GAU Res. J. 1994. 19 (2) : 78-81

Combining Ability Analysis for Polygenic Traits in Greengram

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ABSTRACT

In a 6 x 6 diallel cross of greengram, general and specific combining ability variences were found significant for all the characters except GCA for plant height and SCA for number of grains per pod. The GCA : SCA variences ratio signified the predominant role of additive verience for days to 50 per cent flowering, days to maturity, pod length, number of grains per pod amd test weight. The parent ML-69 and hybrid ML-69 x Gujarat-1 were found to be promising for further exploitation.

(Received on 9th Febru., 1993)

INTRODUCTION

Greengram is an important food grain legume in India, however, very little work has been done to understand the nature of gene action of yield and its components. Consequently, the progress in the development of new high yielding varieties has been quite slow as compared to other crops. The present study was, therefore, undertaken to study the gene action involved in the inheritance of yield and its components.

MATERIALS AND METHODS

Experimental material for the present study consisted of six varieties viz., ML-69, MJC 72, MJC 35, Gujarat 1, Gujarat 2 and Culture 1 and their all possible 15 F_1S (excluding reciprocals). The experimental was evaluated of Pulse Research Station, Junagadh in randomized block design with three replications in 4 m long single row plot spaced 45 cm between rows and 10 cm within a row. Ten plants excluding border ones were randomly selected in each entry in each replication for plant height, days to 50 per cent flowering, number of effective branches per plant, number of cluster per plant, number of pods per plant, days to maturity, pod length, number of grains per pod, 100 seed weight and yield per plant. Data were analysed according to the procedure described by Griffing (1956) using model-1 and method-2.

RESULTS AND DISCUSSION

Combining ability analysis furnishes information about fixable and nonfixable genetic variences. In the present study, general and specific combining ability varience were found to be significant for all the traits except GCA for plant height and SCA for number of grains per

TABLE 1

Analysis of variance for various quantitative trials in diallel analysis in greengram.

Source	df	Plant height (cm)	Days to 50% flowering	No. of effective branches/ plant	No. of clusters/ plant	No. of pods/ plant	Days to maturity	Pod length (cm)	No. of grains/ pod	Test weight (g)	Grain yield/ plant (g)
GCA	5	0.409	0.912**	0.151*	2.208*	35.834**	2.395**	0.899**	1.167**	0.418**	1.391**
SCA	15	9.643**	0.873**	0.277**	2.674**	35.899**	1.610**	0.326**	0.335	0.153**	3.932**
ERROR	40	0.784	0.221	0.053	0.424	0.063	0.183	0.059	0.234	0.020	0.269
GCA / SCA		0.042	1.046	0.545	0.863	0.998	1.487	2.759	3.487	2.728	0.354

* Significant at 5% level of probability.

** Significant at 1% level of probability.

TABLE 2

General combining ability effects for various quantitative traits.

Parents	Plant height (cm)	Days to 50% flowering	No. of effective branches/ plant	No. of clusters/ plant	No. of pods/ plant	Days to maturity	Pod length (cm)	No. of grains/ pod	Test weight (g)	Grain yield/ plant (g)
ML-69	0.300	0.311**	0.078	0.855**	3.969**	0.306**	-0.399**	-0.294	-0.351**	0.507*
MJC-72	0.461	-0.566**	-0.272**	-0.663**	-1.460**	-0.819**	-0.119	-0.503**	0.367**	-0.295
MJC-35	-0.083	0.381*	0.053	0.296	2.234	-0.361**	0.371**	0.478**	0.046	-0.453**
Gujarat-1	0.385	-0.025	0.036	-0.292	0.515	0.721	-0.249**	-0.138	-0.028	0.148
Gujarat-2	0.229	-0.023	0.099	-0.292	-0.230**	-0.111*	0.434**	0.369*	0.154**	-0.325
Culture-1	-0.682*	-0.079	0.007	0.099	0.270	0.264**	0.039	0.088	-0.129**	0.438*
S.E. ± (g_i)	0.286	0.152	0.064	0.210	0.651	0.019	0.078	0.167	0.046	0.168
S.E. ± (g_i-g_j)	0.043	0.235	0.100	0.230	1.008	0.046	0.121	0.242	0.071	0.259

* Significant at 5% level of probability.

** Significant at 1% level of probability.

TABLE 3

Specific combining ability effects for ten quantitative traits.

