https://doi.org/10.29321/MAJ.10.A03003

Madras agric J. 66 (10) : 639—642, Oct., 1979.

Line x Tester Analysis of Combining Ability for Seed Yield in Greengram*

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A line x tester analysis of combining ability for seed yield in greengram (*Phaseolus aureus* Roxb.) revealed preponderance of non-additive gene action. High specific combining ability effects were observed in the combinations involving the parents 12-6-7 x Jalagaon 781 and Jawahar 45 x R. 288-8. The combinations Jawahar 45 x T. 44, Jawahar 45 x Krishna. 11, Jawahar 45 x GG. 525, 12-6-7 x R. 288-8 exhibited additive gene action. Considering the overall performance of the parents involved in the present investigation, two parents Jawahar 45 and R. 288-8 are suggested for utilisation in further programmes for enhancing the yield in greengram.

Improvement of yield in greengram has been achieved so far by adoption of pure-line selection only. Very limited hybridisation work has been done and information on the nature and extent of combining ability and gene action operating for the expression of yield is meagre. With a view to bringout such information a line x tester crossing programme was undertaken with thirteen varieties. The information will help the breeders in formulating the breeding programmes. The results of the study are presented in this paper.

MATERIAL AND METHODS

Four varieties viz., T. 1, T.2, Jawahar 45 and 12-6-7 were used as lines (females) and another nine varieties viz , B.1, T.44, T.51, Jalagaon 781, G.G. 5 '5, Pusa Baisakhi mung, Krishna. 11 and P.S. 16 were used as testers (males). Each of the four females were crossed with all the nine males and 36 cross combinations were produced. The 36 crosses and 13 parents were sown at the commercial farm during December, 1975 in a randomised replicated design. A single row of ten plants with a plot size of 2.70 sq. meters was maintained for each entry in each replication. Observations were recorded on the central six plants in each replication. The data are presented as mean of six plants i e., on single plant basis in eacn replication. In the analysis of combining ability, the method outlined by Kempthorne (1957) for covariance of half-sibs and full-sibs was used for obtaining estimates of general and specific combining ability effects and variances.

RESULTS AND DISCUSSION

The analysis of variance for yield is given in Table I.

* Part of the M.Sc. (Ag.) thesis submitted by the Senior author

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

Source	d.f	Mean sum of squares
Replications	2	0.125
Treatments	48	70.207
Females	3	12.530**
Males	8	7.674**
Hybrids	35	56.290**
Males Vs. Females	1	11.230**
Parents Vs. Hybrids	1	1291.740**
Error	96	0.528

** Significant at 1 per cent level

Significant differences were observed in respect of all the sources viz., females, males, hybrids, females *versus* males and parents *versus* hybrids. From the mean sum of squares it is evident that the females have greater genetic diversity than the male parents and the presence of highly significant variance due to parents *versus* hybrids suggested manifestation of heterosis.

Analysis of variance for combining ability and the components of genetic variation due to general and specific combining abilities are presented in Table II.

From the Table it is seen that the variance due to specific combining ability (σ^2 S.c.a.) was proportionately high when compared to the variance due to general combining ability (σ^2 G.c a) indicating the preponderance of non-allelic interaction in the expression of seed yield. The importance of non-additive component of variance over additive component for yield in greengram has also been reported by Singh and Singh (1974).

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

Source	d f.	Mean sum of squares
Replications	2	0.13
Hybrids	35	56.23**
Females	3	130.95**
Males	8	12.55**
Females x Males	24	61.45**
Error	70	0.58
σ^2 G. c. a		0.53
σ^2 S. c. a		21.34
σ^2 G. c. a/ σ^2 S. c. a		1 00/38.26

** Significant at 1 per cent level

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

Source	G. c. a effects
Females	
T. 1	—1.11**
T. 2	—2.29**
Jawahar 45	2.77**
12-6-7	0.64**
S E. (gi) for females ±	0.127
Males	
B. 1	—.85**
T. 44	0.75**
Jalagaon 781	—0.03
GG. 525	0.53**
Pusa Baisakhi mung	—0.33*
Krishna. 11	0.54**
R. 288-8	1.75**
P.S. 16	1.73**
S.E. (gi) for males ±	0.139

** Significant at 1 per cent level

* Significant at 5 per cent level

The general combining ability effects of female and male parents are presented in Table III.

