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Studies on genetic variability and direct selections for important traits in segregating materials of groundnut (*Arachis hypogaea* L.)

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ABSTRACT
Six crosses of F_2 population and nine parental lines were evaluated for variability, heritability and genetic advance during *Kharif*, 2007. Observations on eleven characters recorded. Analysis of variance revealed highly significant differences among the genotypes, parents as well as crosses for all the characters indicating thereby sufficient variability in the material studied. The range of variation was maximum for plant height, shelling out-turn, oil content and pod yield per plant in most of the crosses. High values of GCV, PCV and genetic advance were observed for days to flowering, number of primary branches per plant, plant height, number of mature pods per plant, number of immature pods per plant, kernel yield per plant and pod yield per plant in most of the crosses. All the characters expressed high heritability estimates except shelling out-turn in the cross-2 and cross-6. The expression of high heritability coupled with high genetic advance and high values of GCV and PCV for pod yield per plant for above characters indicating that F_2 generation was mainly under the influence of additive gene action and scope for improvement through simple selection.

Key words : Genetic variability, Heritability, Genetic advance, Groundnut

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a highly self pollinated crop and can be grown successfully in tropical and subtropical areas. The crop has narrow genetic base therefore, it is essential to create more variability in the segregating materials. F_2 generation in which segregation and recombination were of maximum hence, this generation is ideal for imposing selection. The knowledge of nature and magnitude of genetic variability is of great importance to a breeder for planning efficient breeding programme and selecting desirable segregants. Hence, an attempt was made to study the genotypic variability and direct selections for important traits in the segregating materials of groundnut.

MATERIALS AND METHODS

The experimental material consisted of F_2 generation of six crosses derived from crossing among nine parents. Six F_2 populations and nine parental lines were sown during *Kharif*, 2007 at the Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, in Randomized Block Design with three replications. Each F_2 generation was planted in 10 rows of 4 m length and parent was planted in a single row of same length at the spacing of 60 cm between rows and 15 cm between the plants. Observations on eleven characters (Table 1) were recorded on randomly selected five plants from each parent and fifty plants from each F_2 generation per replication. The data subjected to different statistical analysis *viz.*, analysis of variance, magnitude of genetic variability, phenotypic and genotypic coefficient of variation, heritability and genetic advance were performed following the standard procedures.

RESULTS AND DISCUSSION

Analysis of variance revealed highly significant differences among the genotypes, parents as well as crosses for all the characters indicating thereby sufficient variability in the material studied. Mean squares due to parents *vs* crosses were also highly significant for all the characters indicating significant deviation of F_2 populations from the parents (Table 1). Similar findings were recorded by John *et al*. (2007), Khote *et al*. (2009) and Ladole *et al*. (2009). The mean, range, GCV, PCV, heritability and genetic advance as percentage of mean for different characters in six crosses of F_2 generation are given in Table 2. The range of variation was maximum for plant height, shelling out-turn, oil content and pod yield per plant in most of the crosses indicated that there was a better scope for selection and improvement for these characters. John *et al*. (2007) and Ladole *et al*. (2009) also reported similar results. The estimates of genotypic coefficient of variations were quite close to the phenotypic coefficient of variations for the characters *viz.*, days to first flowering, days to maturity, plant height, oil content and protein content indicating the least influence of environmental variation. This suggested that phenotypic variation can be used reliably to judge genetic variation. High values of GCV and PCV were obtained for days to flowering,

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Table 1 : Analysis of variance showing mean squares for eleven characters in parents and six crosses of F_2 generation of groundnut

Source	d. f.	Days to first flowering	Days to maturity	No. of primary branches per plant	Plant height (cm)	No. of mature pods per plant	No. of immature pods per plant	Kernel yield per plant (g)	Shelling out-turn (%)	Oil content (%)	Protein content (%)	Pod yield per Plant (g)
Replications(R)	2	0.87	0.45	0.40	0.08	1.66	0.21	1.31	11.94	1.60	1.61	0.67
Genotypes (G)	14	10.25**	3.87**	14.44**	210.78**	46.93**	4.03**	42.17**	45.51**	11.61**	31.67**	66.86**
Parents (P)	8	15.39**	5.39**	4.76**	260.95**	6.27**	6.00**	4.68**	59.25**	13.05**	45.24**	8.76**
Crosses (C)	5	3.92**	3.92**	1.76**	78.92**	63.58**	1.26**	55.16**	14.99**	11.37**	13.90**	90.61**
Parents *vs* Crosses	3	5.49**	10.37**	12.40**	80.12**	50.12**	5.32**	44.62**	37.24**	20.40**	51.52**	44.62**
Error	28	0.47	1.65	0.62	1.09	0.95	0.37	1.05	4.20	0.97	0.62	1.63

