypes for grain yield and its component characters in six environments of sowing dates were evaluated. Genotype x environment interaction was significant for grain yield and its components viz., number of productive tillers, panicle length, spikelet fertility per cent, 1000-grain weight and harvest index. Stability parameters of the genotypes exhibited differential response of some of the genotypes. None of the genotypes used in the study was stable for all the characters. However, the genotypes, IET 8116, KMP 101, IR 30864, CTH 1, CTH 3 and IR 64 were stable for grain yield. The study also indicated that sowing of long duration varieties could be extended upto July 1st fortnight and that of medium duration varieties upto 2nd fortnight of July instead of June 2nd fortnight and July 1st fortnight, respectively without significant reduction in grain yield.

Key words: *Genotype x environment interaction, stability, yield components*

In Karnataka, under Cauvery command area rice is cultivated both during wet and dry season. In wet season, the sowing starts in May-June and extends up to September-October. Though different varieties have been identified and recommended for sowing in different months, farmers are facing difficulties in adopting the same due to shift in rainfall pattern and scheduling of irrigation water in canal. As a result, many farmers are sowing long duration varieties in July and medium duration varieties in August instead of June and July, respectively. The delay in sowing is known to reduce the grain yield because of poor seed set and biotic stresses due to lower temperature and high humidity at flowering. However, no systematic study has been made on this aspect under Cauvery command area in the recent past. Hence, the present study was undertaken to estimate the influence of extended dates of sowing of different duration rice genotypes on grain yield and to identify stable genotypes across the seasons.

MATERIALS AND METHODS

The material comprised of twelve promising rice genotypes of different duration including one hybrid obtained from AICRP (Rice), Zonal Agricultural Research Station, V.C. Farm, Mandya, University of Agricultural Sciences, Bangalore.

Seeds were sown in wet nursery on six different dates *viz.*, E1(19th June), E2 (4th July), E3 (28th July), E4 (7th August), E5 (18th August) and E6 (7th September) with 15 days interval between each sowing, that represented a separate environment. The experiment was laid out in a single homogenous block following randomized complete block design with three replications in each environment. The genotypes were planted in a plot measuring 10.8 m^2 each in all the three replications. The crop in all the environments was raised as per recommended package of practices.

The experimental data in respect of days to 50 % flowering, plant height, number of productive tillers, panicle length, spikelet fertility per cent, harvest index and grain yield per plot were recorded on ten randomly selected plants in each replication and each environment. 1000-grain weight, grain density and L: B ratio was calculated from 100 g random sample drawn from each replication. The mean values were used for stability analysis as per Eberhart and Russell (1966).

RESULTS AND DISCUSSION

The analysis of variance for stability revealed significant differences among the genotypes and the environments (Table 1). The genotypes were found to interact significantly with the environments for days to 50 per cent flowering, plant height, number of productive tillers, panicle length, spikelet fertility, 1000-grain weight, grain density, harvest index and grain yield per plot. Suman Kumari *et al*. (1999) also reported significant G x E interaction for these characters. Environment (linear) had the highest influence for all the characters while GXE (linear) was not significant. Pooled deviations were significant for all characters except grain density. Thus the varieties differed for their stability.

For days to 50 per cent flowering KRH 2, CTH 1, CTH 3, Rasi and MTU 1001 were stable, while for number of productive tillers, three genotypes *viz*., IET 8116, BR 2655 and IR 64 were stable (Table 2). KMP 101 and IR 30864 were stable with respect to spikelet fertility. Among twelve genotypes studied, none of them was stable for 1000-grain weight as indicated by their regression coefficient and deviation from regression values. This character was reported as stable by Geetha *et al.* (1994), while Maurya and Singh (1977) identified significance of both linear and non-linear components. Three genotypes *viz*., KMP 101, IR 30864 and IR 64 were found stable for harvest index with the mean performance of 36.48, 37.27 and 36.55 per cent, respectively. It also indicated that their performance could be predicted well over all the environments in the present case of different dates of sowings.

For grain yield per plot, six genotypes *viz*., IET 8116, KMP 101, IR 30864, CTH 1, CTH 3 and IR 64 were stable. Among these genotypes, IET 8116 was highest yielder (7.10 kg) followed by Jaya (6.78 kg) and BPT 5204 (5.64 kg). These genotypes were found suitable for all the environments with predictable grain yield per plot. The above result was in accordance with findings of Wilfred Manual and Rangaswamy (1994), Mishra and Mahapatra (1998) and Mahapatra and Sujathadas (1999).

