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Genotype X environment interaction for moisture stress reaction in *winter* maize

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ABSTRACT

Genotype(G) X Environment(E) interaction in winter maize involving ten diverse parents and their 45 F_1s under four variable environments (early and late sowing with moisture stress and non-stress conditions) were studied for twelve characters, including anthesis-silking interval, tassel condensation, tassel vigour index and grain yield. Significant interaction was observed due to genotype x sowing dates x moisture regimes for tassel condensation, ear height, effective ear length, 500-grain weight and grain yield. Based on mean performance of grain yield and response to environments, the crosses namely, P_1x P_{10} ($G_{15}C_{22}$MH 148U-1-1-1-6-3-BB x CML 117), P_5 x P_6 (Pop 27-S_4-4U-1-3 x Pop 147 (EEY DMR) S_1-117-3 and P_9 x P_{10} (EEY DMR S_1-3-1-1-2-3 x CML 117) were identified to be suitable for early as well as late sowings under both moisture regimes. However, P_1 x P_5 ($G_{15}C_{22}$MH 148U-1-1-1-6-3-BB x Pop 27-S_4-4U-1-3) and P_5 x P_{10} (Pop 27-S_4-4U-1-3 x CML 117) responded significantly better under moisture stress as well as late sowing conditions.

Key words : Maize, Genotype x environment interaction, Environmental sensitivity

INTRODUCTION

Maize (*Zea mays* L.) is an important coarse grain cereal crop and is widely grown throughout the year under different climatic situations. About 80% of the maize area is under rainfed and subjected to various levels of moisture stress, frequently, which causes significant reduction in yield. Water deficits for one or two days during tasselling or pollination may cause as much as 22% reduction in yield (Robins & Domingo, 1953). However, depending upon stage, duration of drought and sensitivity of genotypes, reduction in yield may increase or decrease. The knowledge of G x E interaction is of vital importance for breeders in the process of evolution of improved varieties for moisture stress conditions and also for allocation of resources. Therefore, the present investigation was carried out with the objective to screen out suitable parents as well as crosses having small G x E interaction for yield which could be utilized for further breeding programme under moisture stress condition of rabi and spring seasons of Bihar.

MATERIALS AND METHODS

The experimental materials comprised of ten advanced generation moisture stress tolerant diverse inbred lines (Singh and Jha, 2004). They were crossed in diallel fashion (excluding reciprocals). Altogether ten parents, their forty-five hybrids and two checks (Pusa Early Hybrid-1 and 2) were grown in randomized complete block design with three replications during the rabi season in four diverse environments, viz., (i) Early sowing (02.11.2000) moisture stress (ii) Early sowing moisture non-stress (iii) Late sowing (2.12.2000) moisture stress and (iv) Late sowing moisture non-stress. In the crop stand, moisture stress was created by reducing the irrigation number to one which was applied at knee height stage. Along with the character grain yield under different situations the observations were taken on eleven quantitative characters namely, anthesis-silking interval, tassel condensation, tassel vigour index, plant height, ear height, effective ear length, ear girth, grain filling per cent, kernel rows per ear, 500-graing weight and harvest index. The genotype-environment interaction stability parameters were estimated by following the method suggested by Eberhart and Russel (1966).

RESULTS AND DISCUSSION

In the present investigation the pooled analysis of variance was conducted to test the significance of the influence (individual and interaction) of the four environmental factors during the crop growth period (Table 1). The mean squares due to replication within sowing dates and moisture regimes was significant for all the characters except for tassel vigour index, plant height, ear height and grain filling per cent. Individual influence due to genotypes, sowing

Table 1 : Pooled analysis of variance for design of experiment for twelve quantitative characters in maize

Source	d.f.	Mean Squares											
		Anthesis-silking interval	Tassel condens-ation	Tassel vigour index	Plant height	Ear height	Effective ear length	Ear girth	Grain filling per cent	Kernel rows per ear	500-grain weight	Harvest index	Grain yield
1. Replications within sowing dates and moisture regimes	8	3.30**	0.014**	3.63	59.50	25.45	35.54**	1.57**	9.70	4.19**	105.38**	50.80**	175.69**
2. Sowing dates	1	204.50**	8.75**	8615.99**	48276.61**	21001.91**	9308.84**	109.18**	10242.49**	20.36**	64242.77**	6791.40**	8258.69**
3. Moisture regimes	1	1456.15**	28.93**	33455.82**	167673.13**	113959.15**	33840.18**	586.27**	39151.15**	59.66**	290411.40**	26599.63**	32841.69**
4. Sowing dates x Moisture regimes	1	17.05**	0.27**	115.46**	636.40**	1446.65**	23.95**	2.99**	1.53	0.99	1412.70**	39.73**	134.98**
5. Genotypes	56	1.58**	0.54**	356.39**	661.53**	358.74**	353.28**	6.05**	350.42**	15.98**	2068.95**	204.94**	616.82**
6. Genotypes x Sowing dates	56	0.62	0.045**	5.10	34.49	94.41**	20.96**	0.32	19.48**	1.83	72.37**	5.72	16.55**
7. Genotypes x Moisture regimes	56	0.70**	0.122**	29.77**	100.99**	113.75	47.54**	1.36**	31.94**	2.51**	205.64**	20.17**	75.68**
8. Genotypes x Sowing dates x Moisture regimes	56	0.33	0.017**	5.09	22.10	98.53**	15.62**	0.385	15.48	1.37	26.52*	3.07	10.22**
9. Residual error	448	0.495	0.004	8.69	40.79	28.79	8.72	0.39	17.24	1.36	19.21	8.57	5.78

*, ** : Significant at 5% and 1% level of significance, respectively.

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