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Combining ability analysis in groundnut (*Arachls hypogaea* L.)

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Abstract: Line x tester analysis was performed using 12 lines and four testers of groundnut for pod number and pod yield / plant. Both the characters had the preponderance of variances due to specific combining ability indicating the non-additive gene action for these characters. The parents CO 3, TNAU 359, COGn 4 and TAG 24 were considered as desirable parents and could be used in production breeding programme. Among the hybrids, CO 3 x TKG 19 A and CO 3 x TAG 24 had high *per se* performance for pods / plant and pod yield / plant. These crosses were derived from high x medium or high x high general combining ability of the parents, and would be used for further selection to obtain high yielding segregants in the segregating generation.

Keywords : Groundnut, lines, testers, high yield, combining ability, gene action.

Introduction

The success of any breeding programme primarily depends upon the proper choice of parents. Genetic information about the combining ability of the parents is a pre-requisite for the selection of parents. The line x tester analysis helps the breeder to assess the nature of gene action and also the combining ability effects of parents. The objective of present study is to assess the combining ability of 12 lines with four testers in groundnut *(Arachis hypogaea* L).

Material and Methods

The twelve lines (female parents) consisted of four Spanish bunch types (CO 3, COGn 4, Sacred 1 and ALR 3) and eight Virginia bunch types (ICGV 92126, ICGV 92109, TNAU 359, TNAU 385, TNAU 387, TNAU 390, TNAU 394 and TNAU 406) were crossed with the following four testers (pollinator) GG 2, TG 26, TG 24 and TKG 19A. All these testers were Spanish bunch except GG2 (Virginia bunch). The resultant 48 F_1s were evaluated in a randomized block design with two replications during December 2000 - March 2001. Each entry was sown in two rows of 4m length and the spacing adopted was 30 x 15 cm. Cultural operations recommended for groundnut cultivation in Tamil Nadu were followed throughout the crop season. Ten plants were taken at random from each replication in each entry for number of mature pods per plant and the weight of mature pods per plant. The data were analysed for line x tester analysis as suggested by Kempthorne(1957).

Results and Discussion

The analysis of variance indicated that variance due to lines for both characters was significant indicating differences among the combining ability of lines. The variances due to testers and hybrids were significant for pods / plant and pod yield / plant, respectively. The ratio between the GCA and SCA variances

Table 1. Analysis of variance for pods / plant and pod yield / plant

Source	df	Mean Squares	
		Pods / plant	Pod yield / plant (g)
Replication	1	0.31	1.23
Lines	11	67.64**	58.23**
Testers	3	28.08	20.62*
LxT	33	12.52*	4.89
Error	47	7.77	6.26
GCA		0.29	0.28
SCA		2.38	-0.69
A			
(F = 0)		1.17	1.13
D (F = 0)		9.95	-2.74

Table 2. General combining ability effects of parents in groundnut

	No. of Pods / plant	Pod yield / plant (g)
Lines :		
CO 3	5.93**	6.42**
ICG V 92126	1.25	-1.08
ICGV 92109	-2.71**	-2.22*
TNAU 387	-0.73	0.12
TNAU 406	-3.12**	-2.02*
TNAU 390	-1.99*	-1.67
TNAU 385	2.55*	0.05
TNAU 359	3.49**	3.04**
TNAU 394	-3.55**	-2.68**
Sacred 1	0.86	-0.50
ALR3	-1.64	-1.85*
COGn4	-0.35	2.39**
Testers :		
TKG19A	-0.35	-0.11
TG26	-1.35*	-1.16*
TAG 24	1.08	1.09*
GG2	0.63	0.19
SE (lines)	0.99	0.88
SE (Testers)	0.57	0.66

Table 3. *Per se* of groundnut hybrids for number of pods / plant and pod yield / plant

Genotype	Number of pods / plant				Pod yield / plant (g)			
	TKG 19A	TG26	TAG 24	GG2	TKG 19A	TG26	TAG 24	GG2
CO 3	21.4	14.5	26.6	25.1	20.2	13.9	20.7	19.4
ICGV 92126	18.0	15.5	17.8	17.7	11.0	9.2	112	12.7
ICGV 92109	11.0	17.0	11.1	14.0	8.6	10.3	9.6	11.0
TNAU 387	14.2	15.5	17.2	14.3	12.6	12.3	13.4	10.5
TNAU 406	12.5	10.8	13.2	15.0	10.4	7.5	10.8	11.5
TNAU 390	12.6	13.8	17.1	12.5	9.5	10.4	13.3	8.5
TNAU 385	17.5	16.1	21.5	19.0	11.4	10.3	14.0	13.0
TNAU 359	16.0	18.4	21.4	22.2	14.3	14.4	16.2	15.6
TNAU 394	15.5	9.5	11.4	13.3	10.2	6.5	9.7	11.3
Sacred 1	18.0	13.0	17.1	19.3	10.5	11.0	13.6	11.4
ALR3	14.8	17.1	14.8	10.7	11.3	12.0	10.7	7.1
COGn4	16.1	14.5	15.6	16.4	13.8	13.6	15.1	15.5
SE	2.07	-	-	-	1.8	-	-	-
CD(P=0.05)	5.6	-	-	-	5.0	-	-	-
CD(P=0.01)	7.5	-	-	-	6.7	-	-	-

