Electronic Journal of Plant Breeding, 7(3): 794-798 (September 2016)
ISSN 0975-928X
DOI: 10.5958/0975-928X.2016.00106.X

Research Note

G x E interaction and stability analysis of promising rice cultures under different sowing dates during *kharif*

S. Vanisri*, Ch. Surender Raju, Ch. Damodar Raju, P. Raghurami Reddy and Y. Suryanarayana
Rice Research Centre, ARI, PJTSAU (Formerly part of ANGRAU), Rajendranagar, Hyderabad-500 030, Telangana
Email: vanisree_dhar@yahoo.com

(Received:31 Jul 2015; Accepted:07 Jun 2016)

Abstract
A field experiment was conducted with six advanced Rajendranagar rice cultures along with three popular varieties (BPT 5204, JGL-11470 and MTU-1010) as checks to estimate the stability parameters. The linear part of GxE interactions was significant for plant height, grains per panicle, 1000 grain weight and kernel length. Whereas, non linear part was significant for grain yield, for which prediction of performance is not possible. Higher stability was noticed for grain dimensions in a relative comparison to grain yield and its components, which indicated that the time of planting had less influence on physical grain characters. Considering the three stability parameters RNR 15028 for grain dimensions, RNR 15038 for yield potential and RNR 15048 for grain fineness as well as for yield were identified as promising genotypes in comparison to popular check varieties of the region *viz*., BPT-5204, JGL 11470 and MTU 1010.

Keywords
Rice, GxE interaction, Stability Analysis

Time of sowing and duration of the varieties play an important role in realising higher yields during '*kharif'*, the important rice growing season of Telangana and Andhra Pradesh. Rice breeders keep on evolving varieties with desired characters adaptable to different dates of sowing to give higher yields. To sustain the rice cultivation, varieties with stable yield potential under different dates of sowing in kharif season are to be developed. With the raise in living standards of rice eating population, eating quality preferences of consumer is playing a vital role in deciding the future of a variety apart from its high yield. As a part of this effort, present study was undertaken with six promising advanced rice cultures to identify stable and high yielding quality lines for *kharif* season.

Six advanced Rajendranagar rice cultures along with three popular varieties (BPT 5204, JGL-11470 and MTU-1010) as checks of three duration groups (long, medium and short) were grown in three environments at Rice Research Centre, Professor Jaya Shankar Telangana State Agricultural University, Rajendranagar, Hyderabad. These three environments were created through different dates of sowing representing the regular dates of sowings for three duration groups of rice varieties *viz.*, 20-6-2012, 12-7-2012 and 26-7-2012. A net plot size of 25 m^2 was maintained for each genotype with a spacing of 15 x 15 cm, planting single seedling per hill. Observations were recorded on important yield, yield contributing and quality characters *viz.*, days to 50 % flowering, plant height (cm), effective tillers per plant, panicle length (cm), number of grains per panicle, 1000 grain weight (g), grain yield per plant (g),kernel length (mm), kernel breadth (mm) and kernel length/breadth ratio. Grain yield was recorded on net plot basis, whereas, ancillary data were generated on ten randomly selected competitive plants in each replication. The GxE interactions and stability were estimated following Eberhart and Russel (1966) model.

Analysis of variance and pooled analysis confirmed the presence of sufficient differences among genotypes for all traits except panicle lenght (Table 1) which is in accordance with the findings of Sawant *et al*. (2005) and Panwar *et al.* (2008). GxE interactions were significant for all the characters except for kernel breadth and L/B ratio, when tested against pooled error indicating that the major portion of interaction was linear in nature and prediction over the environments was possible (Satit *et al.*, 2000 and Sarawgi *et al.,* 2000). Higher proportion of linear component of GxE interaction than non linear component indicated the possibility of reliable and feasible prediction of genotype performance based on stability parameters which was also emphasized by Breese, 1969 and Samuel *et al.*,1970.The linear part of GxE interaction was highly significant for plant height, grains per panicle, 1000 grain weight and kernel length, hence the variation in performance of the genotypes with respect to these components was entirely predictable in nature . At the same time, prediction for grain yield performance might not be possible on account of significance of pooled deviation mean squares. Dushyantha Kumar and Shadakshari (2008) also reported that performance in yielding ability was unpredictable and for other components it was partly predictable. Both linear and non linear components are significant for grain yield and similar results were reported by Kulkarni *et al.*, 2000, Senapati *et al.*, 2002, Gouri Shankar *et al.* (2008) and Parry *et al.* (2008). Many workers have also emphasized that when both linear and non linear components are significant, prediction will depend upon relative magnitude of these two measures, whereas, the prediction will be more reliable when only former is significant against latter (Breese 1969 and Samuel, 1970).

