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Stability analysis for grain yield and yield components in red rice

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ABSTRACT
Seventeen red rice genotypes were evaluated for the stability of yield and yield components by growing them in kharif season during 2002-04 at ZARS, Mudigere, Karnataka. Significant differences among the genotypes and environments suggested the presence of wide variability. Both the components of genotypes x environment interaction were significant, indicating that the major portion of interaction was linear in nature and prediction over the environments was possible. Based on the stability parameters, red rice genotypes doddabatta, jaddu batta, kemphasadi and natibatta exhibited higher mean grain yield, regression coefficient near unity and deviation from regression low. These varieties could be recommended for commercial cultivation in this region (Zone – 9).

Key words : Local red rice, Stability Analysis, Genotype, Environment interaction.

INTRODUCTION

Rice is predominantly grown in hill zone of Karnataka during wet season (kharif). The assured rainfall during kharif makes this crop to grown in this area as rainfed crop. Because of the undulations, paddy is being grown in uplands, midlands and low lands. Out of cultivated area of about 3.6 lakh ha paddy occupies an area of 2.8 lakh ha. More than 30 per cent of the area is sown in traditional local varieties because of local preference for some special qualities. A farmer prefers local red rice varieties because of its high market price and par boiling purpose. Thus, the present study was conducted to assess to seventeen local red rice genotypes for their yield stability over the environments.

MATERIALS AND METHODS

Seventeen red rice genotypes viz., Biliya, Doddabatta, Doddi, Doddiga, Halugidda selection, Jaddubatta, Kaggari kirwana, Kemphasadi, Kempusannakki, Kesari, Kirwana, Masale Puttabatta , Mattalaga, Nati batta, Nereguli, Pankaj were evaluated at ZARS, Mudigere, Karnataka during kharif over three years from 2002 to 2004 using a randomized block design with three replications. Twenty six day old seedlings were transplanted at a spacing of 20 x 15 cm in 2.2 x 1.2 m plots. All the recommended cultural practices were followed for raising a normal crop. Observations on days to 50 per cent flowering, plant height, panicle number, panicle length and grain yield were recorded from randomly selected five plants in each replication at maturity. The mean values for all the traits across the years were subjected to stability analysis (Eberhart and Russel, 1966).

RESULTS AND DISCUSSION

The pooled analysis of variance over the three years showed that the Genotype (G) and environment (E) differences tested against the G x E interactions were for all the traits studies (Table 1), indicating the presence of wide variability among the genotypes and environments.

Table 1: Analysis of variance for stability performance for Grain yield and other important traits in rice

Sources	DF	Mean sum of squares				
		Days to 50% flowering	Plant height (cm)	Panicle No.	Panicle length (cm)	Grain yield (t/ha)
Varieties	15	99.7234^{aa}	232.2703^{aa}	0.06949^{aa}	3.8196^{aa}	0.07515^{aa}
Environments	2	81.1047^{aa}	728.9180^{aa}	0.91154^{aa}	1.4471^{aa}	0.09538^{aa}
Variety x environments	30	5.7840^{xx}	37.2437^{xx}	0.03713^{NS}	1.2484^{xx}	0.01342^{NS}
Total	47					
Pooled error	90	1.6164	4.6959	0.2535	0.3854	0.03318
Env + (Var x Env)	32	10.4915^{++}	80.5359^{++}	0.09178^{+}	1.2608^{NS}	0.01854^{NS}
Env (Linear)	1	162.3761^{++}	1459.7059^{++}	1.82292^{++}	2.8905^{NS}	0.19081^{++}
Var x env (Linear)	15	8.1330^{+}	68.6378^{++}	0.02861^{NS}	1.2173^{NS}	0.01341^{NS}
Pooled deviation	16	3.2098^{xx}	5.4922^{xx}	0.04280^{NS}	1.1998^{xx}	0.01259^{NS}

a and aa Significant at P=0.05 and P=0.01 respectively when tested against the G x 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 tested against pooled error.

* Author for corrospondence.

The G x E interaction when tested against the pooled error was significant for almost all the traits, indicating that the major portion of interaction was linear in nature and prediction over the environments was possible (Satit et al., 2000, Sarawgi et al., 2000, Mc Luren and Wade, 2000). The pooled deviation was significant for most of the trait when tested against the pooled error suggested considerable genotypic differences for these traits. A significant linear sensitivity suggested that the performance of genotypes across the environments could be predicted with great precision. Bains and Gupta (1972) reported the response was not predictable and was simply inherited. Apportioning of the G x E interaction revealed that the both linear and non-linear components were significant for the most the traits, indicating their importance in the expression of these traits in rice. However, the non-linear component was greater than the linear component for grain yield, plant height and panicle length, while the linear component was predominant for number of panicles, as was reported by De et al., (1990). Jamadagni and Birari (1990) also reported similar findings for grain yield. Eberhart and Russel (1996) emphasized the need of considering both the linear and non linear components in assessing the stability of genotypes. The magnitude of mean deviation square for the component, which is due to linear regression, is usually small. A genotype was considered stable when the regression coefficient was near unity, the deviation from regression was either zero or as small as possible with high mean performance.

