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Short Communication

Stability analysis in bread wheat (*Triticum aestivum* L. em. Thell) and durum wheat (*T. durum* L.) genotypes

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Wheat is the second most important cereal just after rice. About 85% area of wheat production is under common bread wheat (*Triticum aestivum* L. em. Thell) followed by maccaroni wheat (*T. durum* L.) occupying 14% area. Wheat is grown under diverse agro-climatic conditions leading to wide fluctuation in productivity level from region to region. Since the growing period of the crop becomes restricted due to sudden increase in the temperature after winter; the sowing time has an important bearing on production potential of a genotype. Moreover, in intensive production system, farmers have to adjust the sowing time to suit different crops. Hence, the stable performance of a variety plays an important role in high productivity. The expression of grain yield and its components are the function of genotype of the plant (G), environment at the growing area (E) and G × E interaction. When high G × E interaction prevails, the correlation between genotype and phenotype is reduced to express an optimum phenotype under different environmental conditions. Hence, the main breeding objective is always aimed at to develop high yielding varieties showing good degree of stability over a wide range of environmental conditions. Phenotypic stability in wheat has been investigated by many workers [1-2].

The material comprising of 20 bread wheat and 5 durum wheat genotypes was planted in randomized block design with three replications during *rabi* 2004-2005. The genotypes were evaluated under three environmental conditions *viz.*, rainfed (E_1), timely sown irrigated (E_2) and late sown irrigated (E_3) situations. The plot size consisted of 3m long six rows spaced 23 cm apart in E_1 and E_2 conditions and 3m long six rows spaced 18 cm apart in E_3 condition. Date of sowing for E_1, E_2 and E_3 were 29th October, 18th November and 18th December 2004 respectively. Observations were recorded for days to maturity, number of tillers per meter, number of grains per spike, 1000-grain weight, harvest index and yield per plot.

The data were analyzed to test the significance of differences for various characters, under each environment and then the data were further analysed for stability parameters using the model proposed by Eberhart and Russell [3]. Computations were done for the three parameters, to measure the stability of cultivars.

The analysis of variance revealed significant mean squares for all the genotypes and genotype x environment for all the traits studied. Similar results were obtained by other researchers [4]. The linear component of G × E interactions was also found to be significant for number of grains per spike, 1000-grain weight and grain yield per plot indicating the presence of both predictable and non-predictable components. However, the non-linear component was higher than the linear component supporting the earlier findings [5].

Stability of 16 genotypes for days to maturity can be predicted, which possessed non-significant deviation from regression (Table 1) and 11 genotypes were found stable. Six genotypes possessed higher mean values and nonsignificant regression coefficients greater than one and hence, were stable and suitable to favourable environment.

Six genotypes were linearly predictable in terms of number of tillers per meter because of non-significant deviations from regression. Genotypes UP 2572 and UP 2113 with higher mean values and regression coefficient less than unity were stable and suitable for unfavourable environment. The genotypes PBW 502, UP 2664, PBW 373, UP 262, PBW 343, UP 2634, UP 2554 and UP 2596 had higher mean and regression coefficients greater than one, indicating their suitability for favourable environments.

For number of grains per spike, five genotypes possessed higher mean values and regression coefficient greater than one, indicating their stability for favourable environment. PBW 175 with higher mean performance and nonsignificant regression coefficient less than one was suitable for unfavourable environment.

