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VARIABILITY, HERITABILITY AND GENETIC ADVANCES IN F_2 GENERATION OF 15 CROSSES INVOLVING BOLD-SEEDED GENOTYPES IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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ABSTRACT Significant differences were observed among F_2 population of fifteen single crosses and parents for all characters. Plant height, number of primary branches, number of secondary branches, pod yield/plant showed higher values of Genotypic Co-efficient of Variation (GCV) and Phenotypic Co-efficient of Variation (PCV), heritability (broad sense) and Genetic Advance as per cent of Mean (GAM). The role of additive gene action seems to be significant in the inheritance of these traits. Thus phenotypic selection is early generations would help to make improvement in these characters. Number of mature pods and number of immature pods showed low to moderate values of GCV, PCV, heritability (broad sense) and GAM. The role of non-additive gene action seems to be significant in the inheritance of these traits. In these characters, early generation selection followed by biparental matings and selection in later generations would help to isolate lines with improvement in these traits. Shelling out-turn and sound mature kernel percentage were found to be governed by both additive and non-additive gene action.

Keywords: Variability, heritability, genetic advance, shelling out-turn, sound mature kernel percentage

INTRODUCTION

Groundnut is an annual legume crop grown mainly for high quality edible oil and easily digestible protein of its seeds. It is being grown in an area of 5.8 million ha with a production of 4.98 million tonnes. About 80% is used for oil extraction and a small proportion is consumed as roasted, salted or fried nuts or as meal in various recipes. The demand for confectionery grade oilseeds used for direct human consumption is steadily increasing. With increasing purchasing power and greater awareness created, people have become more conscious about quality standards. Most of the bold-seeded varieties that are being grown are long-duration types maturing in 140-150 days. With growing shortage of irrigation water and power, long duration types won't fit into existing cropping systems in our state. So, it is necessary to breed for early maturing bold-seeded varieties with confectionery quality. In the present study, genetics of pod yield, yield attributes, seed and quality traits in F_2 generation of 15 crosses and parents involving bold-seeded genotypes was analyzed

MATERIALS AND METHODS

The experimental material comprising of fifteen F_2 single crosses involving genotypes *viz.,* ICGV 99157, K 4, TAG 24 as ovule parents and genotypes TG 47, TKG 19A, JSSP-HP 21, BAU 13 and ICGV 86564 as pollen parents were studied in a three replicate and randomized complete block design during *kharif*, 2007 at Regional Agricultural Research Station, Tirupati.

F_2s and parents were grown in three rows of 5 m length by adopting a spacing of 30 x 15 cm. Data were recorded for plant height, number of primary branches, number of secondary branches, number of mature pods, number of immature pods, sound mature kernel percentage (SMK%), shelling out-turn, pod yield/plant in thirty randomly choosen plants. Genetic variability, genetic advance and GAM were estimated. Heritability (broad sense) was estimated according to the formula given by Burton (1952).

RESULTS AND DISCUSSION

Analysis of variance indicated significant differences for plant height, number of primary branches, number of secondary branches, number of mature pods, number of immature pods, sound mature kernel percentage (SM %), shelling out-turn and pod yield/plant among crosses and parents involved. Among crosses K 4 x JSSP-HP 21 was shortest plant type (23.45 cm) followed by TAG 24 x TKG 19A (23.51 cm) and ICGV 99157 x BAU 13 was the tallest cross (36.65 cm) (Table 1).

Table 1: Mean performance of parents and F2 populations for 12 characters in groundnut

