The Andhra Agric. J 61(1):74-78, 2014

Influence of Dates of Sowing on Genetic Parameters for Yield and its Contributing Characters in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

Fifty groundnut genotypes were evaluated in three different environments represented by three dates of sowing. Phenotypic co-efficient of variation, genotypic co-efficient of variation, heritability and genetic advance as per cent of mean were computed for yield and yield contributing characters. Comparison of GCV values across environments indicated that for the characters, plant height, kernel yield per plant, pod yield per plant, harvest index, variation was high in the material studied. For these traits, heritability values were moderate to high which was reflected in moderate to high GAM values. For shelling and sound mature kernel percentage, GCV values were moderate with high heritability estimates resulting in moderate to high GAM values. Days to 50 per cent flowering had low GCV but heritability was high in all three environments with moderate genetic gain. For SCMR and SLA, the traits that confer water-use efficiency, GCV values were low with moderate heritability estimates with low genetic gain in the first two environments but in the third environment (August first fortnight sowing), GCV was higher than the first two environments with high heritability and moderate genetic gain from which it can be inferred that the selection for these traits would be more fruitful in this environment. Oil and protein contents seem to be more influenced by non additive genetic effects as both GCV and GAM were low though the heritability was high.

Key words : Heritability, Variability, Genetic advance, Groundnut.

Groundnut (*Arachis hypogaea* L.) is one of the most important oilseed crops of India and contributes about 30% of the total domestic supply of oil. India ranks second after china in groundnut production in the world with annual production of 5.64 million tonnes and are cultivated in an area of 6.40 million hectares and its productivity is 1144 kg ha-1 (FAO, 2010). In Andhra Pradesh, groundnut is cultivated in an area of 1.62 million hectares and its production is 1.45 million tonnes. Its productivity is 898 kg ha-1 (Annual Report, 2010-11, Ministry of Agriculture, GOI). In Andhra Pradesh, 80% of the area is cultivated in rainfed environment where the productivity is largely determined by the rainfall pattern during the crop period. The onset of the south west monsoon decides the time of sowing. But, due to variation in the onset of southwest (June to August) monsoon and subsequent rainfall pattern, the popularly grown varieties suffer from drought or excess moisture situation at critical stages of growth. Hence, the present study is carried out to study the influence of different dates of sowing on variability, heritability and different genetic parameters and to identify the suitable dates of sowing for selection of various traits in groundnut.

MATERIAL AND METHODS

The experiment was conducted at Dry land farm of S.V. Agricultural college, Tirupati, Acharya N.G. Ranga Agricultural University, which is located at an altitude of 182.9m above mean sea level on 79°E longitude and 13°N latitude and situated in the Southern Agro-climatic zone of Andhra Pradesh during *kharif*, 2011. The experimental material for the present investigation comprised of 50 genotypes. These genotypes were raised in a randomized block design (RBD) with two replications in three environments represented by three dates of sowing *i.e.,* June second fortnight (20-6-2011 – E I), July first fortnight (7-7-2011 – E II) and August first fortnight (12-8-2011 – E III) during *kharif*, 2011.Each genotype was grown in two rows of 3m length following a spacing of 30 cm x 10 cm between plants. All the recommended cultural

practices were adopted to raise a good crop. Five plants were selected at random from each genotype in each replication for recording observations. Data on twelve characters *i.e.,* plant height, Days to 50 per cent flowering, SPAD chlorophyll meter reading (SCMR), specific leaf area(SLA), relative injury (%), pod yield per plant, kernel yield per plant, shelling percentage, sound mature kernel percentage, harvest index, oil content and protein content were recorded. The genotypic and phenotypic variances were calculated following the method suggested by Johnson *et al*. (1955). The genotypic and phenotypic coefficients of variation (GCV and PCV) were calculated according to Burton (1952) and heritability was calculated according to Allard (1960). The genetic advance as per cent of mean was estimated as per the method suggested by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

Analysis of variance indicated that the differences were significant among the genotypes for all the characters studied in all the three environments (Table 1).

In environment I (June second fortnight sown crop), moderate genotypic co-efficient of variation (GCV) was recorded for plant height (13.87), pod yield per plant (14.83), harvest index (13.84) and kernel yield per plant (10.76). For all the other characters, GCV was found to be low. Heritability estimates were high for oil and protein contents (99.5%) followed by days to 50 per cent flowering (96.42%), sound mature kernel percentage (85.3%) and plant height (66.83%). Moderate heritability values were observed for SCMR, SLA, pod yield per plant and shelling percentage (Table 2 & 3). The characters, kernel

Table 1. Analysis of variance for yield and yield attributes in three environments.

