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HETEROSIS IN INTER-VARIETAL HYBRIDS OF RICE (Oryza sativa L.)

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ABSTRACT

The extent of heterosis for yield components in a set of fourteen intervarietal rice hybrids involving thirteen parents were studied. Substantial heterosis over mid-parent and better parent was observed for the fourteen characters studied. The hybrid Vaigai/IET 4786 was superior with high heterosis for boot leaf area, ear bearing tillers, grains per panicle, grain yield and straw yield.

KEY WORDS: Heterosis. Rice hybrids.

Heterosis has been exploited to a great degree in cross pollinated crops like maize and bajra. It has been recently extended to self pollinated crops like wheat, rice, tomato etc. China has convincingly demonstrated that hybrid rice can be developed and commercially cultivated (Virmani et al., 1981). The present investigation attempts to assess the extent of heterosis for yield and its component traits in fourteen rice hybrids.

MATERIALS AND METHODS

Fourteen inter-varietal rice hybrids involving thirteen parents viz., CO 33, CO 37, IET 3273, IET 4786, IET 6148, IET 6639, IET 6712, IET 7259, IET 7564, AS 688, IET 7614, TNAU 8999/4 and TNAU 18328/1 were raised in rabi season (Sept.-October to December-January) of 1983-84 at the Agricultural College and Research Institute, Madurai in a randomised block design with three replications. A spacing of 60 cm between rows and 15 cm between plants was adopted. Observations were recorded on ten randomly selected plants in each treatment for fourteen biometric traits. The overall mean value for each parent and hybrid was taken for computation of heterosis over the mid parental value (di) and the better parent (dii). The significance for di

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and dii heterosis was found out by using the formula given by Wynne et al. (1970).

For computing heterosis for days to panicle emergence, days to maturity and number of non-ear bearing tillers, parent with lower value was taken as better parent.

RESULTS AND DISCUSSION

The data on heterosis are presented in the Table. The expression of heterosis for plant height was relatively low and non-significant.

Eleven of the fourteen hybrids were found to be earlier than the mid parental value and among them, five were earlier than the early parent. Among the hybrids, IET 6639/ IET 7614 was the earliest to flower in 64 days. Singh et al. (1980) also reported heterosis for earliness in flowering and indicated that earliness was dominant over lateness.

Increased leaf area of the boot leaf is one of the important manifestations of heterosis in rice hybrids. The importance of this factor in dry matter accumulation and grain yield was emphasised by Lu-Hao-ran and Zhu-Yiu-Ying (1980). The hybrids involving Vaigai as one of the parents recorded the maximum heterotic effect for length and breadth of boot leaf. High heterosis for length of boot leaf was observed in six hybrids. Maurya and Singh (1978) reported heterosis for this trait. As leaf size formed a major component in determining the leaf area, the high heterotic effect observed in Vaigai/IET 4786 for boot leaf length appears to be worthwhile for further exploitation.

Marked heterosis was obtained for number of ear bearing tillers in most of the hybrids studied. A high relative heterosis of 68 and heterobeltiosis of 66 per cent for this trait in the cross Vaigai/IET 4786 indicates the superiority of this cross combination. Mandal (1982) also reported high degree of heterosis for this trait

In the present study, significant and positive heterotic vigour for panicle length was not observed in any of the hybrids. High and significant heterotic effect was observed for number of primary branches per panicle in Vaigai/AS 688, Vaigai/IET 3273, IET 7259/IET 6639 and CO 33/IET 6148 hybrids. Majority of the hybrids showed