It can be concluded that none of the genotypes used in the study were stable for all the characters across the environments. However, the genotypes *viz*., IET 8116, KMP 101, IR 30864, CTH 1, CTH 3 and IR 64 were stable with predictable grain yield.

Table 1. Analysis of variance for stability of rice genotypes

Source of variance	df	Mean sum of square									
		Days to 50% flowering	Plant height (cm)	No. of productive tillers	Panicle length (cm)	Spikelet fertility (%)	1000 grain weight (g)	Grain density (g/cc)	Harvest index (%)	L : B ratio	Grain yield plot^{-1} (kg)
Genotype (G)	11	401.54**	977.31**	1.52**	11.92**	104.15	70.27**	0.03	44.72	0.55**	1.11**
Environment + GE	60	20.34**	84.17**	0.83**	1.93**	717.1**	4.24**	0.003**	345.82*	0.03	2.89**
Environment (linear)	1	644.2**	3216.9**	24.06**	18.11**	36688**	161.71**	0.054**	18827**	0.073**	151.8**
GE (linear)	11	11.95	42.30	0.67	1.34	169.58	2.46	0.0015	19.79	0.031	0.33
Pooled deviation	48	9.33**	28.50**	0.38**	1.73**	93.18**	1.37**	0.002	35.51**	0.03**	0.38**
Pooled error	132	0.474	14.36	0.23	0.51	50.69	0.25	0.006	17.61	0.008	0.34

*, ** Significant at 0.05 and 0.01 probability level, respectively.

Table 2. Estimates of stability parameters for different traits in rice

Genotypes	Days to 50% flowering			Number of productive tillers			Spikelet fertility (per cent)			1000-grain weight (g)			Harvest index (%)			Grain yield plot^{-1} (kg)		
	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i	Mean	b_i	S^2d_i
Jaya	110	1.47*	1.47**	8	1.38	0.35**	53.31	0.75	111.87**	25.02	0.40	1.25**	35.55	0.95	63.36**	6.78	1.05	0.47**
IET 8116	107	1.86*	24.99**	7	0.70	-0.02	50.68	0.96	121.86**	24.33	0.59	3.75**	32.04	0.80	28.18**	7.10	1.22	0.05
BR 2655	106	0.09*	18.15**	7	1.16	0.06	56.64	0.96	173.61**	21.58	1.18**	-0.07	31.07	0.97	21.40**	6.64	1.30	0.41**
BPT 5204	118	1.05	1.87**	8	-0.14	1.25**	57.09	0.36*	61.68**	13.96	0.41*	0.35**	33.95	0.82	70.77**	5.64	0.98	0.52**
KMP 101	107	1.32	4.97**	7	0.46	0.53**	63.69	1.13	9.51	16.78	0.53**	0.08	36.48	0.94	2.49	6.90	1.01	0.00
IR 30864	98	1.34*	4.05	7	1.52	0.14*	55.27	1.10	21.76	23.38	1.51*	0.39**	37.27	1.21	7.91	6.16	1.12	0.05
KRH 2	98	1.22	5.76	7	0.28	0.31**	58.02	1.14	47.02**	22.26	1.31*	0.85**	37.48	1.04	46.38**	6.00	0.93	0.20*
CTH1	94	0.77	4.20	6	1.52	0.14*	60.00	1.15	137.85**	23.96	0.88	0.21**	29.87	0.88	13.19*	4.76	0.83	0.08
CTH3	93	0.74	11.00	7	1.58	0.55**	55.07	1.02	195.63**	19.29	1.31*	1.71**	31.02	1.08	56.97**	4.88	1.02	0.15
IR 64	93	0.61*	3.78	7	1.66	0.06	60.07	1.19*	-7.37	25.02	1.06	5.37**	36.55	1.11	-0.81	5.22	0.90	0.04
Rasi	93	0.7	15.89	7	0.92	0.19**	57.50	1.15*	57.73**	22.63	1.60*	0.86**	36.46	1.08	23.94**	4.76	0.72	0.31**
MTU 1001	103	0.83	13.91	6	0.96	0.17*	56.16	1.09*	-15.13	22.59	1.20	0.72**	35.40	1.04	21.91**	5.48	0.91	1.02**

b_i = regression coefficient, S^2d_i = deviation from regression
*,** = significant at 5 and 1 per cent, respectively

Performance of genotypes in different environments suggest that sowing of long duration genotypes *viz.*, Jaya, IET 8116 and BR 2655 could be extended up to first fortnight of July and sowing of medium duration varieties like IR 64 and hybrid KRH 2 could be continued up to second fortnight of July instead of June second fortnight and July first fortnight, respectively without significant reduction in the grain yield.

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