From the data it becomes evident, that Jawahar 45 among females and R. 288-8 among males are the best general combiners. Hence, these parents appear to hold great promise for breeding work.

The specific combining ability effects in respect of 36 combinations are given in Table IV.

It would be seen that combination 12-6-7 x Jalagaon 781 showed the highest S.c a effect closely followed by Jawahar 45 x R. 288-8.

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

	Testers								
Lines	B. 1	T. 44	T. 51	Jalagaon 781	GG 525	Pusa Baisa-khi mung	Krishna 11	R. 288-8	P.S.16
T. 1	5.04**	—2.16**	—3.64**	—2.67**	—5.73**	—1.24**	1.95**	—4.79	1.75**
T. 2	—0.21	—2.88**	—0.89**	—1.62**	0.64**	2.80**	—0.55	—0.18	2.89**
Jawahar 45	—2.57**	0.00	7.18**	—4.45**	—4.58**	—0.59	—3.73**	8.66**	0.07
12-6-7	—2.27**	5.03**	—2.66**	8.75**	—1.82*	—0.99**	2.34**	—3.71**	-4.74**

S.E. (sij) for seed yield per plant 0.440

** Significant at 1 per cent level

* Significant at 5 per cent level

TABLE V. Values of heterobeltiotic percentages for 36 combinations in a line x tester experiment for seed yield

	Testers								
Lines	B. 1	T. 44	T. 51	Jalagaon 781	GG 525	Pusa Baisa. khi mung	Krishna 11	R. 288-8	P.S.16
T. 1	75.3	60.1	62.5	18.1	122.7	57.1	88.5	25.2	49.1
T. 2	11.0	34.6	60.5	17.1	51.5	95.6	44.4	66.8	48.6
Jawahar 45	38.0	81.7	140.7	28.7	33.2	64.8	41.9	179.6	57.4
12-6-7	19.7	[illegible]0.1	113.9	164.4	56.8	84.1	113.9	59.5	—3.8

Heterobeltiotic values (the percentage of increase over better parent) are presented in Table V.

From a persual of the Table, it is evident that combinations 12-6-7 x T.44 and Jawahar 45 x 288-8 have recorded the highest heterobeltiotic values.

From the above results, the following broad indications regarding the gene action involved for the expression of seed yield emerge.

Additive x additive gene action is observed in certain specific combinations like Jawahar 45 x R. 288-8 and 12-6-7 x T.44. The parents involved in these combinations are good general combiners. These also exhibited high S.c.a as well as high heterobeltiotic values. As suggested by Rojas and Sprague (1952) advantage can be taken to fix the high yield character in the advanced generations of these crosses.

Non-additive interaction appears to be operating in respect of the combinations 12-6-7 x Jalagaon 781 and Jawahar 45 x T.51. These exhibited high heterobeltiotic values. It is further observed in both the crossess, one of the parents was a good combiner, while the other one was a poor combiner and yet high S.c.a was exhibited in combination. These combinations hold promise for production of hybrid seed.

The expression of heterobeltiosis exclusively for the operation of additive gene action was observed in the combination Jawahar 45 x T.44. Both the parents, though were having high G.c.a effects did not show any S.c.a at all. It is possible to exploit this combination for isolation of high yielding segregants. Similar additive gene action was exhibited by four other combinations, viz., Jawahar 45 x Krishna. 11, Jawahar 45 x GC. 525, 12-6-7 x GG. 525 and 12-6 7 x R 288-8. In these combinations also the parents were associated with high or medium G c.a but in combination exhibited poor S.c.a. Thus, these combinations be used for getting high yielding progenies by proper breeding programme.

The authors are greatful to Sri P. Apparao, Senior Scientist (Cotton) & Head Agricultural Research Station, Lam, Guntur for his suggestions in the preparation of the manuscript.

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