In case of 1000-grain weight, genotype UP 2620 with deviation from regression absolutely zero is highly predictable. Six genotypes possessed higher mean

Table 1. Stability parameters for yield and yield attributing traits in 25 genotypes of bread wheat and durum wheat

Genotypes	Days to maturity			No. of tillers per meter			No. of grains per spike			1000-grain weight (g)			Harvest index (%)			Yield per plot (kg)		
	Xi	bi	S^2di	Xi	bi	S^2di	Xi	bi	S^2di	Xi	bi	S^2di	Xi	bi	S^2di	Xi	bi	S^2di
Bread wheat																		
UP 2338	129.44	0.60**	0.92	79.44	-0.37*	110.97**	43.29	1.64*	173.34**	35.47	1.34	12.21**	32.93	0.47	0.00	1.64	0.96	0.01
UP 2584	129.89	0.94	0.45	77.00	0.91	6.55	41.89	1.16	4.33	33.87	1.80	7.88*	30.02	2.16	0.40	1.61	1.09	0.01
UP 1109	130.89	0.87	0.36	80.67	0.83	340.43**	36.62	3.60**	3.37	34.06	1.80	38.02**	25.77	1.03	1.85	1.60	0.96	0.00
PBW 502	129.33	0.83	28.44**	82.44	1.48	209.93**	35.89	0.51	0.02	35.04	1.88	50.53**	27.84	1.24	53.02**	1.62	0.92	0.02**
C 306	133.11	0.97	4.07	84.44	2.60*	206.57**	33.78	-3.11**	16.32**	37.84	0.25	79.21**	31.85	1.33	281.87**	1.19	0.06*	1.68**
UP 2620	131.22	0.91	9.62**	87.89	0.98	307.52**	32.99	1.34	2.64	37.77	1.76	0.00	29.91	1.54	2.03	1.69	1.04	0.12**
UP 2664	132.67	0.93	6.66*	84.78	1.46	61.59**	37.43	0.58	99.24**	34.74	1.86	14.99**	30.97	3.93*	185.89**	1.53	0.60	0.02**
UP 2526	134.00	0.97	4.87	81.11	0.99	17.30	45.41	-1.3**	349.93**	38.09	0.35	0.11	36.51	2.29	57.01**	1.81	1.45	0.06**
PBW 373	130.56	1.07	5.97	96.44	1.70	147.57**	33.79	0.51	3.85	37.36	1.57	7.69*	32.47	1.48	61.04**	1.68	0.66	0.01
UP 262	128.89	0.91	0.33	98.33	1.09	59.26**	36.62	1.42	57.80**	40.96	-0.41*	6.45	29.80	-0.17	92.67**	1.60	0.74	0.00
UP 2565	129.89	1.29*	5.45*	75.44	0.36	672.40**	48.26	1.12	84.14**	36.93	-1.33**	148.73**	38.68	0.26	93.78**	1.77	1.16	0.01
PBW 175	134.44	1.04	0.84	93.89	2.48*	32.54*	41.60	0.78	88.31**	39.72	0.48	1.19	30.58	0.43	0.05	1.70	0.93	0.06**
Raj 3765	132.33	1.21	8.16*	99.56	0.84	355.19**	40.32	1.12	4.29	40.61	1.06	0.17	34.21	-0.28	77.06**	1.98	1.54	0.01
PBW 343	131.67	0.84	1.57	83.89	1.36	402.32**	38.00	2.5**	59.22**	38.21	1.74	35.66**	27.92	1.25	2.00	1.93	1.16	0.00
UP 2634	128.11	0.86	2.93	83.11	1.07	183.61**	35.42	0.71	351.85**	43.96	0.95	3.63	28.85	-2.47**	77.05**	1.76	1.18	0.04**
UP 2572	134.67	1.04	0.97	84.22	0.34	0.93	39.02	-0.02**	23.50**	40.76	1.14	97.80**	31.85	1.47	1.44	1.96	1.41	0.00
UP 2113	135.89	1.28*	52.57**	83.44	0.55	1.41	37.37	1.09	22.09**	34.08	1.30	16.05**	28.31	1.49	8.65*	1.65	0.79	0.26*
PBW 396	132.89	1.07	0.65	67.56	1.27	64.08**	31.85	0.84	3.43	41.36	0.55	0.19	27.31	1.47	33.37**	1.87	1.03	0.00
UP 2554	129.67	1.01	0.04	83.89	1.26	261.83**	43.79	-2.43**	42.03**	38.35	1.09	8.87*	32.00	0.87	39.70**	1.83	1.18	0.02**
UP 2596	129.00	0.99	0.36	98.33	1.67	109.74**	39.76	4.29**	160.89**	29.93	1.22	18.35**	27.24	0.78	22.80**	1.63	1.06	0.01
Durum wheat																		
UPD 80	131.00	0.93	11.53**	66.78	0.85	232.45**	49.37	1.36	62.94**	47.35	1.55	61.36**	39.31	0.20	15.49**	1.87	0.93	0.16**
PDW 233	131.67	1.04	0.97	68.44	0.30	171.44**	34.07	3.79**	193.77**	36.42	0.37	12.30**	31.40	-0.37	126.10**	1.49	1.04	0.14**
PDW 279	131.33	1.03	11.94**	78.78	-0.45*	24.75	49.26	1.18	1.65	35.72	0.84	1.56	34.84	1.13	53.46**	1.80	1.36	0.40**
UPD 61	133.00	1.34**	1.67	76.89	0.57	0.17	35.07	-2.67**	4.40	43.89	0.66	12.03**	38.22	1.15	15.13**	1.46	0.91	0.06**
UPD 73	133.11	1.24	0.09	49.44	0.85	299.79**	46.13	3.43**	96.58**	27.71	1.20	46.31**	34.26	2.33	384.62**	0.84	0.82	0.02**
Gen.Mean	131.54			81.84			39.48			37.60			31.72			1.66		
Sem ±	0.88			4.38			2.02			2.01			1.84			0.08		

