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HETEROSIS FOR MAJOR YIELD COMPONENTS IN MAIZE RECIPROCAL CROSSES INVOLVING DIVERSE GERMPLASM

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Heterosis was studied for yield and its various components in the reciprocal crosses using diverse (flint-dent) germplasm in maize. The crosses involving a dent and a flint line were superior to the dent × dent or flint × flint crosses and heterotic responses also differed according to the direction of the cross. Generally, crosses among dent × flint were better than their reciprocals in respect of number of kernel rows, number of kernels per row, 100 kernel weight and yield per plant. Dent × flint crosses also took less number of days to silking than dent × dent or flint × flint crosses. Use of superior dent inbred lines as female parent generally resulted in a superior cross than otherwise.

INTRODUCTION

Flint and dent inbred lines differ widely in components of yield which all have a direct effect on yield. Crosses and their reciprocals have the same nuclear genetic material but vary only in cytoplasmic source or maternal effect. Differences for the extent of heterosis have been noted among the reciprocal crosses involving a dent and a flint inbred line in their constitution and thus the way in which such crosses are affected is of considerable significance from production point of view. A number of reports in the literature have indicated the superiority of flint-dent hybrids over flint × flint or dent × dent combinations.

Andress (1952), Maric (1954), Zonjic and Maric (1958), Rao (1960) and Vaidya and Singh (1962) have reported the superiority of the dent × flint combinations in yield and heterotic response as compared to the dent × dent or flint × flint combinations.

Dimmock and Donovan (1956) found a tendency for higher yield when the seed parent of a flint-dent hybrid was a dent type.

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Hoen and Andrew (1959) observed few significant differences between reciprocal flint-dent crosses. Yield was positively correlated with kernel rows, kernels per row, one thousand kernel weight and with dent appearance.

Flemming and Kozelnicky (1960) found reciprocal differences for yield in corn and in majority of the cases of significant reciprocal differences, hybrids deviated in the direction of the maternal parent.

The present studies were aimed at determining the extent of heterosis for yield and its various components in the reciprocal crosses among elite dent and flint inbred lines of maize. Such an information can be helpful in planning crosses to obtain desirable hybrids for commercial production.

MATERIALS AND METHODS

Studies were carried out in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during the year 1974-75. Two dent viz., A509 and Hy7 and two flint viz., Pb37 and $20P_{2-3}$ maize inbreds were combined in all possible combinations including the reciprocals and these were tested for various yield components along with their parental lines in a replicated performance test using a Randomized complete block design.

The data recorded on various characteristics include number of days to 50% silking, number of rows per ear, number of kernels per row, 100-kernel weight and grain weight (yield) per plant.

Heterosis in the expression of various characteristics under study was worked out in relation to the better parent values.

RESULTS AND DISCUSSION

Extent of heterosis for major yield components in the reciprocal crosses using diverse (flint-dent) germplasm are described and discussed below:

Number of Days to Silking

The data presented in Table 1 indicated that the number of days to 50% silking ranged from 51.00 to 63.33 for the crosses as against 51.33 to 60.33 for the parental lines. Maximum number of 63.33 days to silking was taken by the cross Hy-7 × A509 (dent × dent), while the minimum number of 51 days

was observed in the cross A509 × Pb37 (dent × flint). Among the crosses and their reciprocals only eight were earlier in silking than their better parents, of which seven combinations constitute dent and flint germplasm. Cross Hy7 × A509 (dent × dent) took 4.97% more number of days to silking than its better parent while the cross A509 × Pb37 (dent × flint) took 15.46% less number of days than the better parent.

Number of Kernel Rows per Ear

Ten out of twelve crosses outyielded the better parents in respect of number of kernel rows per ear of which eight crosses were among dent and flint germplasm. Maximum kernel rows viz., 19.60 per ear were produced by a cross between a flint and a dent line (Pb37 × Hy7). Cross Hy7 × $20P_{2-3}$ (dent × flint) showed the maximum expression of heterosis producing 32.74% more rows per ear over the better parent value. Similar results have been reported by Hoen and Andrew (1959).

Number of Kernels per Row

Data in Table 1 shows that all the crosses yielded more number of kernels per row than their better parents. Maximum number of kernels viz., 34.63 per row were produced by the cross A509 × $20P_{2-3}$ (dent × flint), while the minimum kernels viz., 27.65 per row were observed in the cross A509 × Hy7 (dent × dent). Maximum heterosis has been observed in A509 × Pb37 with a dent and a flint line in their constitution, which gave 40.73% increase over the better parent value. The least heterotic effect was obtained in a flint × flint cross ($20P_2^{-3}$ × Pb37). Similar results have been reported by Hoen and Andrew (1959).

