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Hybrid Vigour of Some Quantitative Characters in Maize (*Zea mays* L.)

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Abstract: Eight crosses of maize viz; F-103 x F-105, F-105 x F-103, F-113 x F-107, F-107 x F-113, F-138 x F-131, F-131 x F-138, F-147 x F-132, F-132 x F-147 were made. These crosses (F_1) alongwith their parents were planted to study the heterosis for plant height (cm), ear height (cm), ear length (cm), ear diameter (cm), number of rows ear⁻¹, number of kernels row⁻¹, 1000-kernels weight (g) and yield plant⁻¹ (g) in F_1 generation. It was concluded that a cross F-113 x F-107 showed maximum heterosis for yield and its components. Therefore this combination must be given due consideration to utilize for improving yield and its components in future breeding programme.

Key words: *Zea mays*, heterosis, heterobeltiosis, yield, yield components, Pakistan

Introduction

The maize plant has wider adaptability on a global basis as its cultivation stretches from north latitude 58° in Canada and Russia to south latitude 40° in Southern Hemisphere. The success of plant breeding aiming at evolution of high yielding, fertilizer responsive and insect pests resistant maize hybrids depends upon the selection of suitable parents to be utilized in any hybridization programme. Among other means of productivity the exploitation of heterosis holds a good promise and has increased the production of maize crop through hybrid maize enormously. It is evident that hybrid vigor manifests itself both for developmental and economic characters in maize. Significant heterosis was found for number of kernels row⁻¹, kernel rows ear⁻¹ and grain yield (Mukherjee and Saha, 1984; Vasal *et al.*, 1995).

Heterosis was significant and positive for ear length, rows ear⁻¹, kernels row⁻¹ and grain yield as observed by different workers (L1 *et al.*, 1999; Joshi *et al.*, 1998; Vidal *et al.*, 2001). A varying degree of heterosis was estimated for plant height, ear height, ear length, ear diameter, rows ear⁻¹, 1000-grain weight and grain yield. Over mid parent values and some of the crosses exhibited heterobeltiosis also (Velichko *et al.*, 1986; Debnath, 1987; Gama *et al.*, 1984). The objective of this study was to observe hybrid vigor of some quantitative characters in maize.

Materials and Methods

The eight crosses viz; F-103 x F-105, F-105 x F-103, F-113 x F-107, F-107 x F-113, F-138 x F-131, F-131 x F-138, F-147 x F-132 and F-132 x F-147 were made during kharif 2001 to study the heterotic effect for plant height, ear height, length, diameter, number of rows ear⁻¹, number of kernels row⁻¹, 1000-kernels weight and yield plant⁻¹.

The seed obtained from these crosses was sown as F_1 during spring-2002. F_1 crosses alongwith their parents were sown by dibbling in two replications. The data for yield parameters of ten plants in each row were recorded. Standard plant protection measures were adapted to minimize the effect of insect pests and diseases. Heterosis in F_1 for yield parameters were calculated in percentage over the mid parent and better parent values and "t" test was employed to determine whether F_1 hybrid means were statistically different from mid-parent and better parent values. (Wynne *et al.*, 1970)

Results and Discussion

Plant height: All the hybrids gave highly significant increase over their mid parents (Table 1). During the study of plant height, heterosis was observed in crosses over mid parent ranging from 7.03 (F-103 x F-105) to 9.78 % (F-113 x F-107). The magnitude of heterobeltiosis varied from 4.03 (F-103 x F-105) to 8.72% (F-113 x F-107) similar results have already been reported by Gama *et al.* (1984).

Ear height: The significant differences among F_1 s and their parents (Table 1). In this case heterosis was showed in all the crosses over their mid and better parents values which depict the fact that over dominance gene action is present in these crosses. The minimum heterosis over mid parents was 31.35 (F131 x F105) and maximum 96.63% (F-131 x F-138) while the magnitude of heterosis over better parent ranged from 11.80 (F-103 x F-105) to 90.22% (F-131 x F-38). These observations are in accordance with Debnath, 1987.