The selection of stable genotypes was based on three parameters *viz*., population mean (µ) regression coefficient (bi) and deviation from regression (s^2di) as described by Eberhart and Russel (1966). RNR 15048 was identified as the best one for grain yield potential with very high yield *per se* over population mean, non-significant 'bi' from unity and non-significant s^2di from zero (Table 2). This yield advantage was primarily associated with stability for increased number of grains up to 250 per panicle. Spikelet sterility did not come in way, probably due to effective translocation of pre heading assimilates to sink from the semi tall-statured, non-lodging sturdy stems of this genotype. On similar grounds, RNR 15038 was considered as the next best one. Two entries *viz*., RNR 15069 and RNR 15038 exhibited higher number of grains per panicle particularly in favourable environment. However, in case of latter the performance was unpredictable as evident from highly significant s^2di. Slightly higher length of the panicle (over the grand mean) was recorded for three genotypes (RNR 15038, RNR 15048 and RNR 15069), but their s^2di values indicated that they were unstable. Short stature was mostly associated with lower grain yields and no relation existed between yielding ability and growth duration.

Higher stability was noticed for kernel length in the time of planting had less influence on physical grain characters. Relatively, stability for kernel length and L/B ratio was high in RNR 15028 and it was low in RNR 15038 as per the significance of s^2di values. Higher kernel length in RNR 15048 and RNR 15038 was due to better environment. Considering the three parameters *viz*; population mean (µ) regression coefficient (bi) and deviation from regression (s^2di) as described by Eberhart and Russel (1966), RNR 15028 for grain dimensions, RNR 15038 for yield potential and RNR 15048 for quality as well as for yield were decided as promising genotypes in comparison to popular check varieties of the region *viz*., BPT-5204, JGL 11470 and MTU 1010. RNR-15048 was proposed for release based on its subsequent high yield performance in yield evaluation trials, minikit trials and consumer preference for its very slender grain (Fig. 1) and good cooking quality.

References

Breese, E.L. 1969. The measurement and significance of genotype environment interaction in grasses. *Heredity*, 27-74.

Dushyantha kumar, B.M. and Shadakshari, Y.G. 2008. Genotype by environment interactions and stability analysis for grain yield and its components in BKB Local rice mutants. *Ent. Eco.*, **26**(4):1667-1669.

Eberhart, S.A. and Russell, W.A. 1966. Stability parameters for comparing the varieties. *Crop Sci*., **6**: 36-40.

Gouri Shankar, V., Ansari, N.A. and Ilias Ahmed, M. 2008. Stability analysis using thermo-sensitive genic male syerility (TGMS) system in rice (Oryza sativa L.). *Res. on Crops* **9**(1): 141-146.

Kulkarni, N., Nirmala, D.G. and Sarojini, G. 2000. G x E interaction for quality traits in mutants of Samba Mahsuri. *Oryza*, **37**(1): 72-74.

Panwar, L.L., Joshi, V.N. and Mashiat Ali. 2008. Genotype x environment interaction in scented rice. *Oryza*, **45**(1): 103-109.

Parry, G.A., Asif B. Shikari, Manzoor, G.A. and Najib A. Sofi. 2008. Stability in elite rice genotypes under high altitude environments of Kashmir valley. **Res on crops 9**(1): 131-138.