Character	Mean sum of squares in Environment I			Mean sum of squares in Environment II			Mean sum of squares in Environment III		
	Replications (df=1)	Genotypes (df=49)	Error (df=49)	Replications (df=1)	Genotypes (df=49)	Error (df=49)	Replications (df=1)	Genotypes (df=49)	Error (df=49)
PH	54.460	92.550**	18.400	0.547	38.790**	20.790	0.547	38.790**	20.790
DF	0.090	4.932**	0.090	0.640	4.021**	0.190	0.640	4.021**	0.190
SCMR	0.300	8.660**	4.420	0.003	14.830**	0.001	0.003	14.830**	0.001
SLA	187.710	218.930**	112.150	3.147	251.980**	0.889	3.147	251.980**	0.889
RI (%)	0.430	1291.070**	0.056	0.334	63.178**	0.359	0.334	63.178**	0.359
KY	1.540	8.540**	5.360	2.317	5.798**	1.386	2.371	5.798**	1.386
PY	21.900	23.060**	6.310	9.000	12.710**	5.147	9.000	12.710**	5.147
SH (%)	68.520	66.630**	21.140	67.530	51.970**	20.230	67.530	51.970**	20.230
SMK (%)	28.620	93.670**	7.420	9.560	161.360**	28.380	9.560	161.360**	28.380
HI	0.003	0.013**	0.007	0.027	0.016**	0.010	0.027	0.016**	0.010
OC (%)	0.005	2.037**	0.001	0.001	1.674**	0.001	0.001	1.674**	0.001
PC (%)	0.001	0.580**	0.001	0.001	0.436**	0.003	0.001	0.436**	0.003

PH-plant height, DF-days to 50% flowering, SCMR- SPAD chlorophyll meter reading, SLA- specific leaf area, RI(%) - relative injury percentage, KY- kernel yield per plant, PY- pod yield per plant, SH(%) - shelling percentage, SMK (%) - sound mature kernel percentage,HI-harvest index, OC (%) - oil content and PC (%) – protein content.

** Significant at 1% level

Table 2. Mean, range and phenotypic co-efficient of variation for yield and yield contributing characters in three environments

S.No	Characters	Mean			Range						Coefficients of variation (PCV)		
					E_1		E_2		E_3				
		E_1	E_2	E_3	From	To	From	To	From	To	E_1	E_2	E_3
1	Plant height	43.87	40.30	33.96	29.7	60.00	28.70	59.50	24.00	47.60	16.97	20.70	16.06
2	Days to 50% flowering	25.59	25.51	26.36	24.00	29.00	24.00	29.50	24.50	29.50	6.19	5.74	5.50
3	SPAD chlorophyll meter reading (SCMR)	39.01	40.93	36.89	35.20	44.50	35.80	48.05	31.50	43.20	6.55	8.52	7.38
4	Specific leaf area (SLA)	132.01	126.47	142.74	111.06	161.90	104.45	149.02	120.00	169.60	9.74	7.66	7.87
5	Kernel yield/plant	11.71	14.83	6.34	8.80	16.60	9.78	28.62	3.40	12.10	22.50	22.42	29.88
6	Pod yield/plant	19.51	26.65	11.40	14.00	28.40	16.65	47.25	6.80	20.60	19.64	22.73	26.20
7	Shelling (%)	60.58	56.30	55.23	49.56	74.03	40.32	75.79	48.21	69.14	10.93	14.54	10.87
8	Sound mature kernel (%)	76.56	71.80	59.61	54.21	87.12	25.05	99.40	41.35	77.14	9.28	17.84	16.33
9	Harvest index	0.36	0.49	0.42	0.19	0.56	0.30	0.76	0.24	0.58	27.99	23.00	27.38
10	Oil content (%)	47.45	47.41	47.00	45.60	48.90	43.50	48.90	43.60	48.70	2.13	2.36	1.95
11	Protein content (%)	25.59	25.52	26.03	24.40	26.50	23.80	26.50	25.10	26.80	2.12	2.53	1.80

E_1 - Date of sowing 20-6-2011; E_2 - Date of sowing 7-7-2011; E_3 - Date of sowing 12-8-2011.

yield per plant and harvest index exhibited relatively lower heritability values. GAM was high for plant height followed by pod yield per plant, while it was moderate for days to 50 per cent flowering, kernel yield per plant, harvest index, shelling percentage and sound mature kernel percentage.

In environment II (July first fortnight sown crop), GCV was found to be high for kernel yield per plant (20.59), pod yield per plant (22.36) and harvest index while moderate GCV was recorded for plant height (12.32), shelling percentage (12.52) and sound mature kernel percentage (13.47). For all the other characters studied, GCV was low. Heritability was high for the traits, days to 50 per cent flowering (96%), kernel yield per plant (84.4%), pod yield per plant (96.8%), shelling percentage(74.1%), harvest index (70.7%), oil and protein contents (99.5 and 99.6%). It was moderate for the remaining traits. GAM was high for kernel yield per plant, pod yield per plant, harvest index, shelling and sound mature kernel percentages (Table 2 & 3).