Crosses	*Plant hight (cm)*	*Days to 50% flower-ing*	*No. of effective branches/ plant*	*No. of cluster/ plant*	*No. of pods/ plant*	*Days to maturity*	*Pod length (cm)*	*Grain/ pod*	*Test weight (g)*	*Grain yield plant (g)*	
ML-69 x MJC-72	0.736	0.008	1.159**	4.130**	12.873**	1.200**	1.130	0.555	-0.182	2.311**	(12.29)
ML-69 x MJC-35	-0.780	0.140	0.134	0.728	6.206**	0.402**	-0.200	0.045	-0.081	2.528**	(12.35)
ML-69 x Gujarat-1	-0.948	-0.123**	0.485**	0.715	4.628**	-0.010	0.020	-0.410	0.043	2.267**	(12.69)
ML-69 x Gujarat-2	-0.728	0.874*	-0.278	1.425	4.903*	0.492**	-0.502	-0.716	0.002	-0.289	(9.66)
ML-69 x Culture-1	-0.051	-0.399	0.447	-1.206*	4.096	0.447**	0.105	0.435	0.004	0.927	(11.64)
MJC-72 x MJC-35	1.619*	-0.322	-0.082	-0.551	0.775	-1.867*	-0.950**	0.054	-0.759**	-0.709	(8.31)
MJC-72 x Gujarat-1	0.221	-0.246	0.032	0.276	0.484	-1.555**	-0.230	0.329	-0.305*	-0.141	(9.48)
MJC-72 x Gujarat-2	0.316	-1.248	0.038	-0.864	-0.709	-1.723	-0.542	0.238	-0.647	-0.117	(9.03)
MJC-72 x Culture-1	-1.643*	0.478	0.030	1.655**	-2.029	0.902*	0.370	-0.226	0.096	1.870**	(11.78)
MJC-35 x Gujarat-1	1.665*	0.477	0.376*	0.947	1.830	0.987**	0.820**	0.989**	10.186	1.967**	(11.43)
MJC-35 x Gujarat-2	-0.700	0.474	0.047	0.044	-0.315	-1.180	0.008	0.082	0.004	-0.459	(8.53)
MJC-35 x Culture-1	-1.669*	1.090**	0.739	0.653	1.615	-1.215**	0.720**	0.824	0.387**	0.343	(9.41)
Gujarat-1 x Gujarat-2	1.293	1.210**	-0.003	0.361	3.026	1.467*	0.552*	-0.373	0.128	0.340	(9.93)
Gujarat-1 x Culture-1	0.434	0.597	-0.144	0.670	2.056	1.362**	0.020	-0.061	0.089	0.104	(10.25)
Gujarat-2 x Culture-1	0.029	0.934*	0.193	-0.040	0.341	0.865**	0.418	-0.198	-0.040	1.859**	(11.74)
S. E.± (S_{ij})	0.785	0.417	0.176	0.577	1.676	0.145	0.215	0.429	0.125	0.460	
S. E. ± (S_{ij}-Sik)	1.171	0.622	0.263	0.861	2.667	0.323	0.321	0.640	0.187	0.417	
S. E. ± (S_{ij}-Sik)	1.084	0.576	0.244	0.797	2.469	0.277	0.297	0.593	0.173	0.636	

* Significant at 5% level of probability

** Significant at 1% level of probability

Mean grain yield data are given in the perantheses.

pod (Table 1) this suggested the importance of both additive and nonadditive genetic. components. However, higher relative magnitude of GCA varience over SCA varience for days to flowering, days to maturity, pod length, grain per pod and test weight (Table-1) indicated that additive type of gene action was primarily involved in the expression of these characters. Reddy and Shreekumar (1982) had shown the predominance of additive gene action in the expression of most of the traits.

General combining ability effects of the parent (Table 2) revealed that considering all the characters, parent ML 69 appeared to be good general combiner contributed maximum favourable genes for grain yield, pods per palnt and clusters per plant. Parent MJC-72 was found to be good general combiner for days to 50 per cent flowering and test weight. Thimmappa *et al.* (1989), and Saxena and Sharma (1989) also reported the similar results. Parent MJC 35 and Gujarat 2 were good general combiner for days to maturity, pod length and grains per pod. Culture 1 was good combiner for grain yield. Bold seeded varieties MJC 72 and Gujarat 2 exhibited good general combining ability for test weight. Jatasra (1980) had reported in cowpea that bold seeded varieties were good combiners for higher grain weight. It would not be out place to mention here that the commercial variety may not always turn out to be best combiner. In this investigation too. Gujarat 2 a commercial cultivar did not perform well.

The estimation of specific combining ability effects (Table 3) indicated that the top yielding hybrid ML-79 x Gujarat 1 was a good specific combination for grain yield per plant, number of pods per plant, number of effective branches per plant and days to 50 per. cent flowering. These results were as that of Natarajan *et al.* (1989). Thus there is every likelihood of improvement, both by selection and hybridization, for most of the characters.

All the hybrids gave high grain yield their best parent. Significant SCA effect for grain yield per plant was found for hybrid ML 69 x Gujarat 1 which gave highest grain yield (Table-3). The parents involved in this cross were good x average combiner for grain yield and number of pods per plant, average x average for number of effective branches per plant and poor x average combiner for number of days to 50 per cent flowering.

The genetic information obtained from the present study revealed that Parent ML 69 and Hybrid ML 69 x Gujarat 1 were found to be promising for further exploitation.

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