Samuel, C.J.A., Hill, J., Breese, E.L., and Davies, A. 1970. Assessing and predicting environmental responses in *Lolium perenne*. *J. Agric. Sci. Camb.,* **75**:1-9.

Sarawgi, A.K., Kumar, A., Sengar, S.S, Kumar, R., Bhambri, M.C., Siopongeo, J., Mc Laren, C.G. and Wade, L.J. 2000. Genotype by environment interactions for identifying improved rice genotypes in rainfed low land of eastern Madhya Pradesh, India. In: Souvenir on the Rainfed Low Land Drought Workshop. International Rice Research Institute, Manila, Phillipines.p4

Satit, R., Dome, H., Chaluay, B., Pitak, P., Charoenchai, M., Ekasit, S., Siravit, R., Piboonwat, Y., Sukvittaya, P., Tawee, T., Surapong, S., Mc Laren, C.G. and Wade, L.J. 2000. Experiments on genotype by environment (G x E) interactions for identifying improved genotypes of rainfed lowland rice for North-East Thailand. In: Souvenir on the Rainfed Lowland Drought Workshop. International Rice Research Institute, Manilla , Phillipines.p3

Sawant, D.S., Kunkerkar, R.L., Shetye, V.N. and Shirdhankar, M.M. 2005. 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", 18-19th October: 75- 76.

Senapathi B.K., Sepati A.K. and Maiti, D.. 2002. Adaptability of some photo-insensitive rice genotypes at coastal saline zones of West Bengal. *J. Int. Cademicia.*, **6**(1): 17-20.

Electronic Journal of Plant Breeding, 7(3): 794-798 (September 2016)
ISSN 0975-928X

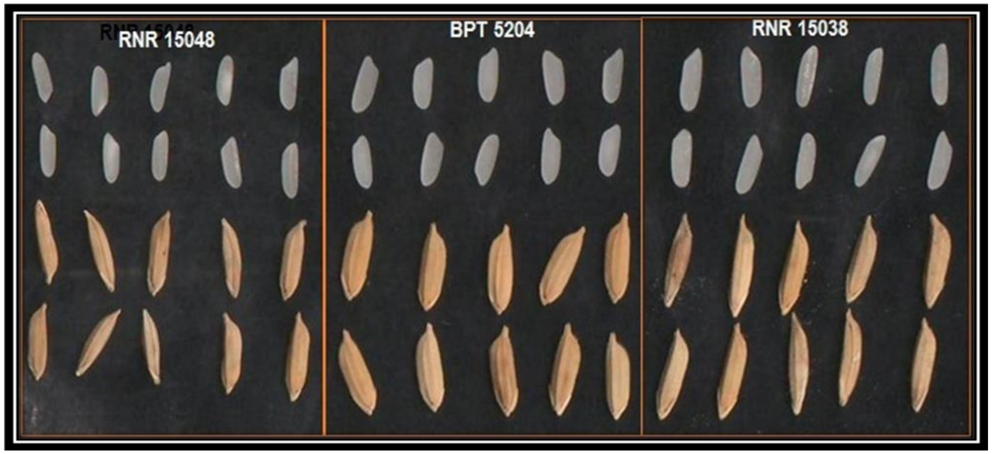

Fig. 1. Grain quality characters of RNR-15048 and RNR15038 in comparison with BPT-5204

Table 1. Pooled analysis of variance for yield and grain quality characters

Source	DF	Days to 50% flowering	Plant Height	Ear bearing tillers /plant	Panicle length	Grains per panicle	1000Seed wt.	Grain yield	Kernel length	Kernel breadth	Length/ breadth ratio
Genotypes (G)	8	116.800**	325.983**	1.525*	11.958	8573.208**	30.713**	1.372**	1.001**	0.203**	0.388**
Environments (E)	2	344.570**	1406.651**	13.820**	11.599*	11598.260**	0.561**	1.117**	0.385**	0.011**	0.050**
G X E	16	28.100***	23.945**	0.948**	1.707*	910.125**	0.317**	0.190**	0.340**	0.001	0.007
E+(G X E)	18	63.263*	177.579**	2.378**	2.806	2097.696**	0.345**	0.293	0.345**	0.002*	0.011
E (Linear)	1	689.140**	2813.302**	27.640**	23.198*	23196.520**	1.123**	2.235**	0.769**	0.022**	0.100**
G X E (Linear)	8	38.744	46.447**	1.392	0.688	1605.150**	0.593**	0.229	0.679**	0.002	0.007
Pooled Deviation	9	15.516**	1.283	0.448	2.424**	191.200*	0.038	0.134**	0.002	0.001	0.005
Pooled Error	48	0.838	3.006	0.359	0.668	84.642	0.057	0.031	0.002	0.001	0.004

