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LINE X TESTER ANALYSIS OF COMBINING ABILITY IN GROUNDNUT

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ABSTRACT

A line x tester analysis was carried out involving eleven lines and two testers in groundnut for assessing the combining ability in respect of number of pods, pod yield, harvest index, shelling outturn and sound mature kernels. The estimate of GCA/SCA variance showed the predominance of non-additive gene action for number of pods and pod yield. The role of both additive and non-additive gene action was found important for harvest index, shelling outturn and sound mature kernels. VG 78 was a good general combiner for all the characters. The combination ALR 1 x CG 2187 was specific combiner for pod yield.

Identification of high combining lines and knowledge on the nature of gene action are the important prerequisites for any successful breeding programme. Line x tester analysis is a useful and easy procedure for identification of potential parents for hybridisation. At ARS, Aliyarnagar, an investigation was taken up in groundnut (*Arachis hypogaea* L.) involving a set of line x tester crosses, to study the general and specific combining ability and the gene action determining five important quantitative characters in this crop.

MATERIALS AND METHODS

The materials consisted of two ovule parents *viz*., ALR 1 (semi spreading) and ALG 33 (bunch) as testers and eleven pollen parents *viz*., NcAc 17135, VG 80, ICGS 1, NRGS(E) 1, TVG 4 (bunch) NcAc 2230, NcAc 2240, VG 78, GB (FDRS) 206, CG 2187 and CG 2145 (semi spreading) as lines. The crosses were effected during *kharif* 1990 season. These twenty two hybrid combinations along with their parents were sown in a randomised block design replicated thrice during kharif, 1991 season adopting a spacing a 30 x 15 cm. Data were recorded in twenty plants chosen at random per replication. Five characters *viz*., number of pods per plant, pod yield, harvest index, shelling outturn and proportion of sound mature kernels were recorded as per standard procedures. The data were subjected to line x tester analysis (Kempthorne, 1957).

RESULTS AND DISCUSSION

Mean expression and heterosis

The results indicated significant differences among the parents for all the characters (Table 1). Similarly the hybrids also varied considerably between themselves as seen from the significant variance for Line x Tester component.

The mean performance and heterobeltiosis for different characters are presented in Table 3. The

Table 1. Analysis of variance for combining ability for different characters in groundnut.

Sources of variance	No. of pods/plant	Pod yield g/plant	Harvest index	Shelling	S.M.K
Replication	0.784	1.056	0.003	14.316	9.628
Genotypes	41.138**	32.029**	0.017**	105.003**	335.882**
Parent	45.604**	21.053**	0.013**	44.159**	352.271**
Parent x Crosses	68.697**	281.988**	0.005	125.08**	50.941
Crosses	37.273**	26.396**	0.020**	138.814**	339.341**
Lines	26.091**	33.832	0.020	117.178*	459.172*
Testers	19.528*	28.538	0.133**	1060.008*	645.158
Lines x Testers	50.229**	18.751**	0.009**	68.23**	188.929**
Error	3.789	3.533	0.001	9.859	15.177
GCA	2.475	3.743	0.004	23.263	54.279
SCA	15.58	5.073	0.003	19.490	57.917
GCA/SCA	0.160	0.738	1.333	1.194	0.937

*, ** Significant at 1% and 5% respectively.

Table 2. Estimation of gca effects with mean performance of different traits in parents

