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LINE x TESTER ANALYSIS OF POD YIELD AND OTHER CHARACTERS IN GROUNDNUT (*Arachis hypogaea* L.)

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A line x tester analysis involving five females and seven males along with their 35 FI crosses was studied in groundnut (*A hypogaea* L.) for combining ability. Among females AK 12-24 was observed to be the best general combiner for days to first flowering, M 145 for shelling per cent and M 13 for pod yield, kernel weight, pod length and pod width Among males U4-4-32 was the best general combiner for pod yield, kernel weight and the days to first flowering Fifteen crosses exhibited high positive sca effects for pod yield of which M 13 x Godjah 61, M 13 x U4-4-32, M 13 x Florida Runner and AK12-24 x Florida Runner involved good x good general combining parents. Both additive and non-additive genetic effects control the inheritance of almost all the characters, the latter type being more important for pod yield, kernel weight and shelling per cent.

The line x tester analysis is a widely accepted and followed statistical procedure for combining ability. The analysis has a practical value in plant breeding as it helps in the selection of suitable parental lines to be used in hybridization programmes. The present investigation aims at evaluating the combining ability of twelve parental lines in groundnut by using line x tester analysis.

MATERIAL AND METHODS

The material for the study comprised five female parents, viz., M 13, M 145, M 37, C 501 (all from Punjab) and AK 12-24 (MS) and seven tester parents, viz. C 139 (Pb), Godjah 61 (USA), Ah 7224 (Nigeria), Ah 7341 (China), Ah 7187 (Australia), U4-4-32 (Sudan) and Florida Runner (USA), selected on the basis of their phenotypic and geographic diversity. The 12 parental lines and their 35 FI's were grown in a randomised complete block design with three replications at Oilseeds Experimental area, PAU, Ludhiana during *Kharif* 1981. In each replication, each genotype was allotted a single row of 4.5 M length spaced 30 cm apart with a plant to plant distance of 30cm. Five plants in each of the parents and F_1 were taken at random from each replication for recording observations on days to first flowering (FF), shelling per cent (SP), pod length (PL), pod width (PW), 100-kernel weight (KW) and pod yield/plant (PV). The observations were then averaged for statistical analysis, The method suggested by Kempthorne (1957) was followed for estimating general and specific combining ability.

RESULTS AND DISCUSSION

The analysis of variance for the design of experiment (Table 1) shows that there were significant differences among the genotypes for all the characters studied which allowed us to

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proceed further. The analysis of variance for combining ability (Table 2) revealed that the mean squares due to males and females were significant for all the characters Significant mean squares due to sca were also observed for all the characters except pod length.

These results indicated that both additive and non-additive genetic effects were involved in the inheritance of all the characters except pod length where additive effects alone were involved. Similar results for pod yield and some other fruit characters were also reported by Wynne *et. al.* (1970); Wynne *et. al.* (1975), Garet (1976) Singh and Labana (1980) and Sangha (1981). However, the estimated variances due to general combining ability and specific combining ability revealed that the adoitive genetic effects predominated for days to first flowering and pod width. The non-additive genetic effects were mainly involved in the inheritance of pod yield, kernel weight and shelling per cent. These results are in agreement with those of Singh and Labana (1980) for pod yield and Kernel weight wheras Sangha (1981) reported additive effects to be more important for kernel weight and Garat (1976) found predominance of non-additive genetic effects with dominance and epistasis for shelling per cent. Gobri *et al*; (1978) reported that only additive (D) component of genetic variance was significant for pod yield/ plant and the number of days to first flowering.

The estimates of general combining ability effects (Table 3) indicated that among the femele parents, M_1, was the best general combiner for pod yield, kernel weight, pod length and pod width; M 145 was the best general combiner for shelling per cent which was followed by M3/ but both these parents were poorest combiners for pod yield. AK 12-24, a spanish bunch strain was the best general combiner for days to first flowering while rest of the parents were poor to average in this respect, M13 being the poorest one Among the male parents, U4-4-32 was the best general combiner for pod yield, kernel weight and days to first flowering Godjah 61 and Ah 7187 were also good general combiners for pod yield and kernel weight respectively. C 139 was the best general combiner for shelling per cent but it was among the poorest for rest of the characters. Florida Runner was second in the general combining ability for shelling per cent and pod yield.

The estimates of specific combining ability effects are prasented in Table 4. No cross combination was observed to be significant for all characters together. Out of 35 crosses, nine gave significant sca effects for days to first flowering, of which only three were in the desired direction. The best cross combination for this character was M 37 X Florida Runner involving poor X average parents. For shelling per cent only four crosses showed sca effects in the positive direction, the best being AK 12–24 X Ah 7341, an average X average combination. Only six out of 35 crosses

showed significant sca effects for pod width in the positive direction, the best being M37 X C_{139} involving average X poor combiners. The high sca effects shown by different crosses for days to first flowering, shelling per cent and pod widthmight be attributed to gene dispersion and genic interactions between favourable alleles contributed by both parents. The chances of getting any desirable segregants for above said characters from these crosses is indeed remote and thus need no furtherattention.

