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HETEROSIS FOR YIELD AND ITS COMPONENTS IN SHORT DURATION RICE (*Oryza sativa* L.) HYBRIDS

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ABSTRACT

A study was taken up to assess the extent of heterosis for yield components in a 4 x 4 diallel. Substantial heterosis was noticed for all the characters studied except 100- grain weight. The hybrid Co 41 x IR 50 was identified to be superior by recording maximum heterosis for grain yield besides heterosis for four other characters namely, plant height, ear bearing tillers, ear length and grain number.

Reports on the successful exploitation of hybrid vigour in rice by the Chinese scientists have evoked interest among the rice breeders all over the world, (Virmani et al., 1981) As yield is a complex character and a cumulative function of various components may result in significant hybrid vigour for the yield *per se*. So, a knowledge on the extent of heterosis available for yield and its components becomes a pre-requisite in the development of hybrid rice. Hence, an attempt has been made in the present investigation to asses the extent of heterosis for yield and five other components in a 4 x 4 diallel cross of short duration rice varieties.

MATERIALS AND METHODS

Four short duration rice varieties viz., ADT 37, Co 41, IR 50 and ADT 36 were crossed in all possible combinations and all the twelve F_1s along with their parents were raised in RBD with three replications during June-September 1989 at Rice Research Station, Ambasamudram. A spacing of 20 cm between rows and 15 cm between plants was adopted. Observations were recorded for six characters on ten randomly chosen plants from each replication and the mean values were used for estimation of heterosis, heterobeltiosis and standard heterosis. The standard heterosis was calculated using best checks viz., Co 41 for plant height and ear length, IR 50 for ear bearing tillers and ADT 37 for grain number, 100-grain weight and grain yield. Significance for heterosis in all the three categories was tested by using 't' test as per the following formula suggested by Wynne et al. (1970) for relative heterosis.

$$\bar{t} = \overline{F1} - \overline{MP} / \sqrt{3/8\, V_e}$$

where $\overline{MP}$ = Midparental Value
Ve = Estimate of error variance.

RESULTS AND DISCUSSION

The data on heterosis are furnished in table. The result in general, indicated that magnitude as well as direction of heterosis differed from character to character depending upon the cross combination. For plant height, all the cross combination showed significantly positive heterosis while heterobeltiosis and standard heterosis were observed in nine and six combinations respectively. Six combinations, in which Co 41 was one of the parents, showed heterosis in all the three categories of estimation.

All the twelve crosses recorded significantly superior heterosis over mid and better parents for ear bearing tillers. In eight combinations it was significantly positive over the best check. The highest relative heterosis of 54.96, heterobelitiosis of 51.75 and standard heterosis of 32. 13 per cent was recorded in the hybrid Co 41 x ADT 36 which indicated the superiority of this cross combination for this character. Similar findings were reported by Kalaimani and Kadambavansundaram (1987) for each bearing tillers.

While the relative heterosis for ear length was significant in all the twelve combinations, the heterobeltiosis was significant in ten crosses and standard heterosis in five. The combination IR 50 x Co 41 which recorded the maximum values in all the three bases offers scope for exploitation of heterosis for this character.

For grain number, significant relative heterosis was noticed in all the twelve combinations. Of them, eight crosses were found to possess heterobeltiosis and standarad heterosis in the negative direction was also recorded in two and

Table 1. Estimates of genetic parameters and their ratios in tomato under moisture stress.