Crosses / Parents	Plant height (cm)	No.of primary branches	No.of secondary branches	No.of mature pods	No.of immature pods	SMK%		Shelling outturn		Pod yield per plant (g)
						T	O	T	O	
Crosses										
ICGV 99157 x TG 47	29.09	5.53	1.38	15.66	7.78	56.53	66.40	47.30	54.10	21.33
ICGV 99157 x TKG 19A	31.35	5.98	2.48	16.62	5.55	46.98	53.20	42.39	45.35	16.00
ICGV 99157 x JSSP-HP 21	29.46	5.56	2.08	13.32	4.32	68.72	80.10	48.58	53.90	19.33
ICGV 99157 x BAU 13	36.65	5.98	3.96	14.94	5.86	66.03	79.00	48.31	57.10	20.33
ICGV 99157 x ICGV 86564	34.33	8.00	6.04	11.86	3.34	64.50	77.70	47.03	53.90	16.66
K 4 x TG 47	24.86	5.13	1.57	14.06	5.79	78.46	91.20	50.75	59.91	22.66
K 4 x TKG 19A	28.25	3.27	0.30	22.83	4.50	80.26	94.10	56.84	71.11	18.66
K 4 x JSSP-HP 21	23.45	3.38	0.60	16.25	5.83	78.63	83.30	56.00	68.80	16.00
K 4 x BAU 13	35.18	4.69	3.45	16.66	4.36	73.15	87.40	49.81	58.00	22.33
K 4 x ICGV 86564	34.20	6.08	4.16	15.10	3.95	68.13	83.20	49.19	56.91	18.33
TAG 24 x TG 47	24.95	3.11	0.07	21.86	5.51	82.31	96.10	54.77	67.40	18.00
TAG 24 x TKG 19A	23.51	3.26	0.22	16.86	6.50	79.24	95.20	56.29	68.80	15.66
TAG 24 x JSSP-HP 21	24.91	3.26	0.30	19.12	5.77	78.07	93.30	55.28	67.40	17.00
TAG 24 x BAU 13	25.43	3.56	0.08	17.75	6.37	76.68	90.60	53.36	63.80	17.66
TAG 24 x ICGV 86564	25.15	3.37	0.47	16.83	6.40	82.73	96.60	54.41	66.00	17.66
Parents										
TG 47	26.27	4.93	3.10	19.96	6.36	78.69	93.60	48.80	56.50	30.00
TKG 19A	32.89	8.33	7.43	23.96	9.56	67.12	82.70	47.61	54.00	31.66
K 4 (Kadiri 4)	25.40	3.46	0.23	20.83	8.26	75.65	90.90	52.69	63.00	16.66
JSSP-HP 21	29.23	3.86	0.46	15.40	8.16	79.07	92.76	47.11	53.70	20.33
BAU 13	32.91	5.76	4.23	23.10	4.50	64.93	78.63	46.54	52.60	27.00
TAG 24	27.16	3.30	0.00	20.30	3.90	80.40	94.26	53.89	65.13	17.00
ICGV 86564	39.37	9.63	7.30	22.10	5.00	69.97	84.46	46.41	52.43	27.00
ICGV 99157	37.92	4.86	1.40	26.13	7.60	65.61	77.86	42.35	45.46	26.66
Mean	29.65	4.97	2.23	18.32	5.88	72.25	-	50.25	-	20.60
SE	2.60	0.65	0.87	2.59	1.45	3.26	-	1.46	-	2.78
CD at 5%	7.41	1.86	2.48	7.40	4.14	9.30	-	4.16	-	7.93
CV (%)	15.20	22.83	67.68	24.56	42.81	7.82	-	5.03	-	23.38

T = Transformed value O = Original value

Among parents K 4 was the shortest plant type (25.40 cm) followed by TG 47 (26.27 cm) and ICGV 86564 (39.37 cm) was the tallest parent. The cross TAG 24 x TG 47 exhibited highest number of primary branches (3.11) followed by TAG 24 x TKG 19A (3.26) and TAG 24 x JSSP-HP 21 (3.26). Among parents highest number of primary branches was recorded by ICGV 86564 (9.63). The number of secondary branches varied from 0.07 (TAG 24 x TG 47) to 6.04 (ICGV 99157 x ICGV 86564) among crosses. Among parents TAG 24 showed no secondary branches and TKG 19A had the highest number of secondary branches (7.43).