Table 4. Specific combining ability of groundnut hybrids for number of pods / plant and pod yield / plant

Testers / Lines	Number of pods / plant				Pod yield / plant (g)			
	TKG 19A	TG26	TAG 24	GG2	TKG 19A	TG26	TAG 24	GG2
CO 3	-0.15	-6.05**	3.62	2.57	1.76	-3.48	1.06	0.66
ICGV 92126	1.13	-0.37	-0.55	-0.20	0.11	-0.68	-0.89	1.46
ICGV 92109	-1.92	5.04*	-3.22	0.10	-1.14	1.55	-1.39	0.98
TNAU 387	-0.75	1.55	0.82	-1.63	0.48	1.26	0.11	-1.86
TNAU 406	-0.01	-0.70	-0.78	1.49	0.48	-1.40.	-0.33	1.25
TNAU 390	-1.04	1.12	2.04	-2.11	-0.80	1.15	1.80	-2.15
TNAU 385	-0.68	-1.07	1.90	-0.15	-0.68	-0.72	0.73	0.67
TNAU 359	-3.11	0.24	0.81	2.06	-0.72	0.44	-0.01	0.29
TNAU 394	3.43	-1.57	-2.10	0.25	0.88	-1.76	-0.79	1.66
Sacred 1	1.51	-2.48	-0.81	1.79	-0.98	0.53	0.88	-0.43
ALR3	0.81	4.07*	-0.61	-4.26*	1.17	2.88	-0.67	-3.38
COGn4	0.78	0.23	-1.10	0.10	-0.57	0.24	-0.51	0.84
SE	1.97				1.77			

indicated the preponderance of non-additive gene action for pods / plant and additive gene action for pod yield / plant. Hence selection should be postponed to later generation for pods / plant. However early generation selection could be adopted for pod yield / plant. Vindhiyavarman (2002) suggested non additive gene action for these characters. Considering the contribution towards the total variance, lines recorded highest contribution of 60 and 74 per cent for pods / plant and pod yield / plant, respectively, thus indicating that the choice of lines is appropriate.

Choice of parents

Among the parents CO 3 and TNAU 359 had significantly positive general combining ability effects for pods / plant and pod yield / plant. The parent COGn 4 and TAG 24 also had significantly positive *gca* for pod yield while the parent TNAU 385 had high *gca* for pods / plant. Hence the parents namely, CO 3, TNAU 359, COGn 4 and TAG 24 were considered as general combiners for their involvement in the production breeding programme.

Choice of crosses

The first criteria in the choice of cross is *per se* performance. The *per se* performance of hybrids (Table 3) revealed that hybrid namely CO 3 x TAG 24 recorded significantly highest *per se* for pods / plant and pod yield / plant. Other hybrids namely CO 3 x TAG 19A, CO 3 x GG 2, TNAU 385 x TAG 24, TNAU 359 x TAG 24 and TNAU 359 x GG 2 recorded significantly superior *per se* for pods / plant than C0Gn4. Since the pod yield is the deciding factor for kernel yield, the hybrids CO 3 x TKG 19A and CO 3 x TAG 24 were considered as desirable crosses.

The second criterion in the choice of the hybrids is the gene action involved in the crosses. The selected crosses namely CO 3 x TKG 19A and CO 3 x TAG 24 had nonsignificant *sca* effects for both characters. Among the parents involved in these crosses, CO 3 is a good combiner for both characters while TKG 24 is a good combiner for pod yield alone. The parent TKG 19A is a medium combiner for both characters. Since one the parents involved in crosses is good combiner and crosses had non significant interaction effect *(sca),* with high mean for pod yield, These crosses were expected to produce more promising segregants for pod yield in early generation itself. This was also reported by Raghaviah and Joshi (1986).

From the foregoing discussion it might be concluded that parents CO 3, TNAU 359, COGn 4 and TAG 24 were considered as desirable parents and could be used in production breeding programme. Among the hybrids, CO 3 x TKG 19 A and CO 3 x TAG 24 recorded superior *per se* for pods / plant and pod yield / plant. These crosses were derived from high x medium or high x high *gca* parents and recorded additive gene action. Hence these crosses would be used for further selection to obtain high yielding segregants in the early generation.

References

Kempthorne, O. (1957). *An introduction to Genetic Statistics,* John Wiley and Sons, New York.

Raghavaiah, P. and Joshi, M.G. (1986).Combining ability studies in Emmer Wheat. *Indian J. Genet.*, **56:** 476-483.

Vindhiyavarman, P. (2000). Combining ability estimates in groundnut *(Arachis hypogea* L.) *Madras Agric. J*., **87 :** 462 - 466.