Hybrids	Plant height			Ear bearing tillers per plant			Ear length			Grain number per ear			100-grain weight			Grain yield		
	d_I	d_{II}	d_{III} (Co 41)	d_I	d_{II}	d_{III} (IR 50)	d_I	d_{II}	d_{III} (Co.41)	d_I	d_{II}	d_{III} (ADT.37)	d_I	d_{II}	d_{III} (ADT37)	d_I	d_{II}	d_{III} (ADT37)
ADT 37 x CO 41 (C1)	24.03**	11.62**	11.62**	27.81**	17.77**	-1.71	4.13**	-1.59	-1.59	7.01**	-8.68**	-8.68**	-11.46**	-4.04	-4.04	64.17**	49.20**	49.20**
ADT 37 x IR 50 (C2)	9.44**	0.69	-19.44**	45.76**	24.14**	24.14**	7.67**	4.59**	-1.20	14.38**	-3.17	-3.17	11.44**	0.45	0.45	69.21**	65.06**	65.06**
ADT 37 x ADT 36 (C3)	8.66**	5.86**	-10.71**	26.57**	14.41**	-0.38	11.18**	8.98**	2.57	32.98**	9.00**	9.00**	3.85	-3.14	-3.14	62.42**	57.32**	57.32**
CO 41 x ADT 37 (C4)	30.56**	17.51**	17.51**	26.82**	16.86**	-2.47	8.17**	2.23	2.23	9.09**	-6.90**	-6.90**	11.46**	-4.04	-4.04	43.93**	30.80**	30.80**
CO 41 x IR 50 (C5)	45.09**	21.30**	21.30**	27.56**	17.02**	17.02**	12.97**	9.87**	9.87**	21.43**	20.25**	-15.01**	-0.59	-5.49	-24.22**	78.77**	66.24**	58.70**
C0 41 x ADT 36 (C6)	25.48**	15.67**	15.67**	54.96**	51.75**	32.13**	8.00**	4.85**	4.65**	46.48**	39.49**	-1.41	5.65	-3.11	-16.14**	49.17**	59.66**	30.88**
IR 50 x ADT 37 (C7)	13.35**	4.29**	-16.56**	45.56**	24.14**	24.14**	6.73**	3.68**	-2.06	14.67**	-2.93	-2.93	12.94**	1.79	1.79	63.71**	59.69**	59.69**
IR 50 x CO 41 (C8)	45.12**	21.33**	21.33**	39.27**	27.76**	27.76**	16.81**	13.60**	13.60**	30.96**	29.69**	-8.33**	5.29	0.009	-17.73**	46.01**	35.78**	29.12**
IR 50 x ADT 36 (C9)	9.51**	-1.69	-17.01**	35.57**	27.00**	27.00**	10.74**	10.54**	4.42**	39.65**	34.23**	-6.96**	0.54	-3.11	-16.14**	54.79**	53.67**	46.13**
ADT 36 x ADT 37 (C10)	7.62**	4.86**	-11.56**	21.86**	10.15**	-4.09	3.06**	5.15**	-1.03	37.65**	13.11**	13.11**	9.13**	1.79	1.79	25.08**	21.15**	21.15**
ADT 36 x CO 41 (C11)	20.72**	11.24**	11.24**	51.73**	48.58**	29.37**	7.72**	4.59**	4.59**	42.00**	35.22**	-4.33**	1.69**	-6.74*	-19.28**	21.24**	13.49**	6.36**
ADT 36 x IR 50 (C 12)	11.22**	-0.07	-15.71**	35.37**	28.62**	26.62**	9.10**	3.90**	2.57	20.52**	15.35**	-19.70**	-1.61	-5.18	-17.34**	56.98**	55.84	48.20**

* Significant at 5% level ** Significant at 1% level

seven combinations respectively. Similar mixed trend of positive and negative heterosis for this character was already reported by Wilfred Manuel (1986) in rice crosses.

Only five crosses exhibited significantly positive relative heterosis for 100-grain weight. But, none of the crosses showed positive heterobeltiosis or standard heterosis for this trait. The cross ADT 36 x Co 41 recorded negative and significant heterobeeltiosis while six other crosses had significantly negative standard heterosis. This indicated the non existence of exploitable heterosis for this character among the hybrids under study.

Positive and significant heterosis for grain yield was observed in all the twelve combinations under all the three categories of estimation. The hybrid CO 41 x IR 50 recorded the maximum relative heterosis of 78.77, heterobeltiosis of 66.24 and standard heterosis of 58.17 per cent. The enhanced grain yield in this hybrid may be obtained to simultaneous significant and positive heterosis obtained for four other yield components, viz., plant height, ear bearing tillers, ear length and grain number. In their stuides, Srivastava and Seshu (1982) also reported that number of ear bearing tillers and grains per ear have contributed to increased grain yield per plant of the rice hybrids. However, the magnitude and direction of contribution of heterosis by different characters to the heterosis in grain yield varid from cross to cross depending upon the parents involved. In crosses invloving IR 50 as one of the parents, the heretosis in grain yield was contributed by the ear bearing tillers alone whereas the heterosis for yield was due to the contribution by two components namely grain number and 100-grain weight in crosses involving ADT 37. Such phenomenon might be due to the interaction between genome of the parents involved in the hybrid. Such hybrids where the heterosis for yield as a result of single component alone, will result in instability of the performance of the hybrids under different environments. In the heterotic system where yield is a result of heterosis of more than one component, the loss of one component may be compensated by the other (Adams, 1967).

The hybrid Co 41 x IR 50 which exhibited the highest heterosis for grain yield besides heterosis for four other traits viz., plant height, ear bearing tillers, ear length and grain number offers scope for commercial exploitation.

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