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Research Notes

Studies on Variability, Heritability and Genetic Advance in Groundnut *(Arachis hypogaeae* L.)

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Abstract
Crosses were made to develop a foliar disease resistant groundnut lines with acceptable pod and kernel traits using TMV 2 and three foliar disease resistant parents. Three F_2 cross derivatives and their four parents were used to study their mean performance, genetic variability, heritability and genetic advance as percentage of mean for yield and contributing characters. Among the crosses, TMV2 x COG0437 had higher mean performance for all the characters followed by TMV2 x COG 438. Higher PCV and GCV values were also recorded by this cross. The cross TMV2 x COG0437 had high heritability and high to moderate GAM for most of characters followed by TMV2 x COG0438. Hence, based on mean and variability parameters, TMV2 x COG437 is adjudged as best cross combination for further selection programme to evolve a promising progeny.

Key words: Groundnut, coefficient of variation, heritability, genetic advance as percentage of mean.

In India, groundnut ranks first among the edible oilseed groups. Its seeds are rich source of edible oil (43-55%) and protein (25 to 28%). Its cake is used as feed or for making other food products and haulms provide quality fodder. The success of any crop improvement programs largely depends on the genetic variability present in the population. Heritability estimates are used to determine the amount of variation present in the population. Heritability combined with genetic advance will bring out the genetic gain expected from selection. In the present study crosses were made to develop a foliar disease resistant groundnut lines with acceptable pod and kernel traits using TMV 2 and three foliar disease resistant parents. These crosses were studied for mean and variability parameters for various pod and kernel yield as well as other component characters.

The field experiment was carried out at Oilseeds Farm, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore during Rabi 2009. Crosses were made to develop a foliar disease resistant groundnut lines with acceptable pod and kernel traits using TMV 2 and three foliar disease resistant parents. A bunch type TMV 2 was used as female parent and foliar disease susceptible (rust and late leaf spot) and foliar disease resistant parents *viz.,* COG0437, COG0438 and ICGV 97150 (all are semi spreading types) were used as male parents. Recommended cultural practices were followed throughout the crop period. The spacing adopted was 30 x 10 cm. All the parents and F_2 crosses were evaluated in non replicated trial. Observations were recorded on plant height(cm), number of branches per plant, haulm yield per plant(g),number of pods per plant, pod yield per plant(g), kernel yield per plant(g), hundred kernel weight(g), pod length(cm) and pod width(cm). A total of 20 in parents and 230-250 plants per crosses were observed. The various genetic parameters like variability, GCV, PCV, heritability and genetic advance as percentage of mean were calculated by adopting the formulae given by Johnson *et al*. (1955).

The results on the mean performance of all the six parents used in the study are presented in Table 1. The female parent TMV 2 had poor performance for all the characters studied. Among the parents, ICGV 97150 followed by COG 438 recorded high pod yield and kernel yield per plant. These two parents also recorded superiority for number of pods per plant, 100-kernel weight (g) and pod length. The parent

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ICGV 97150 also recorded superiority for pod width. The parent COG 437 was found good for plant height, number of branches per plant, haulm yield/plant and pod width. Considering the important characters namely pod yield, kernel yield and haulm yield, the parent ICGV 97150 was adjudged as the best parent followed by COG 438 and COG 437. Similar results with the present findings for most of the characters were also reported by Khote et al.(2009) and Nath and Alam (2002).

The results on the variability, heritability and genetic advance for nine characters in groundnut have been presented in Table 2. For all the characters, the values of phenotypic coefficient of variation (PCV) were higher than the genotypic coefficient of variation (GCV).

Plant height: Among the crosses, cross TMV2 x ICGV 97150 followed by TMV 2 x COG0437 recorded lower mean plant height. All three cross derivatives showed high PCV values and the cross TMV2 x COG0437 recorded medium GCV value. High PCV and GCV values for plant height were reported by John *et al.* (2007). Moderate heritability and moderate genetic advance as percentage of mean (GAM) were noticed in the cross TMV2 x COG0437. Other crosses showed low heritability and low GAM.

Number of branches per plant: The cross TMV2 x COG0437 possessed higher number of branches per plant (5.21) than other three cross derivatives. All the three cross derivatives had high PCV values. The cross TMV2 x COG0437 had high GCV values whereas, other three cross derivatives had low GCV values. All the three cross derivatives showed low heritability. The cross TMV2 x COG0437 had moderate GAM but all other crosses exhibited poor GAM.