Parents	No. of pods per plant		Pod yield		Harvest index		Shelling outturn		S.M.K.	
	gca effect	Mean	gca effect	Mean	gca effect	Mean	gca effect	Mean	gca effect	Mean
Lines :										
NcAc 17135	-0.92	6.2	-0.61	6.2	0.10*	0.34	-2.80*	65.1	-1.30	98.0
NcAc 2230	-1.01	7.7	-1.21	6.0	-0.09*	0.36	-3.24*	64.5	-7.82*	73.2
Nc Ac 2240	-1.57	10.4	-2.26*	6.3	-0.05*	0.26	6.12*	64.6	6.20*	73.0
VG 78	3.36*	11.9	2.10*	9.6	-0.05*	0.24	-7.73*	65.7	-6.85*	71.4
VG 80	-0.32	15.1	-1.53	7.8	-0.03*	0.29	1.02	73.4	-4.52*	95.2
ICGS 1	-1.84*	16.7	-2.29*	12.2	-0.02	0.41	4.72*	74.0	8.03*	93.0
NRGS(E) 1	0.39	19.4	1.06	11.2	0.00	0.46	1.26	71.6	7.66*	89.8
TVG 4	2.03*	9.9	2.68*	9.7	0.06*	0.36	-1.06	73.0	11.43*	90.0
GB (FDRS) 206	3.04*	8.1	4.44*	6.5	0.07*	0.31	5.59*	65.4	2.55	71.3
CG 2187	0.13	9.2	0.63	6.4	0.04*	0.34	4.68*	65.9	2.91	75.5
CG 2145	-3.29*	9.0	-2.99*	5.0	-0.02	0.36	0.77	67.1	-8.29*	66.2
Testers :										
AIG 33	-0.54	13.5	-0.65	10.5	0.05*	0.40	4.01*	73.5	3.09*	78.2
ALR 1	0.54	14.5	0.65	11.7	-0.05*	0.27	-4.01*	68.8	-3.09*	73.8
S.E. (gca lines)	0.80	-	0.77	-	0.02	-	1.28	-	1.59	-
S.E. (gca testers)	0.34	-	1.09	-	0.01	-	0.55	-	0.68	-

hybrids ALR1 x CG 2187, ALR 1 x TVG 4, ALR 1 x VG 78 and ALG 33 x GB (FDRS) 206 expressed high heterobeltiosis for both pod number and pod yield. Similarly the cross ALG 33 x TVG 4 was heterotic for harvest index. For sound mature kernels the pollinators GB (FDRS) 206 and CG 2187 in combination with ALG 33 and NcAc 2240 with ALR 1 recorded heterobeltiosis.

General combining ability effects

VG 78 was a good general combiner for pod number and pod yield. Similarly GB (FDRS) 206 and TVG 4 are also good general combiners for four out of five traits studied. Mani and Rao (1977) suggested that more emphasis should be given to *gca* effects than *sca* in self pollinated crops.

Specific combining ability

A perusal of *sca* effects presented in table 3 revealed that CG 2187 was a specific combiner with ALR 1 for pod yield. Similarly for number of pods, the combinations involving the lines CG 2187 with ALR 1 and NcAc 2230 with ALG 33 had high *sca* effects. The other high combining crosses are ALR 1 x NcAc 2230, ALG 33 x NcAc 2230, ALG 33 x NRGS (E)1 and ALG 33 x TVG 4 (harvest index), ALR 1 x GB (FDRS) 206, ALG 33 x NcAc 2230 and ALG 33 x VG 78 (shelling out turn), ALG 33 x CG 2187, ALR 1 x NcAc 2230, ALR 1 x NcAc 2240 and ALR 1 x VG 78 (SMK). These crosses involve either high x low or low x high combining lines. Hence, heterosis observed in these crosses may be due to non-additive interaction and might tend to be unfixable (Chhotey Lal and Singh, 1974). Hence, it would be possible to recover desirable recombinants only in late filial generations.

In general, the variance due to *SCA* is greater than *GCA* for the characters, number of pods and pod yield indicating the non-additive gene action for these characters. This could also be confirmed by realisation of heterotic crosses from combi nation of parents which have little or poor combi ning ability. Improvement in these characters could be accomplished by selection of heterotic crosses and advancing progenies to later filial generations like F5 or F6. The role of non-additive gene action for these characters were also reported by Sandhu and Khehra (1976) in groundnut. The role of both additive and non-additive gene action may be important for the characters harvest index, shelling outturn and sound mature kernels as could be seen from GCA/SCA ratio. Fixing up these characters in early generations is relatively easier than number of pods and pod yield.

Table 3. Mean, Heterobeltiosis and specific combining ability effects of different crosses in groundnut.