Table. Heterosis (in per cent) for yield and its components in rice hybrids

S. No.	Cross		Plant height	Days to panicle emergence	Boot leaf length	Boot leaf breadth	Number of ear bearing tillers	Panicle length	No. of grains/ panicle	Days to maturity	100 grain weight	Grain yield	Straw yield
1.	Vaigai/	di	11.50	-3.17*	28.55**	6.12	42.59**	11.53	17.50**	-2.35**	-21.52	31.80**	48.68**
	IET 3273	dii	7.62	-0.54	23.88**	5.19	32.19**	8.34	17.30**	-0.40	-28.45*	28.50**	46.63**
2.	Vaigai/	di	6.80	-1.22	9.51	7.61	40.04	18.32	16.25**	-0.84	-22.13	45.11**	6.71
	IET 6148	dii	6.02	2.68	8.68	3.73	32.02*	14.62	15.92**	2.03**	-27.86**	34.29**	2.23
3.	Vaigai/	di	9.69	-14.46**	15.17**	-1.44	38.91**	2.74	-4.71	-10.68**	-18.97	37.99**	22.98**
	IET 6712	dii	8.20	-12.37**	12.69**	-2.00	18.99	2.34	-6.70	-9.07**	-22.02	23.95**	7.34*
4.	Vaigai/	di	13.39	3.56*	20.28**	-10.45**	68.44**	0.73	2.95	2.52**	-0.12	60.74**	19.42**
	IET 4786	dii	8.94	20.39**	16.99**	-12.17**	66.33**	-0.44	2.08	13.77**	-10.45	39.76**	15.40**
5.	Vaigai	di	7.05	7.13**	11.32**	1.86	63.90**	-0.05	13.97*	5.06**	-17.76	25.66**	23.35**
	AS 688	dii	5.34	22.87**	11.31**	-4.62	59.25**	-1.09	10.95**	15.56**	-19.09	14.22*	14.04**
6.	Vaigai/	di	1.88	-5.78**	17.85**	1.89	40.29**	2.27	-4.93	-4.22**	-12.04	32.21**	29.57**
	TNAU 8999-4	dii	-0.01	-4.11**	16.50**	0.57	35.68**	1.08	-6.69	-2.99**	-14.72	28.87**	27.48**
7.	CO 33/	di	-6.40	7.86**	4.36	-6.44	56.46**	-0.32	9.33	5.41**	-17.39*	51.43**	-0.05
	IET 4786	dii	-10.19	14.25**	-0.45	-7.08	21.72*	-3.75	3.39	9.62**	-26.04	49.07**	-5.64
8.	CO 33/	di	-7.00	-2.62	8.20*	4.97	-12.15	0.34	17.77**	-1.80*	-25.90	6.77	-29.93**
	IET 6148	dii	-13.57	2.15	6.36*	0.05	-12.31	-1.15	12.58*	1.50*	-43.13**	-7.61	-38.13**
9.	CO 33/	di	-6.21	-4.86**	-0.50	6.52	14.17	4.37	7.61	-3.47**	-28.82*	-3.28	12.37*
	TNAU 8999-4	dii	-11.86	1.99	-1.34	2.46	2.62*	2.97	0.79	1.39	-43.45**	-15.17	4.74
10.	IET 6639/	di	-4.81	-5.85**	-0.03	-5.15**	45.23**	-0.53	1.85	-3.78**	-24.38	-1.61	-10.95*
	IET 7614	dii	-6.26	-4.40*	-1.04	-6.16	33.90**	-7.68	-29.91**	-3.04**	-28.82*	-15.39*	-29.18**
11.	IET 7259/	di	4.24	-1.15	3.04	-0.61	23.25*	3.92	13.35*	-0.81	-9.43	35.78**	15.89**
	IET 6639	dii	-0.11	3.49*	-3.10	-1.54	15.93	-2.68	-7.02	2.41**	-12.46	22.36**	2.38
12.	IET 7564/	di	7.04	-6.56**	-4.14	2.87	25.73*	1.04	-14.09**	-4.63**	-6.14	-1.58	-11.12*
	IET 7259	dii	0.13	-4.95**	-6.99	0.27	14.61	0.46	-15.06**	-3.48**	-11.12	-3.01	-12.20*
13.	TNAU 18328-1/	di	10.59	-5.96**	2.46	-6.91**	52.60**	6.70	-10.07	-4.28**	-0.06	15.74*	-14.97*
	IET 7564	dii	9.38	1.65	1.42	-10.83**	50.47**	4.47	-12.76*	1.16	-8.87	12.46*	-15.01**
14.	TNAU 18328-1/	di	13.63	-4.49**	15.01*	-11.49**	47.48**	3.53	-7.76	-2.94**	7.83	-4.41	-20.55**
	IET 7614	dii	10.39	4.68**	13.59**	-17.37**	35.34**	-0.33	-7.87	3.84**	6.44	-7.80	-28.95**

negative heterotic effect for number of secondary branches per panicle. Moderate heterosis for number of primary and secondary branches per panicle was reported by Srivastava and Seshu (1982).

Significant and positive heterosis for number of grains per panicle was observed in the hybrids CO 33/IET 6148, Vaigai/IET 3273, Vaigai/IET 6148 and Vaigai/AS 688. Nijaguna and Mahadevappa (1983) reported positive and negative heterotic effects for this trait.

All the hybrids, except Vaigai/IET 3273, matured in less than 110 days. The hybrids IET 6639/IET 7614, IET 7564/IET 7259 and IET 7259/IET 6639 were the earliest and these hybrids can be exploited for early maturity. Heterosis for days to maturity was found to be both in the positive and negative directions in the present study.

Negative heterosis was observed for 100 grain weight in all the hybrids except the cross TNAU 18328-1/IET 7614. However Amirthadevarathinam (1984) observed significant and positive heterosis for grain weight.

High and significant heterosis for grain yield was observed in nine out of fourteen hybrids in the present study. Vaigai/IET 4786 recorded the highest heterosis. The enhanced grain yield in this hybrid may be attributed to simultaneous significant, positive heterosis obtained for three yield component traits namely, number of ear bearing tillers, number of primary branches per panicle and boot leaf area.

Significant heterosis for straw yield was noted in both positive and negative directions in the present study. It is interesting to note that, six hybrids namely Vaigai/IET 3273, Vaigai/IET 6712,Vaigai/IET 4786, Vaigai/AS 688, Vaigai/TNAU 8999-4 and IET 7259/IET 6639 expressed high and positive heterosis for both grain and straw yield.

The hybrid, Vaigai/IET 4786 which exhibited maximum heterosis for grain yield and medium heterosis for straw yield holds promise for commercial exploitation

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