Haulm yield per plant: The cross TMV2 x COG0437 had higher haulm yield per plant (84.10 g) than other three cross derivatives. High PCV and GCV values were recorded by all the three cross derivatives. High PCV and GCV values for haulm yield per plant have been reported by Khote *et al*. (2009). High GCV values indicated greater extent of variability present in the character and can be improved through selection. The cross TMV2 x ICGV 97150 had low heritability for haulm yield whereas, other crosses derivatives had moderate heritability. All the three cross derivatives had higher GAM for haulm yield per plant. Low heritability with high genetic advance indicates that the character is governed by additive gene effects and selection may be effective in such cases. High PCV and GCV and GAm values for haulm yield per plant were reported by John *et al*. (2007).

Number of pods per plant: All three crosses had equal number of pods per plant. High PCV and GCV values were recorded by all the three cross derivatives. High PCV and GCV values for number of pods per plant were reported by Khote *et al*. (2009). The cross TMV2 x COG0437 had moderate heritability whereas other two cross derivatives had high heritability. All the three cross derivatives had high GAM. High PCV and GCV, heritability and GAM values for haulm yield per plant were also reported by John *et al*. (2007). High heritability with high GAM values for number of pods per plant was reported by Savaliya *et al.* (2009).

Pod yield per plant: The cross TMV2 x COG0437 had higher mean pod yield (13.4 g/plant) than other cross derivatives. High PCV values were recorded by all the three cross derivatives. All three cross derivatives had high GCV, moderate heritability and high GAM. High PCV, GCV and GAM values for pod yield per plant were reported by John *et al*. (2007) and Khote *et al*. (2009).

Kernel yield per plant: The cross TMV2 x COG0437 had higher mean kernel yield (9.40 g/plant) than other cross derivatives. High PCV and GCV, moderate heritability with high GAM values were recorded by all the cross derivatives. High GCV value for kernel yield per plant was reported by Khote *et al*. (2009). High PCV, GCV and GAM values for kernel yield per plant have been reported by John *et al*. (2007).

Hundred kernel weight: All crosses had almost same 100-kernel weight. High PCV values were recorded by all cross derivatives. Cross TMV2 x COG0437 showed high GCV values whereas, other two cross derivatives exhibited moderate GCV values. Moderate GCV value for hundred kernel weight was reported by John *et al.* (2008). The cross TMV2 x COG0438 had low heritability; other two cross derivatives had high heritability. Crosses TMV2 x COG0437 had high GAM and other two cross derivatives showed low GAM. High heritability with low GAM reveals non additive gene action and selection for such traits may not be rewarding. High heritability with high GAM values for hundred kernel weight was reported by Savaliya *et al.* (2009).

Pod length: All crosses had same pod length. Cross TMV2 x COG0437 showed high PCV values whereas, other two cross derivatives exhibited moderate PCV values. High GCV values were recorded by the crosses TMV2 x COG0437 and other two cross derivatives had low GCV values. High PCV and GCV values for pod length were reported

by Khote *et al.* (2009). High heritability values were recorded by TMV2 x COG0437 and TMV2 x ICGV 97150 while the cross TMV2 x COG0438 had low heritability. High GAM was recorded by the crosses TMV2 x COG0437. High heritability with high GAM values for pod length was reported by Khote *et al.* (2009).

Pod width: The cross TMV2 x COG0437 had good mean pod length (1.22 cm). Moderate PCV values were recorded by TMV2 x COG0437 and TMV2 x COG0438. The cross TMV2 x COG0437 had moderate GCV value but all other cross derivatives had poor GCV. The cross TMV2 x COG0437 had high heritability and other two cross derivatives had moderate heritability. High GAM was recorded by the cross TMV2 x COG0437 and moderate GAM was recorded by the cross TMV2 x ICGV 97150. The moderate heritability with low GAM values for pod length was reported by Khote *et al.* (2009).

