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Short Communication

Genotype × environment interaction in lowland rice genotypes of hill zone of Karnataka

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Forty promising long duration rice genotypes were evaluated across six farming situations of Hill Zone (Region V) of Karnataka during *kharif* 1998 to study G × E interaction and identity stable genotypes of high grain and straw yield for low land situation where tall genotypes with long duration are preferred. Randomized block design replicated thrice was used in all the six locations each of which represented a farming situation differing in elevation and rainfall. Net plot size was 2 m^2 and spacing between rows and plants with in rows was 20 and 10 cm respectively. Cultural practices as per the recommended package were followed. Plant height was recorded on ten randomly selected plants in each replication and days to 50% flowering, grain yield and straw yield were recorded on whole plot basis. Bartletts test was employed to test the homogeneity of error variances of different environments. The stability parameters of different genotypes were computed as per Eberhart and Russel [1].

The mean squares due to genotype as well as environments were highly significant. The genotype × environment mean squares was significant for all the characters indicating differential response of the genotypes in different environments. Both linear and non linear components of G × E interaction were significant for days to 50% flowering, grain yield and straw yield and only non linear component was significant for plant height. Reports on significance of both linear and non linear components of G × E interaction for grain yield [2], for straw yield [3] and significance of only non linear component for plant height [4] were in line with the above findings.

Table 1. Pooled analysis of variance in promising long duration rice genotypes in six farming situations of hill zone of Karnataka

Source	df	Mean Squares			
		X_1	X_2	X_3	X_4
Genotype (G)	39	156.46**	1562.01**	0.063**	0.44**
Environment (E)	5	123.48**	10650.02**	4.620**	65.70**
G × E	195	25.78**	86.81**	0.03**	0.26**
Envt. (Linear)	1	5617.39**	53250.11**	23.120**	328.49**
G × E (Linear)	39	34.68**	54.53	0.040**	0.54**
Pooled deviation	160	16.68**	72.33**	0.020**	0.12**
Pooled error	480	1.41	6.18	0.004	0.030

** = Significant at P = 0.01

X_1 = Days to 50% flowering; X_2 = Plant height (cm); X_3 = Grain yield kg per plot; X_4 = Straw yield kg per plot

Among the forty genotypes tested, 33 were found stable for grain yield over the locations as indicated by their non significant deviation from regression (S^2di) (Table 2). Among these, IR 57773, IET 13736, Puttabatta, IET 11865, KHRS 28, PUB and BKB showed average response to changes in environmental conditions as indicated by their unit regression coefficient (bi).

Deviation from regression (S^2 di) for straw yield was non significant for 36 genotypes. IRLON 90/39, Mattalaga, IET 11865, ASD 10 and Halugidda showed average performance over environments with unit bi value and deviation from regression coefficient nearer to zero. Regression coefficient of more than unity for KHRS 21, IET 10549 and less than unity for PUB and Kaggari Kirwana indicated their suitability for favourable and unfavourable environments respectively.

The genotypes Intan, KHRS 28, KHRS 22, Biliakki, IET 10549, Mattalaga, Hemavathi and KHRS 32 were found stable for days to 50% flowering over environments with desirable mean as indicated by their non significant deviation from regression (S^2 di) and bi equal to unity.

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Table 2. Mean performance and Stability parameters in promising long duration rice genotypes of hill zone of Karnataka