** Significant at 1% level   * Significant at 5% level

Table 2. Stability parameters for yield and quality traits

Genotypes	Days to 50 % flowering			Plant Height			Ear bearing tillers/plant			Panicle length		
	μ	bi	s^2di	μ	bi	s^2di	μ	bi	s^2di	μ	bi	s^2di
RNR 14956	105.333	1.65	1.82	76.333	0.87	-3.41	10.656	0.08	0.52	22.022	0.95	13.70**
RNR 15028	120.333	0.97	11.35**	98.722	1.49	-2.44	10.478	0.72	-0.10	22.122	0.57	-0.27
RNR 15038	113.778	-0.02	19.64**	101.945	1.27	-0.20	11.344	1.48	0.49	24.600	0.72	-0.61
RNR 15048	106.445	0.95	1.51	99.456	1.17	-3.45	11.100	1.91	0.40	23.757	2.12	2.37*
RNR 15069	102.556	1.24	-0.74	95.889	0.94	-1.67	10.044	0.71	-0.46	24.711	1.49	2.15*
RNR 15170	107.111	0.04*	-0.69	88.822	1.20	-1.49	10.989	0.45	-0.44	22.044	1.00	0.30
BPT 5204	116.556	1.98	93.84**	72.333	0.12*	-2.84	12.156	0.47	-0.30	18.533	0.45	-0.68
RNR 11470	114.444	1.66	-0.42	85.722	1.04	-3.18	9.867	1.96*	-0.46	22.211	0.73*	-0.69
MTU 1010	104.556	0.53	5.60**	86.911	0.90	-1.36	11.356	1.22	0.20	20.222	0.95	-0.67
Population mean	**110.124**			**89.570**			**10.888**			**22.247**		

Genotypes	Grains per panicle			1000 Seed wt.			Grain yield			Kernel length		
	μ	bi	s^2di	μ	bi	s^2di	μ	bi	s^2di	μ	bi	s^2di
RNR 14956	150.000	0.39	-42.23	11.922	-0.38	0.03	2.100	-0.59	-0.02	4.118	-0.05	0.00
RNR 15028	117.556	0.40	-53.46	14.367	0.58	-0.03	1.434	2.14	0.01	5.152	0.18	0.00
RNR 15038	189.111	1.53	707.82**	13.156	0.38	-0.05	2.789	2.22	0.02	4.879	0.23*	0.00
RNR 15048	258.778	1.97	-19.50	10.111	-0.48	0.00	3.080	1.02	-0.02	3.409	8.51*	0.01
RNR 15069	244.111	2.05	-36.88	13.622	-1.46	-0.03	2.772	0.32	0.36**	4.789	0.16	0.00
RNR 15170	172.556	0.36	-64.10	12.556	1.44	0.00	2.580	1.09	-0.04	4.399	0.14*	0.00
BPT 5204	144.667	1.49	223.62	12.100	2.59	0.00	1.143	1.75	-0.03	4.309	0.08*	0.00
RNR 11470	164.111	0.93	249.77	12.544	0.41	-0.04	1.773	-0.01	0.28**	4.343	-0.11	0.00
MTU 1010	97.222	-0.12	-60.83	21.456	5.92*	-0.04	2.647	1.06	0.28**	5.283	-0.14*	0.00
Population Mean	**170.901**			**13.537**			**2.257**			**4.520**		