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Short Communication

Agronomic evaluation for phenotypic stability of cytoplasmic male sterile lines in rice (*Oryza sativa* L.)

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Phenotypic stability in respect of important agronomic traits influencing hybrid seed yield in the cytoplasmic male sterile (cms) lines is highly desirable over a range of sowing dates to ensure commercially feasible and economically viable hybrid seed production. Among the large number of cms lines developed over the years, only few possess traits suitable for developing commercial hybrids. Keeping this in view, ten cms lines were performance-tested for six agronomic traits across four dates of sowing.

The cms lines (Table 1) were evaluated in randomized complete block design in four environments created by varying the date of sowing (E_1 - 1st June, E_2 - 10th June, E_3 - 20th June and E_4 - 30th June) at the Indian Agricultural Research Institute, New Delhi. Thirty days old seedlings were transplanted in the main field. Each entry was allotted to three rows plot keeping 20 cm and 15 cm distance between rows and between plants within the rows, respectively. All recommended agronomic practices were followed. The observations were recorded on five randomly chosen plants per plot for plant height (cm), number of tillers per plant, panicle length (cm), number of spikelets per panicle, number of primary branches per panicle and panicle exsertion (%). The data were analysed statistically for stability parameters following Eberhart and Russell [1] model. The significance of deviation of regression coefficient from unity was tested by t-test.

Environment-wise analysis of variance revealed significant differences among the cms lines for all traits in all environments with the exception of number of tillers per plant in E_3 and E_4 and number of spikelets per panicle in E_4. This suggested that the differences in performance of cms lines may disappear for these two traits due to the influence of sowing dates. Pooled analysis of variance reflected the significance of differences among the cms lines and environments for all traits. However, the interaction component was significant for number of tillers per plant, panicle length, number of spikelets per panicle and panicle exsertion indicating that the cms lines markedly interacted with the environments for these traits. Significant differences observed between environments and G × E effects for different agronomic attributes were in consonance with the report of Yogesha and Mahadevappa [2]. On examination of the relative importance of liner and non-linear components of interaction, the results reflected predominance of the former, although both the components significantly contributed to G × E interaction. Since the practical usefulness of me prediction of performance depends upon significance of the linear component relative to the non-linear component as noticed in the present investigation, the prediction of the performance of cms lines for these traits from their linear regression on environmental values is justified These findings are in corroboration of the earlier reports suggesting the preponderance of linear component compared to non-linear component of interaction [3].

In the present study, the mean performance (*gi*) and deviation from regression (S^2di) of each entry were considered for stability and linear regression coefficient (*bi* = 1) was used for testing the genotypic response to sowing dates [4, 5]. The unit regression coefficient (*bi = 1) indicated average linear response of cms lines to different dates of sowing. Significantly greater (bi >* 1) and less (*bi* < 1) than unit regression coefficient suggested above average and below average linear response of cms lines, respectively. The non-significant values of *bi* were at par with unit regression coefficients. On consideration of different stability parameters, PMS 3A seemed to record predictable performance with non-significant S^2 *di* for all traits (Table 1). Its *bi* was greater than one for number of spikelets per panicle and panicle exsertion, whereas equal to one for remaining traits. The cms line PMS 2A also exhibited non-significant S^2 *di* for all traits and higher mean

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Table 1. Estimates of stability parameters for four characters in cms lines of rice

