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Research Article

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Variability Studies for Yield, Yield Attributes, Water Use Efficiency and Quality Traits in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

Thirty genotypes of groundnut were studied during kharif, 2017 to estimate variability, heritability and genetic advance for twenty two characters contributing to yield, water use efficiency and quality. Analysis of variance revealed that there was a significant variation among the genotypes for all the characters studied. The characters number of immature pods per plant, number of mature pods per plant, kernel yield per plant, number of pods per plant, number of pegs per plant, total free amino acids and pod yield per plant exhibited high GCV and PCV indicating ample amount of variation among the genotypes. High heritability coupled with high genetic advance as per cent of mean were recorded for the characters plant height, number of pegs per plant, number of mature pods per plant, number of pods per plant, kernel yield per plant, carbohydrate content and total free amino acids indicating the preponderance of additive gene action in expression of these characters and selection would be effective for improvement of these characters.

Keywords: *Groundnut, Variability, Heritability, Genetic advance*

INTRODUCTION

Groundnut is a segmental allotetraploid having chromosome number 2n = 40. It is grown mostly for its oil content. It contains 36-54 % of edible oil, 22-36% of easily digestible protein and 18 % of carbohydrates in its seeds. It is native of Brazil and widely grown in tropical, sub-tropical and warm temperate regions of the world.

The study of different genetic parameters is necessary to know the variability present in the genotypes.

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A thorough knowledge of genetic variability present in the different cultivars, heritability of various characters and probable genetic advance to be expected from selection of superior lines aids in the effective selection of desirable genotypes. Groundnut is mainly cultivated under rainfed conditions. Even in irrigated areas, groundnut is frequently exposed to drought because water supply is not sufficient which has its adverse effect on yield, productivity and quality. It was also confirmed that substantial genotypic variation for water use efficiency exists in groundnut. Hence the physiological traits like SLA, SCMR, and relative water content will be useful for the selection of genotypes having high water use efficiency.

MATERIALS AND METHODS

Thirty genotypes of groundnut were evaluated in *Kharif* 2017 using Randomized Block Design at dryland farm, S. V. Agricultural College, Tirupati. Each genotype was sown in three rows of 2.5 m length with the spacing of 30 cm x 10 cm. FYM was applied @ 5t/ acre and recommended dose of chemical fertilizers @ of 20 kg N, 40 kg P2O5 and 50 kg K2O per hectare in the form of urea, single super phosphate and Muriate of potash were broadcasted before sowing. Seed treatment was done with Carbendazim, *Trichoderma viride* and *Rhizobium*. Larvin @ 1g lit^{-1} was used to control insect pests.

The data was recorded for twenty two characters *viz.,* days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of pegs per plant, number of mature pods per plant, number of immature pods per plant, total number of pods per plant, 100-kernel weight, shelling percent, harvest index, kernel yield per plant, SLA at 40 DAS, SLA at 60 DAS, SCMR at 40 DAS, SCMR at 60 DAS, relative water content, oil content, protein content, carbohydrate content, total free amino acids and pod yield per plant. Data was recorded for five plants which were randomly selected from each genotype. For the characters like days to 50% flowering, days to maturity, oil content, protein content, carbohydrate content, total free amino acids it was recorded on plot basis. The analysis of variance was done by using the mathematical model proposed by Panse and Sukhatme (1961). The analysis of GCV and PCV was done by the formula given by Burton (1952). Genetic advance was estimated using the formulae given by Johnson et al, (1955). The quality parameters were estimated by using the biochemical procedures given by Sadasivam and Manickam (1961).

RESULTS AND DISCUSSION

Analysis of variance for 22 characters studied in this experiment is presented in Table 1. It showed that there was a significant difference among the genotypes for all the characters. Phenotypic coefficient of variation is greater than genotypic coefficient of variation for all the traits indicating the effect of environment on these traits (Table 2). These results are in accordance with the results obtained by Narasimhulu et al, (2012) Yusuf et al, (2017). Aparna et al, (2018) and Mahesh et al, (2018).