Table 2: Genetic parameters for different characters in 15 F_2 populations of groundnut

Crosses	Genotypic Coefficient of Variation (GCV) (%)	Phenotypic Coefficient of Variation (PCV) (%)	Heritability (Broad Sense) (%)	Genetic Advance	Genetic Advance as % of mean
	(1)	(2)	(3)	(4)	5)
Plant height					
ICGV 99157 x TG 47	34.64	39.80	75.75	17.87	61.49
ICGV 99157 x TKG 19A	8.00	21.46	14.02	1.94	6.18
ICGV 99157 x JSSP-HP 21	12.55	24.39	26.57	3.85	13.06
ICGV 99157 x BAU 13	17.70	23.65	56.09	10.00	27.28
K 4 x TG 47	12.51	25.74	23.62	3.03	12.18
No.of primary branches					
ICGV 99157 x TKG 19A	8.36	34.94	5.73	0.245	4.01
ICGV 99157 x JSSP-HP 21	34.53	45.50	57.65	2.97	53.41
ICGV 99157 x BAU 13	16.22	38.62	18.01	0.85	14.21
ICGV 99157 x ICGV 86564	14.23	38.57	13.64	0.82	10.23
K 4 x TG 47	5.45	26.70	4.23	0.112	2.18
K 4 x ICGV 86564	21.87	49.67	19.49	1.18	19.40
No.of secondary branches					
ICGV 99157 x TKG 19A	203.26	251.42	65.57	8.24	336.32
ICGV 99157 x JSSP-HP 21	143.75	159.13	81.49	5.52	265.38
ICGV 99157 x BAU 13	77.77	100.75	59.92	4.84	122.22
ICGV 99157 x ICGV 86564	80.13	102.48	61.06	7.77	128.64
K 4 x TG 47	29.29	115.28	6.70	0.22	14.01
K 4 x BAU 13	77.39	101.15	58.76	4.16	120.86
K 4 x ICGV 86564	87.98	125.00	49.66	5.24	125.96
TAG 24 x JSSP-HP 21	652.73	684.24	91.06	3.98	1286.82
No.of mature pods					
ICGV 99157 x TG 47	28.09	68.90	16.67	3.55	22.66
ICGV 99157 x TKG 19A	6.13	62.29	0.97	20.88	125.55
No.of immature Pods					
K 4 x JSSP-HP 21	20.58	91.25	5.08	0.54	9.26
TAG 24 x BAU 13	47.98	76.83	39.10	3.93	61.73
TAG 24 x ICGV 86564	64.74	84.08	59.40	6.55	102.19
SMK%					
ICGV 99157 x TG 47	14.83	28.84	26.50	8.73	15.45
ICGV 99157 x TKG 19A	26.75	40.20	44.29	17.12	36.44
ICGV 99157 x JSSP-HP 21	6.82	22.48	9.23	2.86	4.16
K 4 x TG 47	9.43	16.23	33.80	8.66	11.03
K 4 x TKG 19A	2.89	13.42	4.65	0.88	1.09
TAG 24 x TKG 19A	6.87	14.87	21.33	5.10	6.43
TAG 24 x JSSP-HP 21	2.07	14.60	2.03	0.46	0.58
TAG 24 x BAU 13	16.01	21.15	57.33	19.04	24.83
TAG 24 x ICGV 86564	15.54	21.65	51.51	18.82	22.75
Shelling out-turn					
ICGV 99157 x TG 47	12.21	16.78	53.15	8.66	18.30
ICGV 99157 x TKG 19A	23.16	25.52	82.51	18.27	43.11
ICGV 99157 x JSSP-HP 21	8.08	15.80	26.29	4.11	8.46
ICGV 99157 x BAU 13	5.38	13.02	17.08	2.20	4.55
ICGV 99157 x ICGV 86564	10.67	14.41	54.87	7.54	16.03
K 4 x TG 47	6.77	12.61	29.02	3.82	7.53
K 4 x TKG 19A	10.8	13.36	65.35	10.17	17.90
K 4 x ICGV 86564	10.52	13.96	57.04	8.06	16.39
TAG 24 x TKG 19A	5.54	9.02	37.90	3.87	6.87
TAG 24 x BAU 13	1.98	10.17	3.83	0.33	0.62
TAG 24 x ICGV 86564	4.52	8.69	27.17	2.63	4.83
Pod yield per plant					
ICGV 99157 x TG 47	44.17	65.58	45.39	12.95	60.79
ICGV 99157 x TKG 19A	27.81	71.67	15.08	3.50	22.27
ICGV 99157 x JSSP-HP 21	52.85	67.22	61.00	16.10	84.42
ICGV 99157 x BAU 13	22.27	48.59	21.06	4.26	20.99
K 4 x BAU 13	16.54	39.88	17.28	2.77	13.96
K 4 x ICGV 86564	19.25	44.21	18.99	3.04	16.39
TAG 24 x JSSP-HP 21	15.34	37.04	17.23	2.20	12.97

