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HETEROSIS STUDIES OF SOME PROMISING RICE CROSSES

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Estimation of heterosis were made with respect to plant height, panicle length, number of panicles per plant, yield per plant in 6 hybrids involving 5 varieties of rice. The crosses such as 1053-2-4 x 4048-3 and 1053-2-4 x 4439 appeared to be better by giving heterosis over mid and parent in this study. However, most of the crosses involving 1053-2-4 as one parent showed positive mid and better parent heterosis for grain yield and all or some other traits, therefore, it appeared as best combiner among the material studied.

Key words: *Oryza sativa,* Hybrid vigour, Yield components.

Introduction

Rice is an important crop of Pakistan and occupying a key position in its economy. Besides, evolution of yielding better quality varieties possessing tolerence to prevalent diseases and insect pests, possibility of heterosis offers another opportunity for increasing the rice production in the country. Many researchers [1-4] have observed heterosis in some rice croses for different plant characters including yield of paddy. The exploitation of heterosis on commercial level in Pakistan has also been emphasized by Khan and Khan [13] in cotton. But before making such endeavours selection of parents based on their combining ability and magnitude of heterosis for different traits is considered to be the pre-requisite. The present studies were, therefore, designed to estimate the heterosis effects of different plant characteristics in rice (*Oryza sativa* L.).

Material and Methods

The present studies were undertaken at Rice Research Institute, Kala Shah Kaku during the year, 1989-90. One way cross, six in number between 5 genotypes *viz;* 1053-2-4, 1053-1-2, 4048-3, 4439 and Basmati 385 were made in the experimental field during 1988. One row of 7.5 m long and 50 cm apart each of F_1 crosses and parents containing 10 plants was arranged in 3 replications in a randomized complete block design keeping 50 cm distance between hills. Five plants from each entry were selected at random and data for plant height (cm), number of panicles per plant, panicle length (cm), number of grains per panicle, 1000 grain weight (g) and grain yield per plant (g) were recorded. Estimation of mean square and test of significance were done according to Fisher [6]. Percent heterosis over mid and better parents were estimated and tested at both probability levels as done by Azher *et al.* [7].

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Results and Discussion

Highly significant differences were observed among all the genotypes for all the characters studies except number of panicles per plant (Table 1).

Heterosis. Percent heterosis of F_1 hybrids over their mid parent and better parent for various characters are presented in Table 2. For plant height, out of 6 crosses 4 exhibited positive and highly significant heterotic effects over mid parent ranging from 0.09 (1053-2-4 x Bas 385) to 13.50% (1053-2-4 x 1053-1-2). The manifestation of heterotic effects in F_1 generation in rice was also reported by Vermani *et al.* [2] and Cheema *et al.* [4].

Similarly for panicle length 5 crosses showed increase over respective mid parent and better parent. Kumar and Saini [3] and Sharma and Mani [8] also observed heterosis for panicle length in rice. Panicle in a character which affects the yield. Long panicle length in all types of rice cultivar is useful in obtaining higher yield.

In case of number of panicles per plant, 5 hybrids showed positive and significant heterotic effects over mid parent and 3 crosses only exhibited heterobeltiosis effects over better parent. The magnitude of heterosis over mid parent ranged from 3.74 (4048-3 x Bas 385) to 15.58% (1053-2-4 x 4439) and it ranged from 3.76 (1053-2-4 x 1053-1-2) to 6.09 % (1053-2-4 x 4439) when compared with better parent. It is in the agreement with earlier reports by Kumar and Saini (3).

Manifestation of positive heterosis for number of grains per panicle over mid parent was observed in 3 of the 6 crosses which ranged from 1.88 (1053-2-4 x 4439) to 27.99% (1053-2-4 x 4048-3). Only 2 crosses 1053-2-4 x 4048(11.30%) and 1053-2-4 x4439 (0.10 %) excelled better parent. The number of grains per panicle is the most important yield componant and contribute to the final yield. F_1 hybrid of the cross (1035-2-4 x 4048-3) gave the highest number of grains per panicle (147.75) seems promising and might gave desirable

TABLE 1. MEAN SQUARES FOR PLANT HEIGHT, YIELD AND YIELD COMPONANT IN RICE VARIETIES AND THEIR F_1 HYBRIDS.