** indicates significance of values at P=0.05, against error mean squares

Table 2 : Mean, range, genotypic (GCV) and phenotypic (PCV) coefficients of variation, heritability (h^2) and genetic advance (GA as % of mean) for different characters in six crosses of F_2 generation of groundnut

Crosse	Mean	Range	GCV (%)	PCV (%)	h^2 (%)	GA (%) of mean
Days to first flowering						
Cross 1	19.21	14 – 28	46.26	49.01	94.38	63.53
Cross 2	18.05	15 – 25	27.17	33.57	80.94	37.32
Cross 3	18.92	14 – 26	23.68	27.49	86.14	32.52
Cross 4	20.19	15 – 27	48.40	51.03	94.86	66.48
Cross 5	16.50	14 – 25	44.77	50.57	88.52	61.48
Cross 6	22.23	17 – 28	45.71	49.17	92.95	62.77
Days to maturity						
Cross 1	105.22	100.0– 115.0	22.57	25.59	88.19	30.99
Cross 2	104.25	98.00– 113.0	22.37	22.88	97.78	30.73
Cross 3	103.57	96.00– 109.0	23.16	24.11	96.03	31.80
Cross 4	106.25	98.00– 115.0	23.76	25.51	93.14	32.63
Cross 5	101.75	94.00– 106.0	13.30	13.82	96.24	18.27
Cross 6	106.11	100.0– 112.0	19.06	20.01	95.29	26.18
Number of primary branches per plant						
Cross 1	4.99	3.00 – 6.00	26.96	32.06	84.08	37.02
Cross 2	5.93	4.00 – 8.00	22.10	38.98	56.71	30.36
Cross 3	5.60	2.00 – 9.00	55.61	65.92	84.36	76.37
Cross 4	6.43	2.50 – 10.00	26.48	42.02	63.01	36.37
Cross 5	4.87	3.50 – 7.00	55.58	76.10	73.04	76.33
Cross 6	8.16	3.00 – 12.00	48.00	56.07	85.62	65.93
Plant height (cm)						
Cross 1	31.65	21.00 – 45.00	56.17	59.29	94.73	77.13
Cross 2	37.58	27.00 – 45.00	37.91	39.70	95.50	52.06
Cross 3	34.42	28.00 – 46.00	54.94	57.84	94.98	75.45
Cross 4	36.17	29.00 – 47.00	47.69	50.45	94.52	65.49
Cross 5	32.22	23.00 – 39.00	30.53	32.32	94.46	41.93
Cross 6	46.09	29.00 – 53.00	44.61	46.78	95.36	61.26
Number of mature pods per plant						
Cross 1	13.26	9.00 – 19.00	31.88	39.42	80.87	43.78
Cross 2	15.10	9.00 – 21.00	43.40	50.02	86.76	59.61
Cross 3	17.77	9.00– 29.00	71.64	77.27	92.72	98.39
Cross 4	14.99	11.00– 23.00	31.48	38.15	82.51	43.23
Cross 5	18.71	13.00– 26.00	59.45	64.80	91.75	81.65
Cross 6	26.13	21.00– 33.00	31.65	35.47	89.21	43.46

Contd …. Table 2

Table 2 Contd ….

