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Short Communication

Stability analysis for grain yield and yield components of rice (*Oryza sativa* L.) in low lands of hill zone of Karnataka

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In Karnataka rice (*Oryza sativa* L.) is predominantly grown over an area of nearly 2.85 lakh hectares in eight districts of the hill region with a average productivity of 2.5 t/ha. Hill zone of Karnataka is a peculiar paddy growing belt and crop is cultivated as a mono crop during *kharif* under rain-fed situation in three different topographical situations *viz.*, uplands, mid lands and low lands. The farmers in these areas usually grow, high yielding long duration local varieties which are poor yieldets and lodging types. In order to evolve a suitable and stable rice variety, it is necessary to test different genotypes in the target environment. Information on the G × E interaction and stability parameters provides a better measure of stable variety and the varietal adaptability. The present study was conducted to assess the elite rice genotypes for their yield stability at three different locations during *kharif* season.

Eighteen rice genotypes were evaluated in low lands during *kharif* season of year 2001 at three locations, Mudigere, Ponnampet and Sirsi in Karnataka. The experiment was laid out in a randomized complete block design with three replications. Observations on plant height, days to flowering, panicle length, panicle number and grain yield were recorded at maturity. The mean values for all the traits across the locations were subjected to stability analysis [1].

Analysis of variance showed that the mean sum of squares due to genotypes (G) and environment (E) differences tested against the G × E interaction were significant for all the traits studied (Table 1), indicating the presence of wide variability among the genotypes and environment. The G × E interaction when tested against the pooled error was significant for majority of the traits, indicating that the major portion of interaction was linear in nature and the genotypes interacted considerably with the environment in expression of these traits at different locations. Both the linear and non-linear components were significant for days to 50% flowering, plant height and panicle number. Similar findings were reported earlier [2-4]. Significance of both the linear and nonlinear components of the G × E interaction for these traits indicated the possibility of predicting the performance of genotypes across the locations to a limited extent. Eberhart and Russel [1] suggested considering both the linear regression co-efficient and deviation from regression for phenotype stability.

The estimates on the three stability parameters, mean performance (Xi), regression coefficient (bi) and deviation from regression (S^2di) for different traits are presented in Table 2. The deviation from regression for grain yield were significant in the genotypes Intan, IET-14080, Sharavathi, IET-10472, IET-14320 and KHRS-22, IET-16695, KHRS-21 and KHRS-28 showed unit regression and non significant deviation from regression. The deviation from regression fro days to 50 per cent flowering was significant for the genotypes Intan, IET-15656, IET-14080, Sharavathi, IET-13736 and IET-9926. However, Hemavathi and IET-16695 showed unit regression and less deviation from regression. All the genotypes, except IET-14320, IET-16472, IET-9926, KHRS-21 and Purichippiga exhibits non significant deviation from regression for plant height. A unit of regression and non significant deviation from regression was observed in plant height for the genotypes KHRS-28, Sharavathi, Padma and KHRS-22. A rice variety Sharavathi recorded maximum plant height with unit of regression and non significant deviation from regression. For panicle number, all the genotypes showed non significant regression. But a unit of regression was observed for the genotypes Padma and IET-14320. The S^2di value for panicle length was significant in the genotypes Hemavathi and IET-13736. Any generalization regarding the stability of a genotype for all the traits is quite difficult. Some of the genotypes used in this study did not exhibit a uniform stability and response pattern for different traits. The two attributes appeared to be specific for the individual traits for a given genotype. Eberhart and Russell [1] suggested that, if the traits associated with high yield show stability, the selection of genotype only for yield could be effective. A non significance between the deviation from regression (S^2di) and mean performance (xi) or regression coefficient (bi) indicated that these stability parameters might be under the control of different genes located on different chromosomes [5].

Table 1. Analysis of variance for stability performance for grain yield and other important traits in rice

Source of variation	df	Mean sum of squares				
		Days to 50% flowering	Plant height (cm)	Panicle No.	Panicle length (cm)	Grain yield (t/ha)
Genotypes (G)	17	60.99^{aa}	876.55^{aa}	274.05^{aa}	2.72^{a}	2.26^{a}
Environments (E)	2	301.09^{aa}	775.02^{aa}	188.29^{aa}	2.44^{aa}	9.42^{aa}
G × E interaction	34	8.22^{**}	56.38^{**}	11.04^{**}	0.91	0.76
E + (G × E)	36	24.49^{++}	96.30^{++}	20.89^{++}	0.99	1.25
Env (Linear)	1	602.29^{++}	1550.15^{++}	376.11^{++}	4.87^{++}	18.83^{++}
G × E (Linear)	17	10.67^{++}	31.90^{++}	13.13^{++}	1.21	0.79
Pooled deviation	18	5.44^{**}	76.35^{**}	8.47^{**}	0.58	0.69
Pooled error	102	3.09	88.98	176.45	1.41	0.40

a and aa - Significant at P = 0.05 and P = 0.01 respectively when tested against G × E interaction, + and ++ Significant at P = 0.05 and P = 0.01 respectively when tested against pooled deviation, * and ** Significant at P = 0.05 and P = 0.01 respectively when tersted against pooled error.

