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HETEROSIS STUDIES FOR YIELD AND YIELD COMPONENTS IN SOME CROSSES OF BREAD WHEAT *(Triticum aestivum* L.)

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Heterosis was estimated over mid- and better parents for yield and some important yield components in 10 crosses of wheat, involving 2 local varieties viz. Inq-9l, LU26S and three promising lines viz. HABA-3, HABA-6 and HABA-9. Number of tillers showed maximum heterosis over the mid parent (31.·91 %) followed by grain yield per plant (19.41 %), 1,000-grain weight (17.32 %), number of grains per spike (I 1.37 %) and plant height (5.23 %). The maximum heterobeltiosis was recorded for grain yield per plant (19.08%), number of tillers per plant (15.82 %) and number of grains per spike (10.27%).

Key words: bread wheat, heterosis. yield components

INTRODUCTION

Wheat is the most important food cereal of Pakistan and merits incessant efforts to keep up the production level with the growing population. Yield per unit area in Pakistan is fairly low compared to other wheat producing regions of the world. Wheat productivity can be enhanced through the formulation of wheat cultivars having wider genetic base and capable of performing better in various agroecological conditions. Exploitation of various genetic mechanisms can greatly help in this endeavor.

Several studies have been made on the manifestation of heterosis in wheat crosses. The results obtained show varying degree of heterosis response depending upon the genotype of the parents used. Malik *et £ll.* (1981) observed that all the hybrids exhibited a general increase over the better parent due to heterosis. Average value of increase recorded for plant height was 6.78 %, number of tillers per plant 35.81 %, number of grains per spike 2.22%, lOo0-grain weight 22.85% and grain yield per plant 31.1 % over better parents. Bhatri *et al.* (1982) reported the highest heterosis for grain yield per plant (82.01 %) over mid parental value (MPV) and 32.4% over the better parent followed by lOoo-grain weight (14.16 %) over MPV and (24.46 %) over better parent. Appreciable heterosis over the mid parental value and over the better parent for grain yield per plant, grain weight per ear, grain number per ear, number of productive tillers per plant and 1000-grain weight was reported by Palve *er al. (1986).*

Iqbal *er al.* (990) investigated important morphological traits in a live parent diallel cross and reported that grain yield per plant showed maximum heterosis over the mid parent (83.71 %), number of tillers per plant 21.33%, 1000-grain weight 9.23 %, plant height 8.53 % and number of spikelets per spike 8.16 %. The maximum heterobeltiosis was recorded for grain yield per plant (73.20%) followed by number of tillers per plant (20.53 %). Krishna and Ahmad (1992) found that the highest mean heterosis was 26.78% for grain weight per spike. 14.60% for lOOo-grain weight and 12.52% for grain yield. Chakraborty and Tiwari (1995) derived information on heterosis over mid- and better parents from data on 6 yield components. The high heterotic effects were observed for 1OOO-grain weight, while heterosis was low for tillers per plant. EI-Hennawy (1996) reported heterosis in F_1 hybrids for grain yield ranging from -70.82 to 72.75% and from -79.24 to 61 .34 % over mid- and better parents respectively.

MATERIALS AND METHODS

The present research work was conducted in the experimental area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, during the year 1996-97. Two wheat varieties viz. Inq-91, LU26S along with three lines viz. HABA-3, HABA-6 and HABA-9 were sown in the field during the year 1995-96 and 10 crosses i.e. lilq-91 x LU26S, Inq-91 x HABA-3, Inq-91 x HABA-6, Inq-91 x HABA-9, LU26S x HABA-3, LU26S x HABA-6, LU26S x HABA-9, HABA-3 x HABA-6, HABA-3 x HABA-9 and HABA-6 x HABA-9 were made and their seeds obtained for further study. The seeds of these F_1 hybrids along with their parents were sown in the field during the crop season 1996-97, using randomized complete block design with three replications. The varieties/lines were assigned at random to experimental units in each block having 5 meter long single row. The inter plant and inter row distances were 15 and 30 cm, respectively. Sowing was done by dibbling two seeds per hole and later thinned to one plant per hole. For the entire experiment other cultural and agronomic treatments were kept constant. At maturity ten equally competitive plants were tagged from each row and data were recorded for plant height, number of tillers per plant, number of grains per spike, 1000-grain weight and grain yield per plant.

Statistical analysis was done on the basis of means of ten plants for each character by using standard techniques as described by Steel and Torrie (1980). The percent increase (+) or decrease (-) of F_1 over mid parent as well as better parent was calculated to observe possible heterotic effects for all the traits following Fonseca and Patterson (1968). The tests of significance for mid- and better parents were performed by the formulae as reported by Wynne *et al.* (1970).

RESULTS AND DISCUSSION

Highly significant differences (P < 0.0 I) among the genotypes in respect of all the characters, have been observed which are presented in Table I. Table 2 reflects a detailed account of heterotic effects for various characters studied.

Plant Height: Five hybrids showed positive heterosis over mid parental means with values ranging from 0.67 % (Inq-91 x H!\BA-3) to *523'Y"* (HABA-3 x HABA-6) . Two crosses showed highly significant increase while one cross showed significant increase over respective mid parent values. Only four crosses were found to out yield their better parents. The F1 hybrid OIABA-3 x HABA-6) showed the maximum (4.74%) significant hetcrobcltiosis.