Crosse	Mean	Range	GCV (%)	PCV (%)	h^2 (%)	GA (%) of mean
Number of immature pods per plant						
Cross 1	2.77	2.00 – 7.00	69.85	81.87	85.32	95.92
Cross 2	2.40	1.50 – 5.00	43.72	57.61	75.89	60.04
Cross 3	2.85	2.90 – 9.00	71.73	94.74	75.71	98.50
Cross 4	3.75	3.00 – 7.00	69.27	78.17	88.62	95.13
Cross 5	2.93	1.50 – 4.00	48.43	59.79	80.99	66.51
Cross 6	4.11	2.00 – 7.00	29.19	37.31	78.24	40.09
Kernel yield per plant (g)						
Cross 1	9.77	6.15 – 15.01	24.28	34.62	70.15	33.35
Cross 2	11.98	4.20 – 19.00	53.62	59.73	89.76	73.63
Cross 3	13.76	6.66 – 23.40	50.51	72.91	69.27	69.37
Cross 4	11.79	7.90 – 19.75	38.35	43.03	89.13	52.67
Cross 5	16.05	10.00 – 22.14	54.72	58.04	94.29	75.15
Cross 6	21.79	16.00 – 27.80	10.90	19.94	54.66	14.97
Shelling out-turn (%)						
Cross 1	74.16	60.54 – 80.82	15.02	20.38	73.71	20.63
Cross 2	76.66	65.45 – 81.54	4.30	13.57	31.65	5.90
Cross 3	71.88	54.00 – 79.00	33.52	35.35	94.84	46.04
Cross 4	76.76	68.00 – 81.43	10.81	14.23	75.96	14.85
Cross 5	78.01	70.00 – 83.00	6.49	10.39	62.52	8.92
Cross 6	76.52	67.00 – 81.00	3.12	10.70	29.18	4.29
Oil content (%)						
Cross 1	45.73	34.00 – 54.00	26.71	28.90	92.43	36.68
Cross 2	44.50	30.00 – 49.00	23.08	25.33	91.13	31.70
Cross 3	48.00	41.00 – 54.00	22.73	25.03	90.83	31.22
Cross 4	45.52	42.00 – 50.00	22.06	24.26	90.94	30.30
Cross 5	42.06	32.00 – 46.00	22.68	25.06	90.51	31.15
Cross 6	46.00	40.00 – 51.00	22.34	24.51	91.13	30.68
Protein content (%)						
Cross 1	25.86	20.00 – 34.00	23.33	25.57	91.27	32.04
Cross 2	28.67	23.00 – 33.00	24.05	26.07	92.27	33.03
Cross 3	30.17	25.00 – 34.00	23.67	25.58	92.52	32.50
Cross 4	29.77	22.00 – 34.00	36.51	37.63	97.02	50.14
Cross 5	31.06	24.00 – 35.00	22.63	25.85	87.55	31.08
Cross 6	32.00	28.00 – 38.00	23.34	26.47	88.19	32.06
Pod yield per plant (g)						
Cross 1	13.19	8.00 – 19.00	62.49	70.07	89.18	85.82
Cross 2	15.59	6.00 – 24.00	64.50	70.91	90.96	88.57
Cross 3	19.17	9.00 – 31.00	70.77	97.92	72.27	97.19
Cross 4	15.37	10.00 – 25.00	48.92	55.43	88.26	67.18
Cross 5	20.54	4.00 – 28.00	60.20	65.06	92.52	82.67
Cross 6	28.49	21.00 – 35.00	15.71	24.20	64.92	21.58

Cross 1 = AH-8254 (NRCG-6806) x J-11, Cross 2 = Virginia Improved (NRCG-6935) x JL-24,
Cross 3 = US-14 (NRCG-9356) x GG-5, Cross 4 = PI-339974 (NRCG-6408) x J-11,
Cross 5 = RCM-520B (NRCG-11698) x JL-24, Cross 6 = Pelotas-B (NRCG-10763) x GG

number of primary branches per plant, plant height, number of mature pods per plant, number of immature pods per plant, kernel yield per plant and pod yield per plant in most of the crosses indicating that these characters were under influence of genetic control. Hence, simple selection can be practiced for further improvement. These results are in agreement with the earlier findings of Kadam *et al.* (2007) and Khote *et al.* (2009). They reported high

GCV and PCV for number of pods per plant, number of kernels per plant, kernel yield per plant and pod yield per plant. Whereas Savaliya *et al*. (2008) observed high GCV and PCV for pod yield per plant. High GCV and PCV for plant height and number of pods per plant were observed by Ladole *et al*. (2009). However, high variance values alone were not the determining factors of the expected progress that could be made in respect of quantitative traits (Falconer, 1981). It was suggested that the GCV together with the high heritability estimates would give a better picture of the extent of genetic gain to be expected under selection. In the present investigation, all the characters expressed high heritability estimates except shelling out-turn in the cross-2 and cross-6. The shelling out-turn of these two crosses expressed low values of GCV, PCV and genetic advance as percentage of mean indicated that environment influence was high in these crosses. Savaliya *et al*. (2008) reported high heritability for number of pods per plant, shelling out-turn and pod yield per plant. Whereas Khote *et al.* (2009) observed high heritability for days to flowering and Ladole *et al*. (2009) for plant height. Genetic advance as percentage of mean was high for days to flowering, number of primary branches per plant, plant height, number of mature pods per plant, kernel yield per plant and pod yield per plant in most of the crosses and rest of the characters recorded moderate to low genetic advance and high value of GCV and PCV for pod yield per plant and its yield contributing characters *viz.*, days to first flowering, number of primary branches per plant, plant height, number of mature pods per plant, number of immature pods per plant and kernel yield per plant were exhibited by the F_2 population in the most of the crosses. These results are in conformity with the findings of Khote *et al.* (2009).

Thus, from the present investigation, it can be concluded that these crosses were mainly under the influence of additive gene action and improvement of these traits would be possible through selection in the subsequent generations to isolate high yielding genotypes with desirable characteristics. Moderate values of GCV, PCV and genetic advance as percentage of mean along with high heritability were recorded for remaining characters indicating that both additive and non-additive gene actions governed these characters, implying that heterosis breeding is the best way to improve these characters.

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