100-*Kernel Weight*

Generally all the crosses were better than their better parents. Maximum 100-kernel weight viz., 26.38 gms was produced by the cross Pb37 × Hy7 involving a flint and a dent line, while the minimum was obtained in a flint × flint cross (Pb37 × $20P_{2-3}$). Maximum heterosis was expressed in the cross Pb37 × Hy7 (flint × dent), where the increase was 15.39% over the better parent.

Table I. *Heterosis for Number of Days to 50% Silking, Number of Kernel rows Per Ear, Number of Kernels Per Row, 100-Kernel Weight and Yield Per Plant in the Reciprocal Crosses Among Four Maize Inbred Lines.*

S. No.	Cross/Parent	Number of Days Taken to 50% silking		Number of Kernel rows per ear		Number of Kernels per row		100-kernel Weight		Yield per plant (gms)	
		Mean Value	% increase (+) or decrease (—) of F1 over better parent	Mean Value	% increase (+) or decrease (—) of F1 over better parent	Mean	% increase (+) or decrease (—) of F1 over better parent	Mean	% increase (+) or decrease (—) of F1 over better parent	Mean	% increase (+) or decrease (—) of F1 over better parent
1	Pb 37 × A509	56.00	— 7.17	16.93	+ 8.52	31.75	+33.45	23.92	+ 4.54	127.85	+ 63.42
2	Pb 37 × Hy7	58.33	— 0.56	19.60	+25.34	31.59	+28.58	26.38	+15.39	156.45	+111.50
3	Pb 37 × 20P_2–3	56.66	+ 1.17	15.46	— 0.89	32.06	+21.73	21.94	+ 8.07	107.75	+ 45.66
4	A509 × Pb37	51.00	—15.46	18.13	+16.21	33.48	+40.73	24.08	+ 5.24	143.20	+ 83.04
5	A509 × 20P_2–3	56.00	— 7.17	18.26	+20.13	34.63	+13.57	23.51	+ 2.75	146.30	+ 87.01
6	A509 × Hy–7	59.33	— 1.65	16.80	+10.52	27.65	+21.91	23.72	+ 3.67	109.08	+ 39.43
7	Hy–7 × Pb37	58.66	0.00	18.94	+21.34	33.12	+47.21	25.13	+ 9.93	156.82	+112.00
8	Hy–7 × 20P_2–3	52.00	—11.35	19.46	+32.74	33.70	+35.63	24.10	+ 5.42	155.30	+111.46
9	Hy–7 × A509	63.33	+ 4.97	15.73	+ 3.48	28.59	+26.95	24.04	+ 5.06	107.80	+ 37.79
10	20P_2–3 × Hy–7	51.66	—11.93	7.20	+17.46	31.79	+20.73	25.16	+10.06	136.08	+ 85.29
11	20P_2–3 × Pb37	57.33	+ 2.37	15.06	— 3.46	29.39	+11.66	22.25	+ 9.60	97.76	+ 32.16
12	20P_2–3 × A509	53.00	—12.14	15.86	+ 4.34	31.88	+21.12	23.50	+ 2.70	117.74	+ 50.50
13	A 509	60.33		15.20		22.68		22.88		78.23	
14	Hy–7	58.66		14.66		21.74		22.86		73.44	
15	Pb–37	56.00		15.60		23.79		20.30		37.93	
16	20 P_2–3	51.33		12.80		26.32		20.07		67.80	

Grain Yield per Plant

It is evident from data in Table 1 that highest yield of 156.82 gms per plant was obtained from the cross Hy7 × Pb37 (dent × flint), while the minimum yield of 97.76 gms per plant was observed in a flint × flint combination ($20P_{2-3} \times Pb37$). The results are in agreement with those of Andress (1952), Maric (1954), Zonjic and Maric (1958), Rao (1960) and Vaidya and Singh (1962), who reported that the performance of dent × flint and flint × dent crosses was better than the crosses within each of these two grain types. It is evident from the data that in general, the dent × flint crosses and their reciprocals performed much better than the crosses within dent-dent or flint-flint lines. Maximum heterosis for grain yield was observed in the cross Hy7 × Pb37 (dent × flint), which produced 112.00% more yield than the better parent. Similar results were obtained by Dimmock and Donovan (1956) and Flemming *et al.* (1960). The greater expression of hybrid vigour in dent-flint combinations may be attributed to the greater genetic diversity of the inbred lines.

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