The characters number of immature pods per plant, number of mature pods per plant, kernel yield per plant, number of pods per plant, number of pegs per plant, total free amino acids and pod yield per plant exhibited high GCV and PCV indicating ample amount of variation among the genotypes and selection would be effective for further improvement of these characters. The results of Mahesh et al, (2018) are similar to the present report of high GCV and PCV for number of immature pods per plant, number of mature pods per plant and kernel yield per plant. High estimates of GCV and PCV for kernel yield per plant was also reported by Mukesh and Lal (2017), Chavadhari et al, (2017) and Hussein et al, (2018) High GCV and PCV for number of pods per plant and pod yield per plant were in accordance with the results obtained by Hussein et al, (2018). High GCV and PCV for kernel yield per plant and pod yield per plant was also reported by Nandini et al, (2011) and Venkataramana et al, (2015).

Moderate GCV and moderate PCV was exhibited by plant height, SLA at 60 DAS

and carbohydrate content. Moderate estimates of GCV and PCV for plant height is similar with the results of Nandini et al, (2011) Chavadhari et al, (2017) Yusuf et al, (2017) and Hussein et al, (2018). The characters days to 50% flowering, days to maturity, shelling percentage, SCMR at 40 DAS, SCMR at 60 DAS, relative water content, oil content and protein content recorded low GCV and PCV. Lower estimates of GCV and PCV for days to 50% flowering was in accordance with the results of Chavadhari et al, (2017) Mukesh and Lal (2017), Hussein et al, (2018) and Mahesh et al, (2018). Chavadhari et al, (2017), Mukesh and Lal (2017) also reported low estimates of GCV and PCV for days to maturity. Results of low GCV and PCV for shelling percentage, protein content and oil content were similar to the reports of Omprakash and Nadaf (2017). Lower estimates of GCV and PCV for oil content and shelling percentage were also recorded by Mahesh et al, (2018). The characters plant height exhibited high heritability followed by oil content, days to 50% flowering, SCMR at 60 DAS, carbohydrate content, total free amino acids, number of mature pods per plant, protein content, number of pegs per plant, SCMR at 40 DAS, number of pods per plant and kernel yield per plant indicating that the effect of environment is least in expression of these characters.

High heritability coupled with high genetic advance as per cent of mean were recorded for the characters plant height, number of pegs per plant, number of mature pods per plant, number of pods per plant, kernel yield per plant, carbohydrate content and total free amino acids indicating the preponderance of additive gene action inexpression of these characters and selection would be effective forimprovement of these characters. High heritability coupled with high genetic advance as per cent of mean for number of mature pods per plant and kernel yield per plant were also reported by Bhargavi et al, (2016), Chavadhari et al, (2017), Yusuf et al, (2017) and Mahesh et al, (2018). Bhavya et al, (2017), Yusuf et al, (2017) and Mahesh et al, (2018), also reported high heritability coupled with high genetic advance as per cent of mean for plant height. Bhavya et al, (2017), reported similar kind of results for number of pods per plant. Nandini et al, (2011), also reported high heritability coupled with high genetic advance as per cent of mean for plant height and number of pods per plant.

High heritability with moderate genetic advance as per cent of mean was exhibited by the characters days to 50 % flowering and SCMR at 60 DAS indicating the presence of both additive and non-additive gene action with preponderance of additive genetic variance and selection would be effective to some extent. High heritability with moderate genetic advance as per cent of mean for days to 50% flowering was also reported by Balaraju and Kenchanagoudar (2016). The characters SCMR at 40 DAS, oil content and protein content recorded high heritability coupled with low genetic advance as percent of mean. Silimilar kind of results for oil content was obtained by Bhargavi et al, (2016), The characters number of primary branches per plant, hundred kernel weight and harvest index showed moderate heritability coupled with moderate genetic advance as per cent of mean. Venkataramana et al, (2015), recorded similar kind of results for hundred kernel weight.