For pod yield and kernel weight as many as 28 and 19 crosses respectively showed sca effects which were significantly different from zero. However, only 15 and 11 cross combinations were in the desired direction. The best cross combination in respect of kernel weight was AK 12-24 X C 139 involving both poor x poor parents. The most promising crosses involving good X good parents, were M13 X Godjah 61, M 13 X Ah 7187 and M 13X U 4-4-32 Combining ability is inherited character and segregants with a relatively high frequency of favourable genes would occur more often in the progenies of crosses of high combining parents than in progenies of crosses were one or both parents are lower in combing ability (Green, 1948). Consequently transgressive segregants from those crosses are expected in the advanced generations. The cross N 13 x Florida Runner also exhibited high specific effects for this character.

Four cross combinations showing high positive sca effects for pod yield are Ak 12-24 X Florida Runner, M 13 X Florida Runner, M 13 X U 4-4-32 and M 13 X Godjah 61, which involved good X good general combining parents. Therefore, these cross combinations involving genetically diverse parents are expected to yield desirable segregants in the subsequent generations. Six crosses were having good poor combiner parents and the rest poor X poor or average X poor combinations. This apparently suggested the role of non-additive genetic effects in these crosses.

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REFERENCES

GARET, B. 1976 Heterosis and combining ability in groundnut (*Arachis hypogaea* L.) Oleagineux, 31 : 435-42.

GIBORI, A.; J. HILLEL; A. CAHANER and A ASHRI 1978. A9 X 9 diallel analysis in peanuts (*Archis hypogaea* L.) Flowering time tops weight, pod yield per plant and pod weight; TAG, 53 : 169-79.

GREEN, J. M. 1948. Inheritance of coimbining ability in maize hybrids. J, Amr. Soc. Agron. 40 : 58-6.

KEMPTHORNE, O. 1957. "An Introduction to Genetical Statistics", John Wiley & Sons Inc. New York.

SANGHA, A. S 1981. Diallel analysis in groundnut (*Arachis hypogaea* L.) Unpublished Ph. D. Thesis. Punjab Agricultural University Ludhiana.

SINGH, M and K. S. LANDANA 1980. Combining ability in groundnut Crop. Improv. 7: 113-28.

WYNNE, J. C D. A. EMERY and P. W. RICE, 1970 Combining ability estimstes in *A. hypogaea* L. II Field performance of F_1 hybrids; Crop Sci. 10 : 713-15.

WYNNE, J. C. J. O. RAWLINGS and D. A EMERY 1975. Combining ability in *Arachis hypogaea* L. III. F_3 generation of inter-inter sub-specific crosses; Peanut Sci. 2 : 50-54.

Table 1 : Analysis of variance for the design of experiment

Source of variation	df	MEAN SQUARES					
		FF	S²	PL	PW	KW	PY
Genotypes	46	9.82**	42.98**	0.20**	0.02**	10.06**	89.57*
Error	92	1.44	10.59	0.07	0.005	4.98	1 81

Table 2 : Analysis of variance fo. combining ability.

Source of variation	d f	MEAN SQUARES					
		FF	S²	PL	PW	KW	PY
GCA i) Males	6	11.91**	11.17**	0.14**	0 01**	39.28**	52.03**
ii) Females	4	2.16**	38.02**	0.16**	0.03**	120.23**	108.21**
SCA	24	1.44**	8.97**	0.03**	0.04**	47.87**	52 23**
Error	92	0.48	3.53	0.02	0.002	1.66	0.60
$\frac{1}{10}\left(\Sigma gi^2 + \Sigma gj^2\right)$		1.15	3.41	0.02	0 003	12 71	13.02
$\frac{1}{24}\left(\Sigma sij^2\right)$		0.96	5 44	—	0.001	46.21	51.63

* $P \leq 0.05$, ** $P \leq 0.01$

Table 3 Estimates of general combining ability effects and mean values for different characters

