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Stability analysis of yield and yield related traits in Rice (*Oryza sativa* L.)

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Abstract
Identification of scented fine slender rice varieties with wider adaptability and stability are the important aspects in varietal recommendation to achieve better economic benefits for farmers. Multi location trails are conducted in different locations / seasons to test and identify the consistently performing varieties of wider environments and location specific high performing varieties. So, the present field experiment with thirty four scented fine slender rice genotypes including checks was conducted at Raipur, Jagdalpur, Kawardha and Raigarh research stations of Chhattisgarh during the *Kharif* 2015 to screen out the rice genotypes with wider adaptability and stability. The stability analysis revealed that genotype, environment and genotype (G) x environment (E) interaction were significant for all the characters except for 1000 grain weight. The pooled analysis of variance in stability showed significant differences between the genotypes for all the characters. In the present study based on stability parameters and over all mean, genotype R 1656-2151-1-412-1 was found stable for all environments in performance for grain yield, because this entry had high mean, unit regression and non-significant deviation from regression for grain yield, Whereas entry R 1926-1013-2-595-1 and R 1747-4941-1-515-1 had regression value below than one ($b_i < 1$) and deviation from regression was non-significant, so these entries were found to be suited for unfavorable / poor environments.

Keywords: Stability, regression, yield components, scented fine slender rice

1. Introduction

Rice (*Oryza sativa* L.) is the most important cereal crop of India. The demand of fine rice is always high although it possesses lower yield potentiality than HYV (High Yielding Variety). Yield is depend on a number of other characters and is highly influenced by many genetic factors as well as environmental fluctuation. Genotypes which can adjust its phenotypic state in response to environmental fluctuations in such a way that it gives maximum stable economic return can be termed as well “buffered” or stable Allard and Bardshaw, (1964) [1]. In crop improvement program, potential genotypes are usually evaluated in different environments before selecting desirable ones. For stabilizing yield it is necessary to identify the stable genotypes suitable for wide range of environments. To identify such type of genotypes, G-E interactions are important for a breeder, because such interactions confound the selection of the superior cultivars by altering their relative productiveness in different environments Eagles and Frey (1977) [2]. Varietals study in yield with respect to wide range of environments is one of the most desired properties of genotypes to fit the crop under available cropping pattern. So, wider adaptability and stability are prime consideration in formulating efficient breeding program. Stability analysis is a good technique for measuring the adaptability of different crop varieties to varying environments Morales *et al*., (1991) [3].

Therefore, present study was undertaken to estimate the G-E interactions through stability parameters and performance of some traits of thirty-four scented fine rice genotypes across environments and to identify the suitable genotypes for future breeding programme.

Materials and Methods

The experimental material comprised of 22 rice genotypes with 12 checks of rice in four environments. The experiment was conducted in *kharif* 2015 at four locations namely Raipur, Ambikapur, Jagdalpur and Kawardha. The experiment was laid out in a randomized complete block design. For each genotype, single seedling per hill was planted out 20 x 15 cm spacing in 11 rows of 2.0 m length. The genotypes–environment interactions and stability analysis were done following the method suggested by Eberhart and Russell (1966) [4]. Data onto days to 50% flowering, plant height (cm), grain yield (g/plot) and 1000 seed weight (g) were collected from the field.

Results and Discussion

The results of the combined analysis of variance after Eberhart and Russell model are presented in Table 1. Partitioning of mean sum of squares into that of genotypes, environment + (genotypes x environment) and pooled error revealed that genotypes were highly significant for all the characters studied, indicating the presence of genetic variability in the experimental material under study it is accordance with the findings of Anandan *et al.* (2009) [5]. Also, genotype x environmental interaction was highly significant for all the character showing that the relative performances of the genotypes were significantly affected by the varying environmental conditions. This is accordance with the finding of Taddesse Lakew *et al.* (2014) [11]. Mean squares due to environment (linear) was found significant for most of the characters, indicating differences between environments and their influence on genotypes for expression of these characters (Table 1). This is in accordance with previous reports on rice by Sawant *et al.* (2005) [7] and Panwar *et al.* (2008) [6].

The genotype x environment (linear) interaction component showed non-significance for all the characters. Gouri Shankar *et al.* (2008) [10] and Parry *et al.* (2008) [9] also noticed significant linear component of G X E and nonlinear components of G x E interaction for most of the characters studied. Among the entries tested R 1656-2151-1-412-1 showed high mean, unit regression and non-significant deviation from regression for grain yield. This genotype suitable for general adaptation, *i.e.*, suitable over all environmental conditions and consider as stable genotype. Vishubhog and Mahisugandha (check) showed regression value significantly more than one ($b_i > 1$) and showed non-significant deviation from regression (Table 3). Hence, these genotypes were found to be suitable for favorable environments and there is yield reduction in the unfavorable environments. Entry R 1926-1013-2-595-1 and R 1747-4941-1-515-1 had the regression value below one ($b_i < 1$) and non-significant deviation from regression was found to be suited for unfavorable / poor environments. Similar results were observed by Bhakta and Das (2008) [8] and Panwar *et al.* (2008) [6].