Source	D_1F_1	Plant height	Panicle length	Number of panicles per plant	Number of grains per panicle	1000 grain weight	Grain yield per plant
Block	2	6.20	1.24	8.26	47.44	0.69	60.36
Varieties	10	403.35**	34.71**	40.33^{NS}	640.66**	3.81**	659.82**
Error	20	8.67	1.33	19.79	116.21	0.25	115.26

NS = Non-significant; ** = Highly significant.

TABLE 2. ESTIMATION OF HETEROSIS OF F_1 HYBRIDS FOR YIELD AND OTHER TRAITS IN RICE.

Crosses	Plant height (cm)		Panicle length (cm)		No.of panicles per plant		No.of grains per penicle		1000-grain weight (gm)		Grain yield/plant	
	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP
1053-2-4/4048-3	+ 10.38**	+ 5.89**	+ 22.07**	+17.61**	+7.44**	-6.53^{NS}	+27.99**	+11.30*	+10.64**	+9.27**	+39.66**	+35.27**
1053-2-4/4439	+ 10.14**	+ 2.41^{NS}	+ 20.28**	+12.11**	+15.58*	+6.09^{NS}	+1.88^{NS}	+0.10^{NS}	+14.15**	+13.03**	+17.90*	+9.01^{NS}
1053-2-4/1053-1-2	+ 13.50**	+ 4.53**	+ 21.03**	+16.01**	+12.08*	+3.76^{NS}	-9.36*	-15.31*	+12.32**	+12.04**	+18.03*	+13.26^{NS}
1053-2-4/Bas 385	+ 0.09^{NS}	- 1.26^{NS}	+ 2.09^{NS}	+1.38^{NS}	+14.87**	+5.34^{NS}	-17.75*	-20.09**	+3.81*	+2.05**	-0.75^{NS}	-9.28*
4048-3/1053-1-2	- 2.67*	- 6.73**	- 0.78^{NS}	-1.32^{NS}	-10.99*	-16.82**	+9.28^{NS}	+1.13^{NS}	+0.98^{NS}	-0.10^{NS}	-14.82*	-15.63^{NS}
4048-3/Bas 385	2.15^{NS}	3.27**	13.61**	10.20**	3.74^{NS}	2.11^{NS}	2.81^{NS}	17.53^{NS}	9.81**	7.09**	23.18*	9.18^{NS}

MP,BP = % heterosis over mid and better parents, respectively; NS = No significant; *= Significant at 5% lavel; **= Significant at 1% lavel.

segregates which can be selected from progenies. The present results are in the line with the earlier findings [2-4, 8,9].

In case of 1000-grain weight, all crosses produced havier grains than parental mean values and magnitude of positive and significant heterosis varied from 0.98 (4048-3 x 1053-1-2) to 14.45% (1053-2-4 x 4439.). Out of the 6 crosses, 5 showed higher grain weight than the respective better parent. The increase in weight in crosses over better parent ranged from 2.05 (1053-2-4 x Bas 385) to 13.03 % (1053-2-4 x 4439). The manifestation of heterosis for 1000 grain weight was also observed by Virmani *et al.* [2], Kumar and Saini [3] and Sharma and Mani (8). The havier grain weight is useful in obtaining higher yield.

Similarly for grain yield per plant impressive positive and significant heterosis over mid parent was observed in 4 crosses and it ranged from 17.90 (1053-2-4 x 4439) to 39.06% (1053-2-4 x 4048-3). Heterobeltiosis over better parent was also found in 4 crosses varying from 9.01 (1053-2-4 x 4439) to 35.27% (1053-2-4 x 4048-3). Presence of heterosis is an established phenomenon is other field crops as well [10] and it has been reported by other workers in rice [2, 3, 5, 8, 9, 12].

It can be seen from Table 2 that the cross 1053-2-4 x 4048-3 which proved the best regarding heterosis and heterobeltiosis for yield of grain has shown consistantly better result for other characters too. Similarly the cross 1053-2-4 x 4439 has also shown better performance for characters relating to directly or indirectly to the yield. Therefore, these crosses may be given due consideration in future.

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