Tillers per Plant: The results revealed that 5 out of 10 crosses showed positive heterosis over their mid parents. The range of positive heterosis varied from 5.39 (HABA-3 x HABA-9) to 31.91% (LLJ26S x HABA-3) over mid parents. Two crosses showed non-significant while three crosses showed highly significant heterosis. Most of the crosses showed negative heterosis over better parents. About 30% crosses resulted in increased number of tillers per plant than the better parents. Only one cross (LU26S x HABA-3) possessed highly significant heterosis over better parent with maximum value (15.82 *'X).* The results are in agreement with the findings of Malik *et al.* (198 I) and Palve *er c: (1986).*

Grains per Spike: Four hybrids exhibited positive heterosis over their mid parent values ranging from 5.35% (HABA-3 x HABA-9) to 11.37 % (LU26S x HABA-9). Four crosses exhibited positive heterosis over the better parent values. The values ranged from 1.81 % (HABA-6 x HABA-9) to 10.27~ (LU26S x HABA-9). One cross manifested highly significant increase in number of grains per spike over the mid parent and better parent while two crosses showed non-significant hcterobeltiosis. These results conform to the findings of Malik *er al.* (1981) and Palve *er al.* (1986).

IOOO-Grain Weight: The highest 1000-grain weight (52.33 g) was recorded in hybrid Inq-91 x LU26S. None of the hybrids showed significantly better grain weight than Inq-9 I x LU26S. Seven crosses showed increase in grain weight over mid parents ranging from 5.31 % (LU26S x HABA-9) to 1732'% (Inq-9! x HABA-3). Four of the crosses manifested highly signi ficant increase in lOOO-grain weight over the respective mid parents, while only one cross (Inq-9I x LU26S) showed significant positive heterobcltiosis. Similar results were reported by Iqbal *er al.* (1990), Krishna and Ahrnad (!092) and Chakraborty and Tiwari (1995).

Grain Yield per Plant: Three F, hybrids exhibited positive heterosis over their mid parents ranging from 8.70% (HABA-6 x HABA-9) to 19.41 % (LU26S x HABA-3). Seven crosses showed negative heterosis over their better parents. About 30 % crosses exhibited positive heterosis over their respective better parents. The cross LU26S x HABA-3 showed the maximum

Table I. Analysis of variance for v.lrious quantitatively iI_1J 1c_'I_it_e_d il t àL_'Is l'c_'a_t

S.O. V.	d. f.	Plant height	Tillers per pl.mt	Grains per spike	Grain yield per plant	1000-grain weight
Genotypes	14	44.58**	1.9~m**	35.80**	7.856**	98.707**
Replication	2	0.145	0.695	9.595	0.680	5.105
Error	28	3.34	0.304	4.598	1.120	5.234

* = Significant: ** = Highly significant.

Table 2. Heterotic effects for plant height, number of tillers per plant. urains per spike. IOOO-e.rain wciulu and grain yield per plant

Crosses	Plant height		Tillers per plant		Grains per spike		IOOO-grain wl.		Grain Yield per plant	
	Mid parent	BelleI' parent	Mid parent	Better parent	Mid parent	Better parent	Mid parent	BelleI' parent	Mid parent	Beucr parent
Inq-9IxUJ26S	-0.74	-12.25	+6.02~'	-9.42	-5.65	-8.84'	+ 9.34	+7.43	-3.83" S	-1 1,33
Inq-91 xHABA-3	+0.67'	-1.47~'	-6.61 N'	-9.42'	-9.12"	-935"	+ 17.32"	+6.12"' S	-11.30	-17.97'
Inq-91 xI-lABA-6	-2.59'	-5.11	-6.77" S	-10.39	-9.32"	-10.89"	+ 16.79'	-0.17" S	-7.59	-14.67"
Ing-91 xIlABA-9	+3.14"	+ 1.51" S	-6.02" S	-9.03	(),O1"S	-2.45" S	+ 12.60	+0.81"	-2.52"	-11.93
I,U26SxIIABA-3	-4.94'	-12.34	+31.91	+ 15.82	+8.62'	+4.70" S	-3.18" S	-13.78	+ 19.41	+ 19.()8
LU26SxIIABA-6	-7.62	-15.18	+ 12.26	-0.74" S	-4.56'	-9.33	-3.56" S	-18.74	-0.89" S	-1.15"
LlI26SxlIABA-9	*A.93*	-11.86	+14.17	+0.41 xS	+1 1.37	+10.27	+5.31 "S	-7.19	+ 11.08	+8.64
HABA-3xHABA-6	+ 523	+4.74	-5.42"	-6.20" S	-6.60'	-7.97	+8.65	+ 1.97"	15.82	-15.91
IIA13A-3xIIABA-9	+4.69	+4.10	+5.39" S	+5.17" S	+ 5.35	1 2.53"	-0.72"	_1.89"	.~81 "	-6.D"
I1ABA6xl [ABA-9	+ 1.79"	-to.74"'.	_2.09"	-2.70" S	+615	+ 1,81" S	+825	1-2.77" S	18.70	+ 0.14"

increase over mid (19.41 %) and over better parents (19.08%) in case of grain yield per plant. Hybrid vigour expressed for this character had also been reponed earlier by Malik *et al.* (1981), Bhatti *et at.* (1982), Iqbal *et al.* (1990) and EI-Hennawy (1996). It is concluded that cross LU26S x HABA-3 could be further evaluated for selecting high yielding wheat genotypes.

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