Table 1: Analysis of variance for stability performance for grain yield and component traits

Sources	Degree of freedom	Mean sum of squares			
		Days to 50%flowering	Plant height	1000 Grain weight	Yield Q/ha
Varieties	33	200.1**	1392.39**	28.45**	107.07**
Environment	3	4563.96**	1508.63**	19.43**	2453.93**
Variety x environment	99	20.45**	44.05	3.42	32.39**
Env.+(Var*Env.)	102	154.08	154.08	3.89	103.61
Env. (linear)	1	15691.78**	4525.58**	4.16**	7361.71**
Var.*Env.(Lin.)	33	14.46	38.32	58.35**	31.46
Pooled deviation	68	22.76**	45.53**	1.04*	31.46**
Pooled error	264	3.52	3.59	0.67	0.21

*Significant at 1%, ** significant at 5%

Table 2: Stability analysis for yield and yield components of thirty-four genotypes in Rice

S. No.	Genotype	Days to 50% flowering			Plant height			1000 G.wt.			Yld Q/ha		
		Mean	b_i	S^2D_i	Mean	b_i	S^2D_i	Mean	b_i	S^2D_i	Mean	b_i	S^2D_i
1	R 1926-1013-2-595-1	82.33	0.91	-0.84	91.67	0.54	31.6**	21.17	0.04	0.18	41.02	0.65	-3.50
2	R 1607-321-1-34-1	92.5	0.88	-3.05	102.22	1.13	54.1**	26.31	1.76	8.24**	42.77	1.08	7.34**
3	Ganjikali	99	1.18	15.95**	123.4	0.4	49.98**	19.06	-1.23	10.3**	48.14	0.82	17.79**
4	TET 21053(NDR 9542)	99.92	0.85	10.63**	109.22	0.27	-5.24	21.4	1.87	2.05	46.79	1.04	27.80**
5	R 1536-136-1-77-1-(21842)	90.33	0.99	9.14**	86.41	1.12	-5.11	17.77	1.16	-0.84	38.64	0.91	72.44**
6	R 1903-397-1-364-1	76.75	1.2	57.27**	96.49	0.55	7.17**	21.06	0.7	-1.63	33.91	0.46	41.58**
7	R 2093-1536-1-660-1	83.08	1.47	222.59**	88.66	0.93	45.06**	21.45	1.72	2.52	37.61	0.27	16.84**
8	R 1656-2815-9-3223-1	97.92	1.2	9.23**	100.82	1.96	55.09**	19.12	1.06	3.42**	35.82	0.09	16.62**
9	RSR-2011-12-1	100.5	1.17	31.23**	127.07	0.70	-7.5	19.9	1.05	7.44**	33.46	0.79	42.88**
10	R1700-302-1-156-1	87.92	0.92	0.65**	96.03	0.94	17.47	21.33	0.49	1.28	44.17	0.89	42.96**
11	R 1750-937-1-530-1	82	0.93	5.1**	96.12	0.22	38.12**	24.01	0.7	-0.18	44.24	0.81	18.26**
12	R 1700-2240-4-2295-1	89.08	0.82	8.27**	91.93	0.52	19.71**	22.52	0.76	-0.83	45.84	0.6	39.51**
13	R 1747-4941-1-515-1	83.08	1.17	43.13**	95.71	0.42	-3.43	24.63	0.61	-1.24	45.12	0.84	-3.17
14	R 1917-951-1-541-1	80.25	0.87	30.78**	92.95	1.09	11.16**	23.79	1.95	2.49	41.17	0.98	25.22**
15	R 1656-2151-1-412-1	97.17	1.02	27.39**	120.88	0.72	25.27**	19.43	0.77	7.86**	38.62	1.14	-1.24
16	R 1915-458-1-119-1	91.58	0.81	-3.32	95.16	1.11	36.51**	22.68	-0.44	-1.63	39.44	0.65	3.89**
17	R 2033-512-1-138-1	101.17	1.04	3.17**	100.52	1.62	-0.68	22.21	2.45	5.93	36.89	0.93	38.80**
18	R 1919-537-1-160-1	94.42	0.89	0.08	83.8	0.66	3.09	18.57	1.81	-1.73	41.15	1.52	78.43**

