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HETEROSIS STUDIES FOR YIELD AND ITS COMPONENTS IN BREADWHEAT (*TRITICUM AESTIVUM* L.)

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ABSTRACT

A set of diallel crosses involving 10 parents was made to have information on the extent of heterosis over better parent (BP) and standard variety (SV) for yield and yield contributing characters including some of the physiological traits. The maximum better parent heterosis for grain yield per plant was observed to be 59.7 per cent. The extent of standard heterosis however, was not of appreciable magnitude being 27.3 per cent for grain yield per plant. Magnitude of heterosis over better parent indicated that grain yield per plant was the most heterotic character next only to biological yield per plant. The crosses showing heterosis for grain yield were not heterotic for all the characters.

Key words: Breadwheat, heterosis, yield components, economic crosses.

Exploitation of heterosis is considered to be one of the outstanding achievements of plant breeding. In a self pollinated crop like wheat the scope for utilization of heterosis depends mainly upon the direction and magnitude of heterosis. Estimation of heterosis over better parent (heterobeltiosis) may be useful in identifying true heterotic cross combinations but these crosses can be of immense practical value if they show superiority over the standard or the best variety of the area. The present investigation aims at estimating the magnitude of heterosis over standard variety of breadwheat apart from that over better parent in grain yield and 11 other characters.

MATERIAS AND METHODS

Ten genotypes of breadwheat, viz., HUW 206, HUW 234, HW 2001, HW 2002, HD 2385, HD 2402, UP 262, KS 19, KS 26 and KS 34 were crossed in all possible combinations excluding reciprocals. The 10 parents and 45 F_1s were grown in a randomised block designwith three replications under normal sown irrigated condition. Each plot consisted of single row of 5 meter length spaced at 30 cm. Plant to plant distance was kept at 10 cm. Non-experimental rows were provided all around the

experimental material to avoid any possible border effects. The data were collected on ten randomly selected plants from each row for twelve characters, viz., plant height, ear length, number of earheads per plant, number of grains per ear, 100-grain weight, peduncle length, sheath length, flag leaf area, grain filling period, biological yield per plant, grain yield per plant and harvest index. Heterosis over better parent (BP) and standard variety (SV) was calculated as per standard procedures. UP 262 was kept as standard variety of breadwheat for the present investigation.

RESULTS AND DISCUSSION

The range of heterosis, number of economic crosses (in parenthesis) and number of crosses showing significant economic heterosis over BP and over SV for all the twelve characters have been presented in Table 1. Maximum heterosis for grain yield per plant over BP and SV was observed to be 59.7% and 27.3% respectively. Heterosis for grain yield has been reported by several wheat workers in the past [1-4] which is in accordance with the present finding. Some workers [5-6] reported grain yield to show maximum heterosis than any other character they studied. In the present study also, heterosis observed in grain yield per plant was maximum next only to biological yield per plant.

Table 1. Range of heterosis, number of economic crosses (in parenthesis) and significant economic crosses for twelve quantitative characters in breadwheat

Characters	Range of heterosis (%)		No. of crosses showing heterosis	
	BP	SV	BP	SV
Plant height	-8.6-23.0	-2.0-23.7	1 (6)	- (1)
Ear length	-25.1-16.9	-12.5-19.5	5 (21)	19 (40)
No. of earheads/plant	-27.4-45.5	-25.8-17.5	2 (14)	- (9)
No. of grains/ear	-33.0-26.7	2.2-73.2	6 (14)	37 (45)
100-grain weight	-18.7-17.2	-3.3-21.9	13 (25)	19 (37)
Flag leaf area	-26.1-56.8	3.62-79.8	6 (18)	39 (45)
Peduncle length	-12.3-24.2	6.9-36.1	15 (28)	43 (45)
Sheath length	-19.3-21.0	-0.5-27.2	13 (29)	37 (44)
Grain filling period	-15.9-11.8	-3.9-15.6	12 (22)	19 (33)
Biological yield/plant	-32.3-76.7	-37.7-33.1	3 (13)	1 (7)
Grain yield/plant	-31.3-59.7	-40.1-27.3	3 (12)	1 (7)
Harvest index	-16.4-10.7	-8.5-18.8	4 (18)	6 (25)

BP = Better parent; SV = Standard variety

The crosses showing heterosis for grain yield per plant were not heterotic for all the characters (Table 2). This implied that heterosis in a complex character like yield can be registered by single or several characters [4, 5, 7]. A close perusal of Table 2 showed that by and large, heterosis for number of grains per ear and that for 100-grain weight was independently associated with heterosis for grain yield per plant. This was perhaps due to antagonistic association of these two characters [2]. Biological yield per plant produced heterotic effects in almost all the crosses. Other important characters contributing to yield heterosis in the present study were flag leaf area, sheath length and number of earheads per plant.

Table 2. Relationship of heterosis for grain yield with heterosis in other characters in breadwheat

Crosses showing significant positive heterosis	Grain yield per plant	Ear length	No. of ear-heads /plant	No. of grains per ear	100-grain weight	Flag leaf area	Peduncle length	Sheath length	Biological yield /plant
Over better parent									
KS 19 × KS 34	59.7*	-	-	-	9.3*	-	-	-	48.6*
KS 34 × HD 2402	53.2*	-	26.3*	24.3*	-	-	-	-	76.7*
HUW 206 × KS 19	29.8*	-	19.5*	15.8*	-	28.0*	-	-	43.6*
Over standard variety									
KS 34 × HD 2402	27.3*	12.1*	-	50.1*	-	56.6*	15.8*	13.9*	33.1*

*Significant at 5%

It was observed that high yielding pure lines did not produce high heterotic response for grain yield. Similar results were also reported by Darrell and Charles [9]. Contrary to this finding however, Sharma and Singh [9] observed that higher the mean performance of the parents, greater was the heterotic expression.

Standard heterosis for grain yield over the SV, UP 262 in the present study was not of appreciable magnitude being 27.3% for the cross combination KS 34 × HD 2402 (Table 2). Sindhu and Singh [10] and Atale and Vitkare [11] also did not find appreciable amount of standard heterosis in many crosses of wheat. Negative or lack of significant positive heterosis observed for grain yield in the present study was in conformity with the findings of many wheat workers [12-14]. It appears therefore, that production of hybrid wheat on commercial basis is limited by the lack of appreciable magnitude of standard heterosis.

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