

Studies on heterosis in rice hybrids using thermosensitive genic male sterile lines

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(Received: November 2007; Revised: March 2008; Accepted: April 2009)

The three line system has been the most important method for heterotic rice breeding. In recent years, two-line rice hybrid has received much more attention because it offers many advantages including simplifying seed production, removal of the restriction of restorer genes and overcoming the negative effects of male sterile cytoplasm [1]. The present study attempts to estimate the standard heterosis of 96 crosses evolved by crossing 32 elite *indica* thermosensitive genic male sterile (TGMS) lines with three cultivars viz., Pant Dhan 12, UPRI 92-133R and IR 65598-112-2 in line x tester fashion.

The experiment was conducted at crop research centre, Pantnagar in randomized complete block design with three replications during *kharif* 2002. All the 32 TGMS lines were bred at the centre except TS-29 which was developed at T.N.A.U. (Coimbatore). Pant Dhan 4, a high yielding variety was used as a standard check. Observations were recorded for 11 characters viz., days to 50% flowering, plant height, panicle number per plant, panicle length, spikelet number per panicle, grain number per panicle, percent spikelet fertility, 1000-grain weight, total dry matter per plant, harvest index and grain yield per plant on five competitive randomly selected plants in each replication for each treatment.

Considerable amount of standard heterosis was observed for the characters under study (Table 1). All the 96 crosses showed early flowering than the check Pant Dhan 4, and UPRI 97-54 x UPRI 92-133R was the most heterotic cross for earliness. For plant height, 63 crosses showed significantly negative heterosis over the

check and the cross UPRI 97-51 x UPRI 92-133R was the shortest [2]. For panicle number per plant UPRI 97-68 x Pant Dhan 12 was the best cross and only two crosses exceeded the value of check. For panicle length, TS-29 x Pant Dhan 12 was the best cross and 16 crosses showed positive heterosis over the check. The maximum number of spikelet per panicle was recorded by UPRI 97-62 x Pant Dhan 12 and 23 crosses exceeded the value of Pant Dhan 4 [3]. For number of grains per panicle 37 crosses exceeded the value of check parent and UPRI 97-75 x UPRI 92-133R was the best cross [4]. The cross UPRI 97-63 x pant Dhan 12 had the maximum spikelet fertility and 87 crosses were superior over check. For 1000-grain weight 75 crosses were superior to the Pant Dhan 4 and UPRI 97-62 x Pant Dhan 12 was the best cross. For total dry matter per plant, UPRI 97-61 x IR 655-98-112-2 was the only cross that exceeded the value of check parent. The maximum harvest index was recorded by the cross UPRI 97-76 x Pant Dhan 12 and 12 crosses were superior than the check. The range of heterosis for grain yield varied from -66.73 to 86.12 and 12 crosses exceeded the value of Pant Dhan 4. The cross UPRI 97-67 x Pant Dhan 12 recorded the maximum grain yield per plant [5].

In the present investigation, crosses in general manifested optimum to high magnitude of standard heterosis for grain yield and most of its related agronomic characters. On the basis of high *per se* performance, high specific combining ability (SCA) and high heterosis for one or more yield components, the cross UPRI 97-67 x Pant Dhan 12 had been identified as superior followed by UPRI 97-62 x UPRI 92-133R, UPRI 97-76

Table 1. Five best crosses for grain yield per plant and their corresponding standard heterosis for each character

Character	Range of standard heterosis	Best crosses for grain yield per plant				
		C1	C2	C3	C4	C5
Grain yield/ plant (g)	-66.73 to 86.21	86.21**	85.46**	56.22**	54.03**	40.82**
Days to 50% flowering	-26.92 to 6.25	-20.67**	-17.78**	-21.15**	-22.59**	-19.71**
Plant height (cm)	-12.88 to 15.84	2.96*	-8.05**	0.42	1.44	-8.55**
Panicle number/ plant	-50.00 to 52.00	29.33	1.33	-10.66	26.66	48.00*
Panicle length (cm)	-9.01 to 22.54	8.60	2.04	11.88*	12.70*	6.96
Spikelet number/ panicle	-23.17 to 64.29	0.06	49.39**	-21.64	19.36	15.85
Grain number/ panicle	-13.43 to 103.50	16.41	73.13**	40.97**	13.28	31.71*
Spikelet fertility (%)	3.01 to 20.01	16.37**	16.18**	1.84	12.72**	12.60**
1000-grain weight (g)	-1.46 to 28.84	18.99**	-0.71	18.66**	16.30**	14.98**
Total dry matter/plant (g)	-47.28 to 34.07	18.99	19.77	-3.28	34.07*	11.38
Harvest Index (%)	-52.68 to 54.90	47.37**	46.17**	54.90**	8.81	18.67**

C1 = UPRI 97-67 x Pant Dhan 12, C2 = UPRI 97-62 x UPRI 92-133R, C3 = UPRI 97-76 x Pant Dhan 12, C4 = UPRI 97-61 x IR 65598-112-2, C5 = UPRI 97-68 x UPRI 92-133R; *,**Significant at 5 % and 1 % level, respectively.

x Pant Dhan 12, UPRI 97-61 x IR 65598-112-2, UPRI 97-68 x UPRI 92-133R and these crosses were suggested to exploit for isolating high yielding pure lines and/or for use in hybrid breeding [6].

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