In environment III (August first fortnight sown crop), highest GCV was recorded for kernel yield per plant (23.42) while it was moderate for pod yield per plant, sound mature kernel percentage and harvest index. For all the other traits, it was low. Heritability was high for days to 50 per cent flowering (90.9%), SCMR (99.7%), SLA (99.3%), kernel yield per plant (61.4%), sound mature kernel percentage (70.1%), oil and protein contents (99.4 and 98.7%). Moderate heritability was observed for the traits, plant height (30.2%), pod yield per plant (42.3%) and shelling percentage (44%). Harvest index (23.2%) recorded lower heritability value. Genetic advance as percent of mean was high for kernel yield per plant, pod yield per plant, sound mature kernel percentage and it was moderate for plant height, days to 50 per cent flowering, SCMR, SLA, shelling percentage and harvest index. It was low for the remaining traits (Table 2 & 3).

Table 3. Genetic parameters for yield and yield contributing characters under three environments in groundnut.

S.No	Characters	GCV			$(h^2_{(b)})$			(GAM)		
		E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
1	Plant height	13.87	12.32	8.83	66.83	35.40	30.20	23.37	15.10	10.00
2	Days to 50% flowering	6.08	5.63	5.25	96.42	96.00	90.90	12.30	11.36	10.31
3	SPAD chlorophyll meter reading (SCMR)	3.73	4.74	7.36	32.40	30.90	99.70	4.37	5.42	15.20
4	Specific leaf area (SLA)	5.53	4.73	7.84	32.25	38.10	99.30	6.47	6.02	16.11
5	Kernel yield/plant	10.76	20.59	23.42	22.86	84.40	61.40	10.60	38.97	37.80
6	Pod yield/plant	14.83	22.36	17.04	57.00	96.80	42.30	23.07	45.32	22.85
7	Shelling (%)	7.87	12.52	7.21	51.80	74.10	44.00	11.67	22.20	9.85
8	Sound mature kernel (%)	8.57	13.47	13.67	85.30	57.10	70.10	16.31	20.98	23.58
9	Harvest index	13.84	19.34	13.19	24.50	70.70	23.20	14.10	33.50	13.10
10	Oil content (%)	2.12	2.35	1.94	99.50	99.50	99.40	4.37	4.86	4.00
11	Protein content (%)	2.11	2.52	1.77	99.50	99.60	98.70	4.34	5.22	3.66

E_1 - Date of sowing 20-6-2011; E_2 - Date of sowing 7-7-2011; E_3 - Date of sowing 12-8-2011. PCV – phenotypic co-efficient of variation, GCV - genotypic co-efficient of variation, $(h^2_{(b)})$ – heritability (broad sense), GAM – genetic advance as percent of mean

Comparison of GCV values across environments indicated that for the characters, plant height, kernel yield per plant, pod yield per plant, harvest index, variation was high in the material studied. For these traits, heritability values were moderate to high which was reflected in moderate to high GAM values. For shelling and sound mature kernel percentage, GCV values were moderate with high heritability estimates resulting in moderate to high GAM values. Days to 50 per cent flowering had low GCV but heritability was high in all three environments with moderate genetic gain. For SCMR and SLA, the traits that confer water-use efficiency GCV values were low with moderate heritability estimates with low genetic gain in the first two environments but in the third environment (August first fortnight sowing), GCV was higher than the first two environments with high heritability and moderate genetic gain from which it can be inferred that the selection for these traits would be more fruitful in this environment. Oil and protein contents seem to be more influenced by non additive genetic effects as both GCV and GAM were low though the heritability was high.

Results in the present study are in conformity with reports of earlier workers i.e. Dashora and Nagda (2002), John *et al.* (2005) and Kumar and Rajamani (2004) for kernel yield per plant, Golakia *et al*.(2005), Chunilal *et al*. (2006) and Nazar Ali *et al.* (2000) for pod yield per plant, Vasanthi et al. (2004) for SCMR, Vasanthi *et al*. (2002) for harvest index and Vasanthi et al. (2004) for plant height.

From the results in the present study, it can be inferred that the characters, plant height, kernel yield and pod yield per plant, harvest index can be easily manipulated through simple phenotypic selection as these appear to be largely governed by additive gene action. Shelling and sound mature kernel percentages and harvest index seem to be also amenable for phenotypic selection as they recorded moderate estimates of genetic

parameters. While the traits, SCMR and SLA seem to be governed by non- additive genetic effects and hence selection has to be postponed to later generations as is the case with oil and protein contents. Among the three environments, second environment (crop sown in the first fortnight of July) seem to be more suitable for selection of traits, pod and kernel yields, shelling percentage, sound mature kernel percentage as both heritability and GAM values were high in this environment. For selection for harvest index, the second environment appears to be more suitable. Likewise for selection for SCMR and SLA, third environment seems to be congenial.

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(Received on 20.06.2012 and revised on 26.12.2012)