Lines		Testers									
		ALG 33					ALR 1				
		No. of pods / plant	Pod yield	Harvest index	Shelling out turn	SMK	No. of pods / plant	Pod yield	Harvest index	Shelling out turn	SMK
NcAc 17135	M	12.9	9.1	0.46	69.8	85.6	12.1	13.5	0.39	57.4	76.4
	H	-4.4	-13.3	0.2	-0.6	-12.7	-16.6	15.4	14.7	-16.6	-22.0
	SCA	0.94	-1.54	-0.01	2.16	1.53	-0.94	1.54	0.01	-2.16	-1.53
NcAc 2230	M	14.4	11.5	0.23	71.2	59.1	10.4	9.8	0.23	55.1	69.9
	H	6.3	9.5	-42.5	-5.0	-24.4	-28.3	-16.2	-36.1	-19.9	5.3
	SCA	2.56*	1.53	-0.05*	4.05*	-8.45*	-2.56*	1.53	0.05*	-4.04*	8.45*
NcAc 2240	M	10.9	10.3	0.29	74.1	85.8	12.8	9.0	0.26	70.9	91.2
	H	-0.2	-1.9	-27.5	0.8	9.7	-11.7	-23.1	-3.7	3.1	23.6
	SCA	-0.41	1.31	-0.03	-2.39	-5.80*	0.41	-1.31	0.03	2.39	5.80*
VG 78	M	15.5	12.3	0.30	67.2	70.1	18.0	15.7	0.25	50.1	80.9
	H	0.2	11.2	-25.0	-8.6	-10.4	24.1*	34.2	-7.4	27.2	9.6
	SCA	-0.67	-2.03	-0.02	4.53*	-8.49*	0.67	1.02	0.02	-4.53*	8.49*
VG 80	M	14.2	11.3	0.32	74.1	83.0	11.9	9.4	0.28	60.7	72.9
	H	-5.9	7.6	-22.5	0.8	-12.8	-21.2	-19.7	-3.4	-17.3	23.7
	SCA	1.67	1.61	-0.03	2.71	2.08	-1.68	-1.61	0.03	-2.71	2.08
ICGS 1	M	9.2	7.4	0.36	74.3	97.2	13.9	11.7	0.24	67.9	83.5
	H	-44.9	-39.3	-12.2	1.1	4.5	-16.8	-4.1	-41.5	-8.2	10.2
	SCA	-1.77	-1.49	0.01	-0.79	3.76	1.77	1.49	-0.01	0.79	-3.76
NRGS (E) 1	M	15.5	13.7	0.44	68.5	92.3	12.3	12.1	0.21	66.5	87.6
	H	-20.1	22.3	-4.3	-6.4	2.70	-36.3	3.4	-54.3	-7.1	2.4
	SCA	-2.26*	2.46	0.07*	-2.89	-0.74	-2.26*	-1.46	-0.07*	2.89	0.74
TVG 4	M	12.6	11.8	0.50	65.2	96.8	18.2	17.4	0.26	65.5	90.7
	H	-6.7	12.4	25.00*	-11.3	7.6	25.5*	48.7*	-27.8	10.3	0.8
	SCA	-2.24	-2.14	0.08*	-4.17*	0.00	2.24	2.14	-0.08*	4.17*	0.00
GB(FDRS) 206	M	19.3	17.6	0.41	71.5	91.6	13.6	15.0	0.36	72.5	78.1
	H	42.9*	67.6*	2.50	-2.7	17.1*	-6.2	28.2*	16.1	5.4	5.8
	SCA	3.41*	1.94	-0.02	-4.49*	3.68	-3.41*	-1.94	0.02	4.49*	-3.68
CG 2187	M	6.1	9.1	0.39	63.9	98.5	20.9	15.9	0.33	59.5	72.0
	H	-54.8	-13.3	-2.50	-13.1	25.9*	44.1*	35.9*	-2.9	-13.5	-4.6
	SCA	-6.84*	-2.70	-0.01	-1.79	10.15*	6.84*	2.71*	0.02	1.79	-10.15*
CG 2145	M	10.6	9.3	0.35	74.3	79.4	9.6	8.5	0.25	60.1	68.7
	H	-21.5	-11.4	-12.50	1.1	1.5	-33.8	-27.4	-30.6	-12.6	-6.9
	SCA	1.08	1.07	0.01	3.07	2.28	-1.08	-1.08	-0.01	-3.09	-2.28
SE (m)		1.2	1.1	0.02	1.81	2.8	M - Mean				
CD 5%		3.1	3.0	0.06	5.0	7.6	H - Heterobeltiosis %				
SE (SCA)		1.12	1.09	0.02	1.81	2.25	SCA - Specific combining ability				