Table 2 Estimate of different stability parameter for days to 50% flowering, plant height and panicle number, panicle length and grain yield in rice

Genotype	Days to 50% flowering			Plant height			Panicle number			Panicle length (cm)			Grain yield (t/ha)		
	Xi	bi	S^2di	Xi	bi	S^2di	Xi	bi	S^2di	Xi	bi	S^2di	Xi	bi	S^2di
Hemavathi	131.11	0.88	0.08	119.94	1.67	–29.19	263.56	2.61	–56.69	22.30	4.71	2.27**	4.21	0.64	0.34
IET-15655	139.89	2.02	–0.48	125.00	1.82	–24.49	241.89	1.71	–55.71	21.30	2.40	–0.43	4.73	0.35	0.32
Intan	127.11	0.89	8.32**	109.91	1.62	25.34	256.78	0.43	–58.12	20.43	5.02	1.24	3.94	3.13	3.71**
IET-15656	137.00	1.36	10.51**	128.89	1.81	–29.57	258.11	2.29	–58.83	19.94	3.74	–0.21	5.22	0.41	–0.08
IET-14080	136.22	1.31	6.48**	94.83	0.70	25.32	250.33	0.70	–56.39	20.97	1.44	–0.42	4.33	0.12	0.77**
KHRS-28	130.78	0.30*	1.29	120.31	0.95	31.39	245.00	1.15	–57.95	22.14	1.28	–0.47	5.53	0.85	–0.08
Sharavathi	143.22	0.99	7.42**	146.57	0.95	–29.62	245.56	1.19	–58.33	22.09	–1.35	–0.45	4.33	2.02	0.56**
IET-13736	135.78	1.83	20.66**	120.19	0.08	35.82	254.11	0.73	–40.11	20.64	–1.95	1.52**	5.06	1.21	–0.13
IET-16472	130.89	0.18*	1.51	86.29	0.95	91.90*	232.56	0.18	–51.87	19.37	2.81	–0.26	5.22	2.12	0.70**
Padma	131.44	0.80	–0.10	111.19	0.99	–29.12	235.00	0.99	–58.58	21.30	1.16	–0.46	5.32	0.33	0.36
IET-16213	133.67	0.60	–0.51	97.28	0.69	77.62	249.33	0.22	–41.18	21.10	–0.64	–0.30	4.20	0.48	–0.13
IET-14320	137.11	1.13	1.99	98.21	0.91	95.56*	258.11	1.04	–58.65	21.10	–0.38	–0.33	4.54	0.05	0.73**
IET-9926	134.89	1.49	17.64**	97.60	–0.30	306.91**	259.22	0.65	–57.65	19.97	–0.28	–0.19	5.18	1.17	–0.03
KHRS-10	139.22	1.73	1.47	146.27	1.49	6.58	237.00	–0.64**	0.24	23.29	–1.84	–0.16	5.04	0.32	0.94**
KHRS-21	136.00	0.09*	–0.43	117.78	0.83	103.30*	238.67	0.28	–56.29	21.34	–0.85	–0.43	6.61	0.58	0.16
IET-16695	139.56	1.00	0.42	96.56	0.17	8.39	251.67	1.42	–57.31	21.29	0.00	–0.45	4.66	0.74	–0.09
KHRS-22	133.33	0.31	–0.06	119.19	1.00	49.11	248.67	1.64	–25.55	21.49	0.97	0.85	5.74	1.06	–0.01
Purichippiga	126.22	1.07	3.21	124.49	1.68	125.23**	234.67	1.42	–57.30	21.97	1.76	0.62	4.23	2.42	2.01**
Mean	134.64			114.47			247.79			21.22			4.78		
SEm ±	1.65			1.61			1.20			0.51			0.58		

Based on the individual stability parameters, the genotypes KHRS-21, KHRS-22, KHRS-28 exhibited higher grain yield over the population mean, with regression coefficient near unity and negligible deviation from regression, indicating their average stability [6, 7]. Thus, it is concluded that the genotypes KHRS-21, KHRS-22 and KHRS-28 were ideally adaptable and stable. They could be recommended for cultivation in this hill zone of Karnataka.

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