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HETEROSIS IN EARLY EXOTIC MAIZE

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The present study has been undertaken to have genetic information on the nature of combining ability of parents and their performance in hybrids in a 7 x 7 diallel cross of subtropical early pool and populations of maize received from CIMMYT Mexico.

The experimental material comprised two diverse populations, P 46 and P 48, and five Pools, viz., Pool 27, Pool 28, Pool 30, Pool 40 and Pool 42, and their crosses in all possible combinations. The experiment was laid out in randomized block design with three replications. Each treatment consisted of two 5 m long rows. A spacing of 75 x 20 cm was adopted with normal cultural practices.

Data were recorded on grain yield per plant, days to silking, plant height, and ear height. The sum of squares for the diallel was subjected to nonorthogonal partition (Analysis II) of Gardner and Eberhart [1], where general combining ability was considered as varietal heterosis and specific combining ability as specific heterosis.

Significant differences among entries were observed for the characters under study. Heterosis as per cent increase over midparent (MP), ranged from –21.3 to 55.0 and was significant in ten crosses for grain yield. Better parent (BP) heterosis for grain yield was significant in four crosses: P 46 x Pool 42 (45.8%), Pool 27 x Pool 28 (38.2%), P 46 x Pool 30 (33.7%) and P 46 x Pool 27 (30.1%). Heterotic effect was not observed for early silking. The best performing crosses were P 46 x Pool 27 (13.9%) for plant height and P 48 x Pool 40 (18.8%) for lower ear height. Earlier workers [2, 3] have also reported significant heterosis for early silking and grain yield, respectively.

Analysis of variance (Table 1) revealed that the variances due to varieties (V_i) and heterosis (h_{ij}) were significant for grain yield. The variance due to heterosis (h_{ij}) was also significant for plant height and ear height. Average ($\bar{h}$) and specific (S_{ij}) heterotic effects of

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Table 1. Analysis of variance (mean squares) for analysis II [1] in maize

Source	d.f.	Grain yield	Days to silking	Plant height	Ear height
Replications	2	11.1	8.8	858.3^{**}	117.4^{**}
Entries	27	73.7^{**}	2.3^{**}	66.2^{*}	35.0^{*}
Varieties (V_i)	6	112.9^{**}	7.9^{**}	75.7	7.7
Heterosis (h_{ij})	21	62.5^{**}	0.7	63.4^{*}	41.3^{*}
Average ($\bar{h}$)	1	204.0^{**}	0.3	107.4	45.0
Variety (h_i)	6	24.7	0.9	27.0	43.4
Specific (S_{ij})	14	68.6^{**}	0.7	75.9^{*}	40.1^{*}
Error	54	12.1	0.7	33.9	20.2

*,**Significant at 5 and 1% levels, respectively.

the crosses were responsible for magnitude of overall heterosis for grain yield. Heterosis for plant height and ear height was significant mainly due to the specific heterotic effects (S_{ij}) of the crosses. However, for days to silking, the deviation of crosses from parental values was mainly due to the varietal effects (V_i). In the Brazilian populations also, significant average heterosis for grain yield and specific heterosis for plant height and ear height was reported [4].

A perusal of the estimates of genetic constants (Table 2) indicated that the parental mean was significant for all the characters whereas average heterosis was significant and positive

Table 2. Estimate of genetic constants in maize

Variety	Grain yield		Days to silking		Plant height		Ear height	
	V_i	h_i	V_i	h_i	V_i	h_i	V_i	h_i
P 46	-4.5	6.1^{*}	1.4	-0.2	-8.3	3.4	-11.5^{**}	7.9^{**}
P 48	10.5^{**}	2.0	1.4	0.4	11.7^{*}	-4.3	5.6	-2.5
Pool 27	-6.6^{*}	0.3	0.7	0.6	-15.0^{**}	4.1	-4.8	3.1
Pool 28	-4.0	-0.2	2.1	-0.7	-1.6	2.4	1.9	-0.9
Pool 30	8.3^{*}	-2.9	-1.6^{*}	0.9	6.7	-2.4	-1.5	0.8
Pool 40	0.5	-3.7	-1.6^{*}	-0.1	-0.0	0.6	6.9	-5.0
Pool 42	-4.2	-1.6	-2.3^{**}	-0.7	6.7	-3.8	3.5	-3.5
μ	38.1^{**}		60.3^{**}		128.3^{**}		58.1^{**}	
$\bar{h}$		6.2^{**}		0.2		4.5		2.9

*,**Significant at 5 and 1% levels, respectively.

only for grain yield. Varietal effects (V_i) were desirable and significant for grain yield in P 48 and Pool 30, for early silking in Pool 30, Pool 40 and Pool 42 for tallness in P 48 and for reduced plant and ear height in Pool 27 and P 46, respectively. However, the heterotic effect of P 46 was significant for grain yield and ear height only. Specific heterotic effects for plant height were significant (positive or negative) in the crosses Pool 27 x Pool 40 (10.0), P 46 x Pool 40 (–14.4), and Pool 27 x Pool 42 (–14.0). Similarly, for ear height it was significant in the crosses, P 48 x Pool 27 (14.5), P 46 x Pool 40 (8.3) and P 48 x Pool 40 (–8.1). Maximum specific heterotic effect for higher grain yield was observed in the cross P 46 x Pool 30 (12.5), followed by Pool 27 x Pool 28 (8.0), Pool 27 x Pool 40 (7.9), P 48 x Pool 28 (7.8), P 48 x Pool 42 (7.7), and Pool 30 x Pool 40 (6.8). The promising crosses with high per se performance and involving one parent with desirable varietal effect for grain yield were P 46 x Pool 30 and P 48 x Pool 28. However, the cross P 48 x Pool 42 had special significance as its parents, P 48 and Pool 42, possessed desirable varietal effects for grain yield and early silking, respectively. These three promising crosses may be used to develop broad genetic base populations which may be further improved through selection scheme.

REFERENCES

1. C. O. Gardner and S. A. Eberhart. 1966. Analysis and interpretation of the variety cross diallel and related populations. Biometrics, **22**: 439–452.

2. B. K. Mukherjee, N. L. Dhawan and N. N. Singh. 1971. Heterosis in inter-varietal crosses in maize (*Zea mays* L.). Indian J. agric. Sci., **41**: 489–494.

3. S. A. Akhtar and T. P. Singh. 1981. Heterosis in varietal crosses of maize. Madras Agric. J., **68**: 47–51.

4. E. E. G. Gama, R. T. Vianna, Naspolini Filhov and R. Magnavaca. 1984. Heterosis for four characters in nineteen populations of maize. Egyptian J. Genet. Cytol., **13**: 69–80.