Parent	FF	SP	PL	PW	KW	PY
Female parents						
M 13	1.20**	-3.55**	0.17**	0.11**	6.51**	5.64**
	(25.05)	(62.7)	(2 86)	(1.21)	(55 2)	(15 5)
M 145	0.70**	2.25**	-0.06	-0.05**	-2.64**	-3.40**
	(24.7)	(68.7)	(2.25)	(1.05)	(37.3)	(10.4)
M 37	0.60**	1.85**	-0.06	0.01	1.27**	-3.07**
	(24.3)	(67.0)	(2.41)	(1.08)	(37.3)	(14.5)
C 501	0.41	0.25	0 15**	-0.03**	-1.04*	-1.66**
	(24.3)	(66.7)	(2.43)	(1.01)	(33.3)	(11.0)
AK 12-24	-2.89**	-0 85	-0.15**	-0.05**	-4.07**	2.50**
	(23.7)	(72.0)	(2.05)	(0.96)	(31.5)	(16.9)
SE ±	0.23	0.64	0.05	0 01	0.44	0.26
Male parent						
C 139	0.72*	2.15**	-0 20**	-0 08*	-3.11**	-5.52**
	(24 7)	(67.7)	(2.30)	(1.13)	(43.0)	(16 1)
Godjah 61	0.00	1.55*	0.23**	0.04*	-0 13	0 26
	(24.3)	(59.5)	(2 52)	(1.20)	(40.8)	(12.4)
Ah 7224	-0.50	0.55	-0 03	-0.01	2 37**	0.70
	(27.7)	(64.8)	(2.33)	(1.12)	(35.3)	(19 5)
Ah 7347	0.20	-1.15	-0.20**	-0.04*	-4.27**	-1.78**
	(21 3)	(70.2)	(1.94)	(0.98)	(29.4)	(18.1)
Ah 7157	0.10	-1.45	-0 01	0.01	1.51**	-0.70*
	(23.7)	(65.2)	(2.71)	(1.15)	(41.8)	(16 2)
U 4-4-32	-0.92**	-0.15	0.06	0.02	3.35**	4.72**
	(21.0)	(70.8)	(1.94)	(1.02)	(37.0)	(15.1)
Florida	0.40	1.55*	0.18**	0 03	0.31	2 34**
Runner	(23.3)	(69.0)	(2 24)	(1.11)	(45 0)	(18.7)
SE ±	0 29	0.78	0.06	0 02	0.53	0.32

* $P \leq 0.05$, ** $P \leq 0.01$; Mean values are given in brackets

Table 4 : Estimates of specific combining ability for different characters.

Cross			FF	SP	PW	KW	PY
M 13	X	C 139	1.11	1.15	-0.12**	-7 93**	-10 22**
,,	X	Ah 7224	-0.70	1.55	0.01	-7 21**	-3.60**
,,	X	Godjah 61	-0 90	-0 55	-0.22	2.29	2.26**
,,	X	Ah 7341	-0.39	-3.25**	0 08	-0.77	4 64**
,,	X	Ah 7187	0.71	-1.45	0.03	4.45**	3.56**
,,	X	U 4-432	0 01	0 15	-0.04	4.11**	2.84**
,,	X	Florida Runner	1.41*	2.56	0.08	5.05**	3.36**
M 145	X	C 139	-0.09	-1.95	-0.06*	2.22*	-0.28
,,	X	Ah 7224	1 31*	-4.65**	0.03	3.11**	-0.46
,,	X	Godjah 61	0.81	2.75	0.00	-4.56**	-2.90**
,,	X	Ah 7341	-0.29	0.95	-0.02	0.38	0.88
,,	X	Ah 7187	0.51	3.15*	0.03	2.00	0 50
,,	X	U 4-4-32	1.79**	0.65	0 08**	0 76	5.68**
,,	X	Florida Runner	0.51	-0.85	-0.06*	-4.00**	-3.44**
M 37	X	C 139	0.31	0.45	0.09**	-0 29	6.49**
,,	X	Ah 7224	-0.29	1.15	-0.03	-0.47	3.61**
,,	X	Godjah 61	-0.09	-1.85	-0.01	1.23	-1.63*
,,	X	Ah 7341	0.21	2.65	0.01	0.87	-1.95**
,,	X	Ah 7187	-0.09	3.65*	-0.06*	-2.31*	-4.13**
,,	X	U 4-4-32	1.91**	-0.75	-0.06*	-1.15	-5.15**
,,	X	Florida Runner	-1.69**	0.05	0.04	2.09	2.73**
C 501	X	C 139	-0 09	-0.95	0.02	0.32	2.78**
,,	X	Ah 7224	1.61**	0.25	0.01	1.14	-0.60
,,	X	Godjah 61	-0 89	4.65**	0 04	2.14*	3.66**
,,	X	Ah 7341	0.71	-1.35	-0.01	-0.22	2.14**
,,	X	Ah 7187	-0.19	-0.75	-0.04	-1.60	-4.34**
,,	X	U 4-4-32	-0.19	-0 55	0.08**	-4.06**	1.34*
,,	X	Florida Runner	-1.19*	-1.25	-0.08**	-5 90**	-4.98**
Ak 12-24	X	C 139	-1.29*	1.45	0.07*	5.65**	1.22
,,	X	Ah 7224	-0.59	1.85	-0 04	3.37**	1.04
,,	X	Godjah 61	1.31*	-4.95**	-0.02	-1.13	-1.40*
,,	X	Ah 7341	0.91	6.45**	-0.04	-0.29	-5.72**
,,	X	Ah 7187	-0.99	-4.75**	0.04	-2.57*	4.40**
,,	X	U 4-4-32	0.01	0.45	-0.03	-7.81**	-4.72**
,,	X	Florida Runner	0.71	-0.25	0.04	2.73*	5.16**
SE (sij)±			0.57	1.56	0.03	1.07	0.64
SE (sij-skl) ±			0.79	2.15	0.05	1.48	0.89

* $P \leq 0.05$, ** $P \leq 0.01$