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Genotype x environment interaction of flowering characters under moisture stress condition in *winter* maize

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ABSTRACT
Genotype (G) x Environment (E) interaction of maize genotypes for anthesis-silking interval (ASI), tassel condensation (TC) and tassel vigour index (TVI) were studied under four diverse environments of sowing dates and moisture regimes. Highly significant mean squares due to genotypes, environments and G x E (linear) were observed for all the flowering traits. The crosses P_1 x P_5 (G_{15} C_{22} MH148-1-1-1-6-3-BB x Pop27-S_4-4U-1-3) and P_5 x P_{10} (Pop27-S_4-4U-1-3 x CML 117) were identified as tolerant to moisture stress as they were having lesser ASI with condensed tassel and high yield. However, three crosses, namely, P_1 x P_{10} (G_{15} C_{22} MH148-1-1-1-6-3-BB x CML 117), P_2 x P_{10} (Pool 21 Sequia best SYN CoF_2 x CML 117) and P_5 x P_6 [Pop 27-S_4-4U-1-3 x Pop 147(EEY DMR) S_1-117-3] exhibited high yield with minimum ASI over environments which may be exploited during winter season of Bihar.

Key words : Anthesis-silking interval, Tassel condensation, Tassel vigour index, Maize.

INTRODUCTION

In India, maize is cultivated throughout the year which is characterized by erratic rainfall and moisture stress. Moisture stress/ drought is a major factor responsible for limiting maize production and productivity in developing world. Edmeades *et. al.* (1992) have estimated about 15% global annual losses of maize production due to drought. Therefore, it is essential to develop a variety/genotype endowed with high degree of stability for flowering characters like ASI, tassel condensation and tassel vigour index to achieve high fertilization rate and ultimately good production & productivity. Moisture stress, if occurred just before or during the flowering period, a delay in silking is observed resulting in an increase in the period of anthesis-silking interval (Rabaut *et. al.*,1996), and decreased seed setting even if pollination occurs (Bassetti and Westgate,1993), resulting into decrease in grain yield.

MATERIALS AND METHODS

The experimental material consisted of ten genetically diverse and advanced generations maize inbred lines possessing different levels of tolerance to moisture stress (Singh and Jha, 2004). Diallel mating design was adopted to generate forty-five F_1s. Ten parents along with forty-five F_1s and two checks (Pusa Early Hybrid-1&2) were sown in randomized block deign, replicated three times with plot size of 4.5 m^2 and tested in four diverse environments, viz.,(i) Early sowing moisture non-stress (ii)Early sowing moisture stress (iii) Late sowing moisture non-stress and (iv)Late sowing moisture stress. The number of irrigation in moisture stress plot was reduced to one which was applied at knee high stage. The observations were recorded on three characters, namely, anthesis-silking interval, tassel condensation and tassel vigour index. The experimental data for ASI was recorded as per plot basis, whereas TC and TVI were recorded on ten competitive plants in each plot. Mean value of each plot was used for statistical analysis. The stability analysis was carried out as per method by Eberhart and Russell (1966). Genotypes having lower values of ASI and TVI, and higher value of TC were considered as desirable.

RESULTS AND DISCUSSION

The analysis of variance for design of experiment over environments revealed highly significant mean squares due to genotypes, environments and genotype x environment interaction for all the three traits included with study indicating the existence of significant difference among genotypes, environments and their interactions with environments (Table-1) Among the three flowering traits, only tassel condensation exhibited significant pooled deviation as well as G x E (linear) inferred that part of variability due to G x E is unpredictable in nature. Menkir and Akintude (2001) reported that moisture deficit significantly affected the ASI.

Table 1: Pooled analysis of variance for genotype-environment interaction for twelve quantitative characters in maize

Sl. No.	Characters	Mean Squares			
		Environment (E) d.f.=3	Genotypes (G) d.f.=56	G x E d.f.=168	Pooled error d.f.=448
1.	Anthesis-silking interval	186.41**	0.53**	0.18*	0.14
2.	Tassel condensation	4.22**	0.18**	0.02**	0.001
3.	Tassel vigour index	4687.50**	118.80**	4.44**	2.90
4.	Plant height	24064.59**	220.49**	17.52*	13.60
5.	Ear height	15156.27**	119.58**	34.08**	9.60
6.	Effective ear length	4797.08**	117.76**	9.35**	2.91
7.	Ear girth	77.60**	2.02**	0.23**	0.13
8.	Grain filling per cent	5488.42**	116.80**	8.55**	5.75
9.	Kernel rows per ear	13.50**	5.26**	0.63**	0.43
10.	500-grain weight	39564.00**	689.70**	33.82**	6.52
11.	Harvest index	3714.48**	68.31**	3.22**	2.19
12.	Grain yield	4581.71**	205.61**	11.38**	2.73

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

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