*,**Significant at P = 0.01 and P = 0.05 respectively

values with regression coefficient higher than one indicating their stability under favourable condition. Genotypes C 306, UP 2526, PBW 175, UP 2634, PBW 396 and UPD 61 were stable and suitable for unfavourable environment due to their higher mean performance and regression coefficient slightly less than unity.

For harvest index UP 2338 showed deviation from regression value exactly zero indicating its high predictability. Other six genotypes were found to have predictability due to non-significant values of deviation from regression. Seven genotypes with high mean values and regression values greater than unity indicating stability under favourable environment and five genotypes with higher mean performance and non-significant regression value lower than unity were suitable for unfavourable condition.

For yield per plot UP 1109, UP 262, PBW 343, UP 2572 and PBW 396 possessed deviation from regression exactly zero indicating their high predictability. The performance of another six genotypes was also predictable due to non-significant deviation from regression. Genotype C 306 was unstable due to its significant deviation in regression coefficient from unity. Ten genotypes with higher mean values and regression coefficient higher than unity indicated stability under favourable conditions. Three genotypes were stable and suitable for unfavourable conditions due to their higher mean values and nonsignificant regression coefficient lesser than one.

The different varieties showing moderate stability and wider adaptability exhibited stability for different characters. Genotypes Raj 3765, PBW 343, UP 2565, PBW 373, UP 2572 and PBW 396 which are good in yield and possessed wider adaptability may be exploited.

References

1. **Kaltsikes P. J. and Larter E. N.** 1970. The interaction of genotype and environment in durum wheat. Euphytica, **19**: 236-242.
2. **Acciaresi H. A. and Chidichimo H. D.** 1999. Genotype environment interactions in wheat in the IV and V south Argentinean subregions. Cereal Res.-Commun., **27**: 115-122.
3. **Eberhart S. A. and Russell W. A.** 1966. Stability parameters for comparing varieties, Crop Sci., **6**: 36-40.
4. **Sial M. A., Arain M. A. and Ahmad M.** 2000. Genotype × environment interaction on bread wheat grown over multiple sites and years in Pakistan. Pakistan Journal of Botany, **32**: 85-91.
5. **Madariya R. B., Poshiya V. K. and Kavani R. H.** 2002. Phenotypic stability of yield and its contributing characters in bread wheat (*Triticum aestivum* L. em. Thell). Madras-Agricultural-Journal, **88**: 648-650.