Among the four crosses, the cross TMV2 x COG0437 had higher mean performance for all characters followed by the cross TMV2 x COG0437 for most of characters. The cross TMV2 x COG0437 had high PCV and GCV values all characters. It also had high heritability and high or moderate GAM all characters. This cross was followed by the cross TMV2 x COG0438 had shown high or moderate heritability and GAM for most of characters. High heritability with high GAM is indicated the presence of additive gene effects and the characters are selected with greater efficiency. Hence based on mean and variability parameters for pod and kernel yield and yield contributing characters, the cross TMV2 x COG437 is adjudged as best cross for further selection through pedigree breeding programme to obtain promising progenies.

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Table 1. Mean performance of parents

Parents	Plant ht (cm)	No.of branches /plant	Haulm yield/ plant (g)	No.of pods/ plant	Pod yield/ plant (g)	Kernal yield/ plant(g)	100 kernal weight/ plant (g)	Pod length (cm)	Pod width (cm)
TMV2	16.38	4.83	74.55	9.17	7.30	5.64	27.12	2.28	1.17
COG0437	19.13	8.13	132.6	18.63	14.27	8.93	31.25	2.61	1.29
COG0438	21.25	6.33	72.48	21.42	19.09	12.75	47.55	2.69	1.28
ICGV97150	20.90	5.50	186.4	23.25	22.83	12.92	50.93	3.00	1.34

Table 2.Estmates of genotypic and phenotypic coefficient of variability, heritability and genetic advance as percentage of mean in 3 F_1 derived crosses and one F_5 derived cross in groundnut

Character	Cross	Mean	PCV	GCV	h^2	GA	GA%
Plant ht	TMV2 x COGO437	**18.40**	25.42	**14.45**	**32.33**	3.09	**16.79**
	TMV2 X COG0438	**17.27**	30.99	5.24	2.86	0.33	1.91
	TMV2 x ICGV 97150	15.83	25.20	9.81	15.15	1.23	7.77
No.of	TMV2 x COGO437	**5.21**	36.77	**15.94**	**18.8**	0.71	**13.63**
branches/plant	TMV2 X COG0438	**4.66**	28.06	10.73	14.62	0.4	8.58
	TMV2 x ICGV 97150	4.57	25.24	10.26	16.54	0.38	8.32
Haulm	TMV2 x COGO437	**84.10**	58.56	32.41	**30.63**	30.44	36.20
yield/plant(g)	TMV2 X COG0438	**64.43**	56.54	42.70	**57.05**	42.78	66.40
	TMV2 x ICGV 97150	62.91	54.24	24.84	20.98	14.76	23.46
No.of	TMV2 x COGO437	**17.96**	46.77	30.23	**41.76**	7.27	40.48
pods/plant	TMV2 X COG0438	16.76	50.42	40.78	**65.42**	11.31	67.48
	TMV2 x ICGV 97150	**17.98**	46.89	41.95	80.03	13.89	77.25
Pod	TMV2 x COGO437	**13.46**	53.71	34.21	40.56	6.11	45.39
yield/plant(g)	TMV2 X COG0438	**12.15**	59.25	36.86	38.7	5.78	47.57
	TMV2 x ICGV 97150	11.86	56.22	40.80	52.65	7.28	61.38
Kernal	TMV2 x COGO437	**9.40**	55.50	39.30	50.15	5.38	57.23
yield/plant(g)	TMV2 X COG0438	**8.52**	60.92	34.54	32.15	3.42	40.14
	TMV2 x ICGV 97150	8.21	58.96	39.11	44.0	4.84	58.95
100 -kernel	TMV2 x COGO437	**34.91**	27.38	**20.49**	**56.04**	11.03	**31.60**
weight (g)	TMV2 X COG0438	**34.90**	25.40	11.68	21.14	3.83	10.97
	TMV2 x ICGV 97150	33.44	25.99	14.39	**30.64**	5.55	16.60
Pod length (cm)	TMV2 x COGO437	**2.40**	**31.73**	**30.62**	**93.10**	1.46	**60.83**
	TMV2 X COG0438	2.32	10.73	4.09	14.52	0.08	3.32
	TMV2 x ICGV 97150	**2.36**	10.38	5.99	33.33	0.16	6.78
Pod width (cm)	TMV2 x COGO437	**1.22**	**18.33**	**16.39**	80.0	0.36	**29.51**
	TMV2 X COG0438	1.14	10.0	6.79	46.15	0.10	8.77
	TMV2 x ICGV 97150	**1.18**	11.98	8.47	50.0	0.14	11.86