The high combining parents identified in this study are also donars for pests and diseases - ALR 1, ALG 33 and VG 78 for foliar diseases, GB (FDRS) 206 for tolerance to thrips, CG 2187 for leaf miner and NcAc 2240 for jassids. TVG 4 and ICGS 1 are potential yielders with desirable quality traits. Hence it would be possible to recombine the yield, quality and pest and disease tolerance at least to a limited extent by careful selection and planned progeny advance. The varying levels of nicking ability in these parents may also be profitably utilised in groundnut improvement programme.

REFERENCES

CHHOTEY LAL and SINGH,A.B. 1974. Line x tester analysis in Indian mustard. Indian J. Agric.Sci.44: 508-602.

KEMPTHRONE,O. 1957. An Introduction to Genetic Statistics, John Wiley and Sons, New York, pp 468-471.

MANI,S.C. and RAO, M.V. 1977. Combining ability in Wheat (*Triticum aestivum* L.) Proc. of the first National Seminar on Genetics Wheat Improvement, Ludhiana: 23-30.

SANDHU,B.S. and KHEHRA,A.S. 1976. The role of epistatis in the inheritance of yield and its components in groundnut. Crop Improvement 3:9-17

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ASSOCIATION ANALYSIS IN GRAIN SORGHUM (*Sorghum bicolor* (L.) MOENCH)

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ABSTRACT

The correlation coefficients at genotypic level between eight quantitative characters and path coefficients were estimated in eightyone hybrids and eighteen parents of sorghum. Genotypic correlations clearly established the positive and significant relationship between panicle weight and yield, number of grains per panicle and yield, number of leaves and yield, days to bloom and yield. The intercorrelation among the yield components were also estimated. Partitioning of the correlation coefficient through path analysis indicated that the direct effect of number of grains per panicle was maximum and positive upon yield and this was followed by 1000 grain weight and days to 50 per cent bloom.

The component characters of yield are not independent in their action but are interlinked. In this interlinked compex genetic system, selection practised for an individual character might subsequently bring about simultaneous change in others. Therefore, an understanding of the association between the component and their relative contribution to yield is essential to bring out a rational improvement in the desirable traits as they might be differently correlated. To understand the association between characters, the present study was carried out.

MATERIALS AND METHODS

Eighty one hybrid combinations along with their eighteen parents (9 lines + 9 testers) were evaluated adopting a randomised block design with two replications. The row to row and plant to plant distances were 45 cm and 15 cm respectively. The biometrical observations on grain yield and yield components were recorded on five randomly selected plants per replication. The replicationwise mean values of the genotypes were subjected to statistical analysis. Based on the data collected, the genotypic correlation coefficients were estimated following standard procedures. Path coefficient analysis as applied by Dewey and Lu (1959) was utilised to partition the genotypic correlation coefficients into measures of direct and indirect effects.

RESULTS AND DISCUSSION

The genotypic correlation coefficients were estimated based on the genotypic variances and covariances. The correlation coefficients between yield and yield components and the

Table 1. Genotypic, correlation coefficients among yield characters

Characters	Plant height	Panicle length	Number of leaves per plant	Panicle weight	Number of grains per panicle	1000 grain weight	Grain yield / plant
Days to 50% bloom	0.21*	-0.01	0.80**	0.57**	0.38**	0.27**	0.49**
Plant height		0.09	0.38**	0.41**	0.16	0.58**	0.41**
Panicle length			0.10	0.15	0.21**	-0.19	0.14
Number of leaves per plant				0.62**	0.46**	0.37**	0.56**
Panicle weight					0.75**	0.49**	0.88**
Number of grains per panicle						0.05	0.87**
1000 grain weight							0.49**

** Significant at one per cent level. * Significant at five per cent level.