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Combining Ability for Grain Yield in Greengram (*Vigna radiata* (L.) Wilczek) *

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Line × tester analysis stroy for estimating the combining ability revealed non-additive gene action for the expression of grain yield in greengram (*Vigna radiata* (L) Wilczek.) Parents Jawahar 45 and BI showed the highest general combining ability effects. Additive gene action was found in the combinations T1 × B1, T1 × Jalagaon 781, T1 × GG 525 and Jawahar 45 × Jalagaon 781. Two combinations namely T1 × T51 and Jawahar 45 × Pusa Baisakhi mung were found to be associated with both additive as well as non-additive type of gene action. It is suggested that the parent Jawahar 45 may be used in hybridization programmes for increasing the grain yield in greengram.

The present work is aimed at finding out the nature of combining ability and the type of gene action responsible for the expression of the character, grain yield. This information can be utilized for improving greengram yield through hybridization programmes, a rather new approach for the improvment of this crop where so far pureline selection has largely been the breeding method. Further these studies comprising of line × tester analysis of combining ability for grain yield pertaining to F_2 generation will enable a comparison with the findings already made in F_1 generation by Krishna Rao and Nagur (1979) and likely to throw more light on the utilization of the parents in the breeding programmes.

MATERIAL AND METHODS

F_2 progenies of the thirty six hybrids obtained from the crossing programme, using T1, T2, Jawahar 45 and 12—6—7 as lines (female parents) and B1, T44, T51, Jalagaon 781, GG 525, Pusa Baisakhi mung, Krishna II, R 288—8 and PS 16 as testers (male parents) were sown along with the parents in a randomized block design with a plot size of 3.6 sq. meters in three replications. The experiment was laid at the commercial farm of the college of Agriculture, Rajendranagar during March — May of 1975. Data were collected from the central 15 plants of two rows in each replication and are presented on a single plant basis

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(mean of 15 plants). The estimates of combining ability and their variance were made according to the method outlined by Kempthrone (1957) for covariance of half sib and full sibs. Heterobeltiotic values (the percentage of increase over better parent) were also calculated.

TABLE I Analysis of variance for parents and hybrids in a line × tester experiment for grain yield.

Source	d. f.	Mean sum of squares
Replications	2	0.75
Treatments	48	4.79**
Females	3	3.91**
Males	8	3.04**
Hybrids	35	2.86**
Males Vs Females	1	4.12**
Parents Vs Hybrids	1	89.18**
Error	96	0.42

** Significant at 1 per cent level.

RESULTS AND DISCUSSION

The analysis of varience for yield is given in Table I. All the females males, hybrids, male versus females and parent versus hybrids have shown significant differences among themselves. The females exhibited more diversity than the males. Though the variance due to parents versus hybrids was significant it was not as high as it was recorded in the F_1 generation (Krishna Rao and Nagur, 1979) indicating a reduction in the amount of heterosis in the F_2 generation.

TABLE II Analysis of variance for combining ability and the components of genetic variation for grain yield.

Source	d. f.	Mean sum of squares
Replications	2	0.12
Hybrids	35	2.86**
Line	3	7.82**
Tester	8	1.80**
Line × Tester	24	2.60**
Error	70	0.51
σ^2 g. c. a.		0.11
σ^2 s. c. a.		0.71
σ^2 g. c. a./s. c. a.		1.00 / 6.45

** Significant at 1 per cent level.

Analysis of variance for combining ability and the components of genetic variation due to general and specific combining ability are presented in the Table II. From the Table, it is seen that the variance due to specific combining ability (σ^2 s. c. a.) was much higher than the variance due to general combining ability (σ^2 g c. a.) indicating the operation of non-additive gene action for the expression of grain yield. Krishna Rao and

Nagur (1979) have also obtained similar results in their studies with the F_1 generation.

TABLE III General combining ability effects estimated for female and male parents for grain yield.