Cms line	No. of tillers			Panicle length			No. of spikelets			Panicle exsertion		
	x_i	*bi*	S^2di	x_i	*bi*	S^2di	x_i	*bi*	S^2di	x_i	*bi*	S^2di
PMS1A	16.38	0.95	16.96**	24.47	1.10	−0.07	212.45	1.11**	−32.44	52.08	1.24	11.44**
PMS2A	12.30	0.89	−0.18	25.24	1.38**	−0.16	216.02	1.81**	30.08	47.19	1.25	4.14
PMS3A	13.50	0.64	1.98	25.48	1.09	0.10	222.02	1.31**	226.93	48.78	1.34*	3.53
PMS10A	13.75	0.39**	−0.32	24.91	1.61**	0.08	209.60	1.73**	230.59	44.54	1.54	30.06**
PMS11A	12.57	1.02	−0.13	24.24	1.05	0.07	191.95	0.74*	327.15*	59.96	1.04	0.94
Pant cms 2A	15.22	0.87	−0.35	24.35	0.56*	0.25	147.75	0.56**	9.02	56.66	0.27	31.76**
IR54755A	16.48	2.51**	3.43*	25.43	0.82*	0.06	196.03	1.03	213.58	42.01	1.22	15.52**
IR68886A	12.77	1.12	6.46**	24.07	0.04**	0.98**	162.70	0.32**	158.37	47.29	0.81**	0.68
IJR68899A	11.75	0.71	0.65	22.89	0.60	1.34**	152.62	0.63**	−45.76	44.85	0.66	11.88
IR70372A	12.12	0.91	−0.18	30.33	1.74**	0.62*	173.55	0.77**	−55.79	47.75	0.62**	0.37
CD 5%	3.07	-	-	1.14	-	-	22.04	-	-	5.75	-	-

*,**Significantly different from unity for bi and from zero for S^2di at 5% and 1%, respectively.

values across sowing dates except for number of tillers per plant. However, its *bi* was equal to one for number of tillers per plant and panicle exsertion while greater than one for other traits. With *bi* not significantly deviating from unity for some of the important agronomic traits, PMS 3A and PMS 2A could be therefore, regarded as stable across sowing dates. In rest of the cms lines, S^2 *di* was found significant for one or more trait(s).

Going by the valued of S^2 *di*, it appeared that most of the cms lines with the exception of PMS 2A and PMS 3A exhibited unstable performance with respect to one or more character(s). According to dynamic concept, stability refers to predictability and defined in relation to the genotypes under test [5]. A stable genotype should not show deviation in performance in each environment from that predicted on the basis of linear response. The critical analysis of data on mean performance of cms lines in different environments revealed that the presence of large S^2 *di* has rendered the linear prediction in above mentioned cases unreliable. However, for other traits, PMS 1A and PMS 11A with average while PMS 10A with above average to average and IR70372A with below average to average response in most of the cases exhibited predictable performance. Taking into account the mean performance in conjunction with stability parameters for different traits, the cms lines PMS1A, PMS10A, PMS11A and IR70372A also appeared to be promising, although they were not as adaptable to a range of sowing dates as PMS3A and PMS2A are.

Significant positive association was observed between mean performance (*gi*) of the cms lines and their linear sensitivities (*bi*) for panicle length (r = 0.64) and number of spikelets per panicle (r = 0.83). While the non-linear sensitivity (S^2 *di*) was not significantly correlated with *gi* or *bi* of cms lines in the case of even a single trait. Thus, from the nature of correlations observed among stability parameters for different characters, it appeared in consonance with the earlier reports that these parameters are at least in part under independent genetic control [6, 7].

References

1. **Eberhart S. A. and Russell W. A.** 1966, Stability parameters for comparing varieties. Crop Sci., **6**: 36-40.
2. **Yogesha H. S. and Mahadevappa M.** 1994. Adaptability of CMS and maintainer lines of rice (*Oryza sativa* L.). Seed Res., **22**: 98-103.
3. **Kandhola S. S. and Panwar D. V. S.** 1999. Stability for grain yield and its components in rice. Ann. Biol., (Ludhiana), **15**: 29-33.
4. **Breese E. L.** 1969. The measurement and significance of genotype-environment interaction in grasses. Heredity, **24**: 27-44.
5. **Decker H. C. and Leon J.** 1988. Stability analysis in plant breeding. Plant Breeding, **101**: 1-23.
6. **Reddy J. N. and Chaudhary D.** 1991. Stability for grain yield and its components in rice. Oryza, **28**: 295-299.
7. **Hedge S. and Vidyachandra B.** 1998. Yield stability analysis of rice hybrids. Int. Rice Res. Notes, **23**: 14.