The data 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 non-linear component of the G x E interaction was significant in the genotypes doddabatta, doddi, doddiga, jaddubatta, kaggari kirwana, kemphasadi, mattalaga for days to flowering and biliya, doddabatta, doddi, halugidda selection, jaddubatta, kemphasadi, masala puttabatta for plant height and dodda batta, doddi, halugidda selection, kaggari kirwana, kempusannakki, mattalaga, pankaj for panicle length, The non linear component was greater than the linear component, indicating its preponderance for these traits (De et al., 1990, 1992). The above said genotypes for days to flowering plant height and panicle length were found responsive to the favourable environment and stable.

The regression coefficients for grain yield were significant in the genotypes pankaj, masala puttabatta, kirwana and kaggari kirwana whereas the genotypes doddabatta, jaddubatta, kemphasadi, kersari and natibatta showed unit regression and non-significant deviation form regression. The deviation from regression for days to flowering was significant in the genotypes biliya, doddabatta, doddi, jaddubatta, kaggari kirwana, kemphasadi and muttalaga. However, kirwana showed unit regression and non – significant deviation from regression. Seven genotypes showed significant S^2di values for plant height. A unit of regression value was observed for the genotypes mattalaga, natibatta and pankaj. The S^2di and regression values for panicle number were not significant for all the genotypes. However, genotypes nereguli and kaggari kirwana showed unit regression and lower S^2di values. For panicle length, seven and five genotypes showed significant S^2di and regression values respectively.

Based on the individual stability parameters the genotypes doddabatta, jaddubatta, kemphasadi and natibatta exhibited higher grain yield over the population mean, with regressioin coefficient near unity and negligible deviation from regression, indicating their average stability (Amrithadevarthinam, 1987; De et al., 1990, Jamadagni and Birari 1990). Thus it is concluded that the genotypes were

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

Var	Days to 50% flowering			Plant height			Panicle number			Panicle length (cm)			Grain yield (t/ha)		
	X	Bi	S^2di	X	Bi	S^2di	X	bi	S^2di	X	Bi	S^2di	X	Bi	S^2di
Biliya	146.00	0.44	-0.53	140.51	1.36	8.57^{++}	5.57	0.37	-0.03	24.04	2.79	0.01	1.68	1.46	-0.01
Doddabatta	146.56	0.69	2.25^{++}	126.04	1.49	20.72^{++}	5.76	1.77	-0.07	21.18	0.22	1.87^{++}	1.77	0.60	-0.01
Doddi	142.22	0.64	2.02^{++}	144.93	2.52	17.42^{++}	5.56	1.49	-0.07	24.20	0.36	1.16^{+}	1.55	1.79	0.07
Doddiga	144.11	1.09	10.86^{++}	146.24	2.55	-0.62	5.64	0.34	0.03	24.56	1.86	0.75	1.73	2.00	0.00
Halugidda sel.	147.78	0.61	0.45	135.93	0.30	12.99^{++}	5.58	1.25	-0.08	23.36	3.84	3.47^{++}	1.68	2.07	-0.01
Jaddubatta	140.44	1.90	2.21^{++}	123.49	2.06	4.07^{++}	5.57	0.82	-0.08	21.36	-4.95^{**}	3.44^{++}	1.47	1.07	-0.01
Kaggari kirwana	141.22	0.05	1.73^{++}	129.38	1.45	-0.87	5.53	0.91	-0.07	21.92	3.82	-0.12	1.57	-0.38*	0.00
Kemphasadi	140.56	-0.43*	14.56^{++}	126.09	0.28	4.72^{++}	5.58	0.61	-0.08	22.76	5.67	1.56^{++}	1.59	0.88	-0.01
Kempusannakki	149.22	0.49	1.94^{++}	125.51	1.34	-1.49	5.36	1.68	-0.08	21.56	1.34	0.41	1.25	1.45	0.02
Kesari	131.44	2.46	0.73	126.18	-0.34^{*}	-0.27	5.71	1.43	0.15	23.38	-0.86^{**}	-0.06	1.43	0.68	0.03
Kirwana	139.33	0.97	-0.47	124.80	0.09	-1.46	5.73	0.46	-0.05	23.60	-0.66^{**}	-0.13	1.52	-0.59*	-0.01
Masale Puttabatta	146.11	0.30	-0.48	126.07	0.54	0.99^{+}	5.64	1.25	0.01	21.80	-0.64^{*}	0.26	1.64	-0.29*	0.00
Mattalaga	142.44	0.42	1.50^{++}	129.43	0.90	-1.57	5.31	0.70	-0.03	21.24	-1.96^{**}	1.46^{++}	1.50	2.02	-0.01
Nati batta	131.22	2.24	0.50	117.49	0.60	0.02	5.63	0.37	-0.08	21.96	1.35	0.02	1.54	0.95	-0.01
Nereguli	131.22	2.60	-0.22	114.78	0.21	-0.23	5.58	0.98	-0.04	22.87	0.66	-0.13	1.18	2.91	0.00
Pankaj	143.78	1.52	5.68^{++}	128.29	0.66	-0.16	5.56	1.58	-0.08	22.06	3.18	3.16^{++}	1.58	-0.62*	0.00

* and ** Significant at P-0.05 and P=0.01 respectively, bi-regression coefficient and S^2di-deviation from the regression.

ideally adaptable and stable and could be recommended for commercial cultivation in the hill zone of Karnataka.

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