Source	g. c. a effects
Females	
T1	0.439**
T2	—0.514**
Jawahar 45	0.676**
12—6—7	0.178
S. E. (gi) for males ±	0.140
Males	
B1	0.792**
T44	—0.252
T51	0.258
Jalagaon 781	0.562*
GG 525	0.483
Pusa Baisakhi mung	0.137
Krishna 11	—0.609*
R 288—8	0.152
PS 16	—0.801**
S. E. (gi) for males ±	0.210

** Significant at 1 per cent level

* Significant at 5 per cent level

The general combining ability effects are presented in Table III. The parent Jawahar 45 which proved to be the best combiner in the earlier studies also. Thus, it is suggested that Jawahar 45 which has consistently exhibited good general combining ability may be included in the future breeding programmes for improving the grain yield.

The specific combining ability effects in respect of the 36 combinations are presented in the Table IV. It is evident from the Table that the combination T1 × T51 has shown the highest s. c. a. effect followed by Jawahar 45 × Pusa Baisakhi mung.

Heterobeltiotic values are presented in the Table V. The combination T1 × T51 has recorded the highest heterobeltiotic value. A steep fall in the heterobeltiotic value of grain yield is observed from F_1 generation to F_2 generation, in the combination, T1 × B1; Jawahar 45 × T51, 12-6-7 × Jalagaon 781, T2 × Pusa Baisakhi mung and T1 × Krishna 11 indicating a high level of inbreeding depression in these combinations. It is interesting to note that the above combinations. It is interesting to note that the above combinations were associated with non-additive type of geneaction in F_1 studies made by Krishna Rao and Nagur, (1979).

Though non-additive gene action appeared to be in operation towards the expression of the character grain yield, specific combinations have exhibited additive type of gene action

allowing scope for undertaking progeny selection for the isolation of high yielding lines. Combinations like T1 × B1, T1 × Jalagaon 781, T_1 × GG525, T_2 × Jalagaon 781, Jawahar 45 × B1, Jawahar 45 × Jalagaon 781, Jawahar 45 × R 288 - 8 have shown additive type of gene action and it is possible to make high yielding selections in these combinations. The two combinations namely T1 × T 51 (heterobeltiotic value of 61.9 per cent) and Jawahar 45 × Pusa Baisakhi mung (28.2 per cent) were found to be associated with both additive as well as non-additive type of gene action indicating the scope for progeny selection in these combinations also.

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TABLE IV Specific combining ability effects estimated for 36 combinations in a line × tester experiment for grain yield.

LINES	TESTERS								
	B1	T44	T51	Jalagaon 781	GG 525	Pusabai-sakhi mung	Krishna 11	R 288-8	PS 16
T1	0.361	—0.842	2.810**	0.399	0.189	—1.670	—0.755	1.040*	0.419
T2	—1.735**	0.315	1.210*	—0.604	1.320	—0.158	—0.105	1.590**	—0.303
Jawahar 45	—0.229	0.186	—2.661**	—0.479	—0.707	1.937**	0.682	0.007	1.760**
12—6—7	0.753	1.930**	—1.893*	0.717	—0.408	—0.231	—0.179	—0.026	—2.042

S. E. (sig) for grain yield per plant ... 0.410

** Significant at 1 per cent level

* Significant at 5 per cent level

TABLE V Values of heterobeltiotic values for 36 combinations in a line × tester experiment for grain yield.

LINES	TESTERS								
	B1	T44	T51	Jalagaon 781	GG 525	Pusabai-sakhi mung	Krishna 11	R 288-8	PS 16
T1	35.3 (75.3)	9.2	61.9	45.2	42.3	6.4	21.8 (88.5)	5.7	15.5 (49.1)
T2	9.8	6.5	49.7	31.7	37.9 (51.5)	6.1 (95.6)	31.2	16.4	11.7 (48.6)
Jawahar 45	14.2	20.6	—4.9 (140.7)	10.7	6.1	28.2	17.3	14.2	19.3
12—6—7	23.6	19.3	0.36	22.3 (164.4)	6.6	8.5	18.5	7.10	—6.20

Note : The values in the parenthesis refers to the heterobeltiotic values of F_1 generation for the combinations exhibited non-additive type of gene action in that generation.