19	R 2054-685-1-205-1	96.42	0.89	0.08	84.66	0.99	-3.13	20.73	0.37	3.86*	41.19	1.37	10.29**
20	R 2058-687-1-208-1	88	0.74	1.3**	91.57	1.48	18.09**	26.12	-0.28	-1.68	37.54	1.08	2.87**
21	R 1656-1146-5-513-1	97.08	0.92	-1.56	86.41	1.19	-7.65	19.92	-0.24	2.32	42.12	1.07	23.29**
22	R 1656-2816-9-323-1	96.75	1.16	1.08**	98.42	1.28	148.31**	19.61	1.08	6.92**	33.98	0.96	21.63**
23	Badsha Bhog	99.17	1.18	17.70**	147.78	1.42	195.79**	15.77	2.80	-0.18	28.75	1.00	41.27**
24	Chinnor	99.17	1.25	16.05**	149.43	1.71	70.38**	19.94	0.24	-1.36	33.89	0.96	94.52**
25	Mahisugandha	85.92	0.92	56.02**	106.28	1.39	32.51**	23.42	1.32	3.68*	35.04	1.18	0.95
26	Indira sugandhit Dhan-1	95.92	0.92	16.14**	98.29	1.77	4.14*	23.15	1.67	-0.57	37.18	1.28	7.92**
27	Dubraj	98	1.15	43.55**	130.95	1.96	292.1**	19.7	0.53	-1.33	34.87	0.95	69.22**
28	Shamjeera	97.17	1.35	20.66**	148.52	2.01	7.68**	15.23	3.72	-0.02	26.2	1.23	22.28**
29	Vishnu Bhog	98.42	1.21	20.23**	129.48	0.07	115.31**	18.88	1.74	4.53*	33.18	1.92	-0.70
30	Dubraj selection 1	95.67	0.82	7.73**	99.06	1.30	-5.17	19.74	0.8	3.47	36.71	1.89	11.98**
31	Pusa basmati-1	88.08	0.67	-1.45	98.45	0.88	15.81**	23.88	0.16	-0.11	33.32	0.73	19.32**
32	IR- 64	83.5	0.86	-2.25	93.04	0.55	2.51	25.38	0.29	-0.27	44.02	1.21	17.64**
33	Chandrahasini	82.08	0.86	-3.03	95.18	0.30	-2.41	23.03	0.52	-0.56	36.97	1.28	42.00**
34	Indira Sona	87	0.78	-3.31	96.92	1.25	-0.09	22.99	2.04	20.25	44.48	1.36	33.28**

*Significant at 1%, ** significant at 5%

Conclusion

The study suggests that genotype R 1656-2151-1-412-1 may be selected as stable genotype for all environments. These materials can be used in scented fine slender rice breeding program as a source of genes for stability.

As a result, almost all of the evaluated genotypes were affected by the genotype × environment interaction effects, so that no genotype had superior performance in all environments. Thus the highly significant G × E effects suggest that genotypes may be selected for adaptation to specific environments.

Reference

1. Allard RW, Bradshaw AD. Implications of genotype environment interactions in applied plant breeding. Crop Science. 1964; 4:503-508.
2. Eagles HA, Frey KJ. Repeatability of the stability variance parameter in oats. Crop Sci. 1977; 17:253-256.
3. Morales AC, Paragas AA, Carangal VR. Phenotypic stability for grain yield in mung bean. (Vigna radiata L.) FLCG Newsletter. 1991; 16:12-15.
4. Eberhart SA, Russel WA. Stability parameters for comparing varieties. Crop Science. 1966; 6:36-40.
5. Anandan A, Eswaran R, Sabesan T, Prakash M. Additive main effects and multiplicative interactions analysis of yield performances in rice genotypes under coastal saline environments. Advances in Biological Res. 2009; 3:43-48.
6. Panwar LL, Joshi VN, Mashiat Ali. Genotype x environment interaction in scented rice. Oryza 2008; 45(1):103-109.
7. Sawant DS, Kunkerkar RL, Shetye VN, Shirdhankar MM. Stability assessment in late duration rice hybrids. In: National seminar on “Rice and Rice Based Systems for Sustainable Productivity, Extended summaries, ICAR Research Complex for Goa”, 2005, 75-76.
8. Bhakta N, Das SR. Phenotypic stability for grain yield in rice. *Oryza*, 2008; 45(1):105-119.
9. Parry GA, Asif B, Shikari, Manzoor GA, Najib A Sofi. Stability in elite rice genotypes under high altitude environments of Kashmir valley. Res on crops. 2008; 9(1):131-138.
10. Gouri Shankar V, Ansari NA, Ilias Ahmed. Stability analysis using thermo-sensitive genic male syerility (TGMS) system in rice (*Oryza sativa* L.). Res. on Crops 2008; 9(1):141-146.
11. Taddesse Lakew, Sewagegne Tariku, Teferi Alem, Mulugeta Bitew. International Journal of Scientific and Research Publications, 2014; 4(4)