

COMBINING ABILITY IN RICE

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ABSTRACT

In rice, the variances of specific combining ability were higher than general combining ability for plant height, panicle length and grain yield per plant which indicated non additive gene action. The genotypes ADT 31 and Utrirajappan were found to be good general combiners for grain yield and their cross involving these two parents showed high sca effects.

KEY WORDS : Rice, Combining ability.

The relative information regarding nature of general and specific combining ability with respect to parents and hybrids will help the breeder to build up his breeding programme in an effective manner. Hence, a study on the combining ability of three lines with four testers was undertaken and the results presented

have contributed more than testers in respect of all characters (Table 2)

The total variance due to genotypes was further partitioned into that due to parents, crosses, parents V_s crosses. The highly significant variance due to parents V_s crosses indicated the prevalence of heterosis for plant height, number of productive tillers and panicle length. The variance due to lines also differed for all the characters. The mean squares due to lines x testers interaction were found significant for all characters indicating the importance of sca effects for these characters. The relative estimates of variance due to specific combining ability were higher than general combining ability for plant height, length of panicle and grain yield per plant indicating predominantly non additive gene action. Similar reports were recorded by Sivasubramanian and Madhava Menon (1973), Singh and Nanda (1976), Rao *et al.* (1978), Singh *et al.* (1979), Amirtha Devarathinam (1983) and Ananda Kumar and Sree Rangasamy (1984). But productive tillers showed high variance for general combining ability which indicated the predominance of additive gene action which confirms the findings of Singh *et al.* (1979). This revealed the ample scope for improvement in productive tillers by pedigree breeding method.

MATERIALS AND METHODS

Three semi-tall lines viz., IR-36, IR-50 and ADT-31 and four tall and semi-tall testers viz., Utrirajappan, ARC 6650, Manoharsali and KAU 10667 and their 12 hybrids by line x tester mating design were raised during Kharif, 1984 in randomised block design replicated thrice with a spacing of 20 x 10 cm. The crop was fertilized with N:P and K at the rate of 120:60:60 kg/ha. Each variant was represented by thirty plants in a row.

Observations on plant height, number of productive tillers, panicle length and grain yield per plant were recorded on ten plants in each replication. Estimates of combining ability were computed as suggested by Kempthorne (1957).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes in respect of all characters (Table 1). The proportional contribution to the total variance by lines and testers revealed that the lines and lines x testers

The general combining ability effects of the males (testers) and females (lines) are given in Table 3. The testers did not show

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Table 1. Analysis of variance for combining ability in Line X Tester for four characters

Source of variation	df	Plant height	Productive tillers	Panicle length	Yield per plant
Replication	2	0.93	0.91	1.60	0.334
Treatments	18	105.16**	11.70**	15.56**	23.54**
Parents	6	158.51**	3.52	15.53**	12.57**
Parents Vs Crosses	1	503.22**	1030.80**	57.18**	-0.16
Crosses	11	40.37**	13.15**	5.20*	31.68**
Lines	2	198.99**	41.12**	13.97**	18.30**
Testers	3	2.90	410.23**	0.36	16.08**
Line X Tester	6	6.22**	-194.71**	14.19**	10.61**
Error	36	13.05	22.96	1.36	42.60
Estimated Variance					
σ^2 gca (female)		392.22	-293.87	-0.025	382.294
σ^2 gca (male)		-41.49	-549.81	-2.090	25.882
σ^2 gca (average)		-7.32	235.40	-0.369	4.568
σ^2 sca or σ^2 D		5.82	-1524.13	5.98	136.51
σ^2 D / σ^2 A		-8.82	-3.24	5.24	14.94

* Significant at 5% level;

** Significant at 1% level.

Table 2. Contribution of line, tester and their interaction to the total variance.

S.No.	Source	Plant height	Productive tillers	Panicle length	Grain Yield per plant
1.	Contribution of Lines	89.63	56.85	24.47	67.99
2.	Contribution of testers	1.96	21.10	0.95	13.84
3.	Contribution of lines X testers	8.41	21.99	75.58	18.27

Table 3. General combining ability effects of lines and testers

Genotype	Plant height	Productive tillers	Panicle length	Yield per plant
Males (Testers)				
Utrirajappan	1.99	5.34	0.10	12.85*
A R C 6650	-2.85	-2.72	-0.29	-2.91
Mancharsall	0.71	3.01	0.25	-6.20
K A U 10667	0.17	-5.56	-0.07	-3.72
Female (line)				
IR 36	-9.21	-10.11	-1.21	-17.07*
IR 50	-7.74	6.43	-0.13	-5.65
ADT 31	16.97	3.67	1.30	22.73**
SE (gi) lines	25.02	11.65	5.03	7.53
SE (gi) testers	21.67	10.09	4.35	6.52
SE (gi-gi) lines	35.38	16.48	7.11	3.50
SE (gi-gi) testers	37.53	14.27	6.16	9.23

* Significant at 5% level;

** Significant at 1% level.

Table 4. Specific combining ability effects of crosses in rice

Source	Plant height	Productive tillers	Panicle length	Grain Yield per plant
IR 36 x Utrirajappan	7.34	1.14	-41.41**	4.11
IR 36 x ARC 6650	-3.60	-6.67	-42.85**	-6.51
IR 36 x Manoharsali	-4.49	0.81	-44.93**	-2.80
IR 36 x KAU 10677	0.72	4.67	-43.85**	5.25
IR 50 x Utrirajappan	-2.07	-6.11	-44.30**	-18.85**
IR 50 x ARC 6650	1.75	4.37	-43.60**	8.85*
IR 50 x Manoharsali	3.87	5.61	-41.50**	8.30*
IR 50 x KAU 10667	-3.59	-3.87	-43.63**	1.83
ADT 31 x Utrirajappan	-5.28	35.58	-44.06**	14.86**
ADT 31 x ARC 5650	1.82	2.31	-43.34**	-2.35
ADT 31 x Manoharsali	0.61	-6.41	-43.35**	-4.45
ADT 31 x KAU 10667	2.83	-0.78	-41.62**	-7.08
SE (Sij)	12.511	5.83	2.52	3.77
SE (Sij-Ski)	25.023	8.24	3.56	5.33

Significant at 5% level

** Significant at 1% level

Significant *gca* effects for all characters except grain yield per plant by Utrirajappan, which may be used for yield increase. On the other hand, the genotype, ARC 6650 gave high non-significant negative estimates of *gca* for plant height. Negative estimate was desirable for dwarf plant type. The line, ADT 31, was found to be a good general combiner for grain yield.

The estimates of *sca* effects of twelve crosses are given in Table 4. All the crosses expressed negative and significant *sca* effects for panicle length. Three crosses expressed positive and significant *sca* effects for grain yield per plant. Even though the three hybrids *viz.*, ADT 31 x ARC 6650, ADT 31 x Manoharsali and ADT 31 x KAU 10667 involve one of the best general combiner for yield, ADT 31 as one of their parents, *sca* effects were negative and non significant. Two parents *viz.*, Utrirajappan (male) and ADT 31 (female) which were found to be good general combiners for

grain yield and exhibited high *sca* effects in specific combination could be exploited further in breeding programme for realising the most desirable recombinants.

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