The lowest mean for immature pods/plant was recorded by ICGV 99157 x ICGV 86564 (3.34). Among parents TAG 24 (3.90) had lowest number of immature pods followed by BAU 13 (4.50). The mean value for mature pods/plant ranged between 11.86 (ICGV 99157 x ICGV 86564) to 22.83 (K 4 x TKG 19A). Among parents the mean value ranged between 15.40 (JSSP-HP 21) to 26.13 (ICGV 99157). Highest mean for sound mature kernel percentage was expressed by TAG 24 x ICGV 86564 (96.60 %) while in parents TAG 24 (94.26 %) recorded highest mean for sound mature kernel percentage. Mean shelling out-turn ranged from 45.35 % (ICGV 99157 x TKG 19A) to 71.11 % (K 4 x TKG 19A). Among parents it ranged from 45.46 % (ICGV 99157) to 65.13% (TAG 24). Average pod yield among the crosses ranged from 15.66 g (TAG 24 x TKG 19A) to 22.66 g (K 4 x TG 47). Among parents TKG 19A (31.66 g) was the highest pod yielder followed by TG 47 (30.00 g).

High GCV and high heritability and high GAM were observed for plant height in the cross ICGV 99157 x TG 47, for number of primary branches in the cross ICGV 99157 x JSSP-HP 21, for number of secondary branches in the crosses ICGV 99157 x TKG 19A, ICGV 99157 x JSSP-HP 21, ICGV 99157 x ICGV86564, for mature pods in the cross ICGV 99157 x TG 47, for immature pods per plant in the crosses TAG 24 x BAU 13 and TAG 24 x ICGV 86564 for shelling out-turn in the cross K 4 x TKG 19A for sound mature kernel percentage in the crosses TAG 24 x JSSP-HP 21 and ICGV 99157 x TKG 19A. John *et al.* (2007) observed high GCV, heritability and GAM for plant height. John *et al.* (2008) reported high heritability for number of secondary branches per plant which corroborate with the results in the present study. Naik *et al.* (2000) observed higher heritability estimates and low genetic advance for the number of primaries. Reddy *et al.* (1995) reported low heritability for mature pods per plant. Vasanthi *et al.* (2004) reported moderate heritability and high GCV and GAM for number of immature pods per plant and sound mature kernel percentage. John *et al.* (2008) reported low to moderate values of heritability for shelling out-turn were reported by Vasanthi and Raja Reddy (2002) and Seethala devi (2004) which also corroborate with the results in the present study.

High heritability and high genetic advance for character in a population indicate the role of additive gene action in the inheritance of that particular trait. From the overall discussion, the promising crosses for different traits are as follows:

For plant height	-	ICGV 99157 x TG 47 and ICGV 99157 x BAU13
For number of primary branches	-	ICGV 99157 x JSSP-HP 21
For number of secondary branches	-	ICGV 99157 x TKG 19A, ICGV 99157 x JSSP-HP 21, ICGV 99157 x ICGV86564
For pod yield	-	ICGV 99157 x TG 47, ICGV 99157 x JSSP-HP 21
For shelling out-turn	-	K 4 x TKG 19A, ICGV9915 x TG 47, ICGV 99157 x TKG 19A
For sound mature kernel percentage	-	ICGV 99157 x TKG 19A, TAG 24 x BAU13 and TAG 24 x ICGV86564

Abbreviations: GCV=Genotypic Co-efficient of variation, PCV=Phenotypic Co-efficient of variation, GAM= Genetic Advance as per cent of Mean

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