Genotype	Days to 50% flowering			Plant height (cm)			Grain yield kg/plot			Straw yield kg/plot		
	Mean	bi	S^2 di	Mean	bi	S^2 di	Mean	bi	S^2di	Mean	Bi	S^2 di
ASD 10	126.61	0.16	143.01**	109.37	0.97	743.98**	0.55	1.14	0.02	2.98	1.03	0.35
Biliakki	135.11	1.04	51.78	122.81	1.02	91.85	0.75	1.36	0.05	2.86	1.53	0.92
Bilia	139.06	1.07	28.37	140.32	1.11	1154.90**	0.72	1.20	0.11	2.59	0.87	1.26
BKB	142.94	1.24	15.50	147.01	0.80	226.96	0.69	0.91	0.06	2.78	0.88	0.26
BJ 1	139.33	0.71	29.16	125.11	1.16	185.85	0.70	1.16	0.10	2.62	1.24	0.27
CN647RRR27	131.67	–0.53	340.46**	108.87	1.17	135.84	0.49	1.06	0.02	2.30	0.63	0.83
Doddi	137.56	1.11	9.07	129.27	1.12	231.04	0.62	1.12	0.14**	2.33	0.87	0.96
Halugidda	141.89	1.25	18.65	145.25	1.05	144.94	0.64	0.86	0.06	2.92	1.05	0.07
Hemavathi	135.72	0.86	7.15	112.73	1.45	470.21**	0.58	1.08	0.03	2.23	0.84	0.16
HR 12	132.78	–0.96	476.27**	101.26	1.26	1175.43**	0.40	0.73	0.04	1.95	0.86	0.35
IET 9926	141.22	1.16	18.48	93.24	0.95	267.80	0.83	1.41	0.09	2.11	1.13	0.33
IET 10549	136.44	1.05	23.76	122.95	1.36	187.90	0.53	0.85	0.07	2.57	1.31++	1.12
IET 11865	138.11	1.08	1.68	131.38	1.13	85.35	0.70	0.92	0.04	2.57	1.03	0.44
IET 11875	129.11	1.34	22.56	117.59	1.27	490.51**	0.49	1.20	0.08	2.51	1.27	0.58
IET 13736	140.17	1.30	7.50	107.27	0.70	200.36	0.64	1.02	0.05	2.20	0.81	0.59
IET 14320	138.50	0.82	78.98**	95.61	0.75	151.25	0.69	1.27	0.23**	2.29	0.43	0.93
IET 14329	140.22	1.16	36.14	97.53	1.01	115.56	0.61	1.05	0.12*	2.58	1.35	0.79
IET 14707	136.94	1.30	7.79	107.89	0.64	869.53**	0.50	0.94	0.09	1.90	1.06	0.37
Intan	130.28	0.96	36.84	103.31	0.95	48.16	0.51	0.85	0.08	2.29	0.72	0.44
IR 34956	126.94	1.31	407.35**	79.46	0.74	105.74	0.47	0.85	0.08	2.09	0.79	0.41
IR 55914	145.67	1.25	26.43	83.99	0.62	129.58	0.62	0.87	0.04	2.30	1.10	0.21
IR 57773	145.50	1.32	16.26	134.01	0.92	8.04	0.66	0.98	0.04	2.74	1.16	1.18
IRLON90/39	139.28	1.53	32.26	123.26	0.87	203.86	0.78	0.78	0.18**	2.72	0.99	0.63
KHRS 10	144.50	1.27	20.84	136.13	0.94	562.85**	0.66	0.65	0.08	2.67	1.14	0.28
KHRS 21	140.22	0.81	25.34	106.02	1.00	90.13	0.61	1.25	0.02	2.75	1.32+	0.20
KHRS 22	134.50	1.04	51.41	106.59	0.92	101.34	0.63	0.94	0.07	2.87	1.43++	0.02
KHRS 28	134.17	0.89	71.35	109.94	0.80	242.97	0.64	1.08	0.06	2.03	0.71	0.94
KHRS 32	136.67	1.14	4.41	129.60	1.21	67.13	0.63	1.24	0.05	2.38	0.71	0.58
KHRS 34	137.33	1.17	12.28	129.36	1.20	384.24*	0.74	0.86	0.12*	2.47	1.03	0.32
KHRS 37	129.17	1.49	147.33**	106.34	1.11	81.57	0.50	1.19	0.03	2.46	0.56	0.49
Kaggari Kirwana	136.67	1.28	19.95	129.63	0.97	90.76	0.77	1.14	0.10	2.41	0.68+	0.15
Kempu Sannakki	144.61	1.25	33.40	131.42	0.86	107.27	0.65	0.62	0.05	2.69	1.14	0.52
Kirwana	137.28	0.91	33.32	131.08	1.03	91.77	0.69	0.76	0.11	2.69	1.30	0.38
Mattalaga	136.56	1.14	18.94	120.25	0.86	139.64	0.63	1.11	0.09	2.68	1.01	0.12
Rajamudi	136.33	0.66	274.11**	115.59	1.19	1008.43**	0.58	0.622	0.15**	2.58	1.22	0.47
P 20-3	141.56	1.53	14.49	118.84	0.78	100.70	0.82	0.74	0.79**	2.55	1.27	0.23
PUB	142.00	1.33	9.93	127.13	0.81	231.67	0.70	0.92	0.04	2.46	0.77	0.40
Urala Chippiga	141.56	1.19	7.28	135.54	1.02	81.05	0.73	0.87	0.10	2.90	0.81	1.07
Vallya	126.11	0.34	75.16	104.55	1.16	623.52**	0.59	1.36	0.07	2.52	0.80	0.23
Mean	137.20			117.72			0.63			2.50		

* and ** : Significant at 5% and 1% respectively; + and ++ : Significantly different from unity at 5% and 1% respectively

KHRS 21, IET 14329, Intan, KHRS 22, KHRS 37 and Mattalaga were the stable genotypes for plant height with average performance, while IET 11865, KHRS 32, IET 10549 and CN 647 RRR 27 were identified as suitable genotypes for favourable environments as indicated by their high regression coefficient (bi > 1) value and BKB, Kempu Sannakki, PUB and IRLON 90/39 for unfavourable environments as revealed by their low bi values (< 1).

From the present study, IR 57773, IET 13736, Puttabatta, IET 11865, KHRS 22, KHRS 28, PUB and BKB with high mean, regression coefficient equal to one and deviation from regression nearer to zero were identified as high yielding stable genotypes for grain yield across six farming situations of hill zone of Karnataka for lowland cultivation.

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