Ear length: As regards ear length, all the crosses showed highly significant differences over their mid as well as

Table 1: Estimates of heterosis in respect of eight maize crosses

	Plant height		Ear height		Ear length		Ear Diameter	
	MP	BP	MP	BP	MP	BP	MP	BP
F-103 x F-105	7.03**	4.03*	31.35**	11.80**	24.12**	19.03**	8.14**	3.19**
F-105 x F-103	8.83**	5.59**	33.33**	13.48**	24.51**	19.40**	6.11**	2.21**
F-113 x F-107	9.78**	8.72**	39.04**	39.04**	34.41**	26.72**	6.21**	13.25**
F-107 x F-117	7.64**	5.62**	32.88**	30.20**	22.67**	15.65**	5.28**	12.25**
F-138 x F-131	9.12**	5.10**	62.92**	57.61**	37.82**	22.39**	12.48**	9.18**
F-131 x F-138	11.49**	7.15**	96.63**	90.22**	32.77**	17.19**	9.96**	6.73**
F-147 x F-132	8.74**	4.19**	38.29**	24.00**	29.94**	17.69**	9.30**	17.06**
F-132 x F-147	9.78**	5.10**	49.44**	34.00**	21.44**	10.00**	13.17**	21.20**
	No. of Rows/Ear		No. of Kemals/Row		1000-Kemals weight		Yield/plant (gm)	
	MP	BP	MP	BP	MP	BP	MP	BP
F-103 x F-105	7.46**	2.33**	51.23**	25.65**	14.91**	6.52**	62.81**	37.13**
F-105 x F-103	6.07**	1.00**	53.02**	27.14**	12.73**	4.49**	57.8**	32.91**
F-113 x F-107	4.23**	-7.50NS	101.63	67.87**	22.62**	0.98NS	184.99**	180.2**
F-107 x F-117	12.68**	0.00NS	92.39**	60.18**	8.81**	-10.39NS	159.21**	154.85**
F-138 x F-131	12.86**	8.22**	72.05**	45.71**	31.34**	22.09**	137.93**	90.19**
F-131 x F-138	11.43**	8.85**	57.11**	33.06**	33.00**	23.26**	115.78**	72.48**
F-147 x F-132	10.61**	8.96**	56.07**	55.17**	24.85**	24.59**	161.88**	164.87**
F-132 x F-147	22.73*	20.9**	52.02**	51.14**	24.36**	23.98**	130.58*	129.69**

* = Significant at 5 % level,

** = Significant at 1 % level

M.P = Mid parent,

B.P = Better Parent

better parents. When the values of these crosses were compared with their mid parental values, hybrid vigor ranged from 21.44 (F-132 x F-147) to 37.82 % (F-138 x F-131). The corresponding values for heterobeltiosis were 10.0 (F-132 x F-147) to 26.72% (F-113 x F-107). Hybrid vigor has also been reported for this character by Velichko *et al.* (1986) and Li *et al.* (1999).

Ear diameter: The perusal of results showed that all the combinations gave highly significant values of heterosis when compared with mid parental values, giving a range of 5.28 (F-107 x F-113) to 3.17% (F-132 x F-147). In comparison with better parental values it ranged from 2.21 (F-105 x F-103) to 21.20% (F-132 x F-147). The above findings confirm those of Velichko *et al.* (1986).

Number of rows ear⁻¹: The data of number of rows ear⁻¹ showed highly significant differences among F1,s over their mid parents (Table 1). The heterosis over mid parents ranged from 4.23 (F-113 x F-107) to 22.73% (F-132 x F-147). The range of heterobeltiosis in this case was -7.5 (F-113 x F-107) to 20.9% (F-132 x F-147). Vasal *et al.* (1995), Joshi *et al.* (1998) and Vidal *et al.* (2001) have reported the similar findings.

Number of kernels row⁻¹: In case of number of kernels row⁻¹ all the crosses showed highly significant differences among F1,s and parental values (Table 1). The heterosis over mid parental values ranged from 51.23 (F-103 x F-105) to 101.63% (F-113 x F-107) while in comparison with better parental values it ranged from 25.65 (F-103 x F-105) to 67.87% (F-113 x F-107). Similar findings were reported by Vasal *et al.* (1995).

1000-kernels weight: It is evident from that highly significant differences among F1,s and their parents were found regarding 1000-Kernal weight (Table 1). All the crosses showed appreciable values of heterosis over mid-parents which ranged from 8.81 (F-107 x F-113) to 33.0% (F-131 x F-138). All the crosses also showed heterosis over better parents except (F-113 x F-107) and (F-107 x F-113) which showed non-significant differences. The magnitude of range over better parental values was -10.39 (F-107 x F-113) to 24.59% (F-147 x F-132). Hybrid vigor has also been observed for this character by Gama *et al.* (1984) and Li Yu *et al.* (1999).

Yield plant⁻¹: As far as yield plant⁻¹ is concerned highly significant differences among F1 and their parental values were observed (Table 1). All the crosses showed an appreciable amount of heterosis and heterobeltiosis. The magnitude of heterosis of F1 over mid parents ranged from 57.8 (F-105 x F-103) to 184.99% (F-113 x F-107) and over the better parents ranged from 32.91 (F-105 x F-103) to 180.2% (F-113 x F-107). The similar results were reported by Mukherjee and Saha (1984) and Vidal *et al.* (2001).

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