Moderate heritability coupled with high genetic advance as per cent of mean was exhibited by the characters number of immature pods per plant, pod yield per plant and SLA at 60 DAS suggesting that pedigree method of breeding and phenotypic selection can be used for improvement of these characters. Moderate heritability coupled with high genetic advance as per cent of mean was also reported by Venkataramana et al, (2015) for pod yield per plant.

Moderate heritability and low genetic advance as per cent of mean were recorded for the characters days to maturity and relative water content. Moderate heritability and low genetic advance as per cent of mean for relative water content was in conformity with the findings of Srivalli and Nadaf (2016). The

characters shelling percentage and SLA at 40 DAS showed low heritability coupled with low genetic advance as per cent of mean indicating that these characters are highly influenced by the environment and the selection would be ineffective.

Table 1: Analysis of variance for 22 characters in 30 genotypes of groundnut

S.No	Character	Mean sum of squares		
		Replications (df:2)	Treatments (df:29)	Error (df:58)
1	Days to 50 % flowering	1.078	20.431**	0.572
2	Days to maturity	26.144	39.579**	8.489
3	Plant height	4.259	153.885**	1.392
4	Number of primary branches per plant	0.546	1.535**	0.604
5	Number of pegs per plant	12.994	122.418**	15.307
6	Number of mature pods per plant	14.872	46.739**	5.545
7	Number of immature pods per plant	0.152	1.467*	0.372
8	Number of pods per plant	12.076	53.401**	8.104
9	Hundred kernel weight	37.753	65.933**	14.149
10	Shelling percentage	22.218	27.401*	12.692
11	Harvest index	19.849	51.985**	11.718
12	Kernel yield per plant	8.350	19.939**	3.571
13	SLA at 40 DAS	416.208	1064.781**	505.163
14	SLA at 60 DAS	682.021	2601.710**	569.080
15	SCMR at 40 DAS	7.095	18.442**	2.328
16	SCMR at 60 DAS	6.065	29.441**	2.027
17	Relative water content	16.004	60.700**	15.304
18	Oil content	0.001	3.069**	0.072
19	Protein content	0.0006	0.008**	0.001
20	Carbohydrate content	0.021	0.850**	0.070
21	Total free amino acids	0.006	0.139**	0.012
22	Pod yield per plant	11.979	38.988**	9.307

*, ** significance at 5 % and 1 % level respectively

Table 2: Mean, range, coefficient of variation, heritability (broad sense) and genetic advance as per cent of mean for 22 characters in 30 groundnut genotypes

S No.	Character	Mean	Range		variance		Coefficient of variation		Heritability (broad sense) (%)	Genetic advance (GA)	Genetic advance as per cent of mean (%)
			Min	Max	genotypic	phenotypic	Genotypic	Phenotypic			
1	Days to 50 % flowering	32.84	27.33	37.33	6.62	7.19	7.83	8.17	92.00	5.09	15.48
2	Days to maturity	96.48	89.33	104.00	10.36	18.85	3.34	4.50	55.00	4.92	5.10
3	Plant height (cm)	44.80	34.40	63.74	50.83	52.22	15.91	16.13	97.30	14.49	32.34
4	Number of primary branches per plant	4.70	3.80	6.07	0.31	0.92	11.87	20.37	33.90	0.67	14.24
5	Number of pegs per plant	23.74	15.27	45.73	35.70	51.01	25.17	30.09	70.00	10.30	43.39
6	Number of mature pods per plant	12.99	7.93	26.00	13.73	19.28	28.52	33.80	71.20	6.44	49.59
7	Number of immature pods per plant	1.80	0.93	3.53	0.365	0.74	33.65	47.80	49.50	0.88	48.78

8	Number of pods per plant	14.71	8.93	28.40	15.09	23.20	26.41	32.74	65.10	6.46	43.89
9	Hundred kernel weight (g)	42.66	32.77	51.84	17.26	31.41	9.74	13.14	55.00	6.35	14.87
10	Shelling percentage	58.31	49.14	68.39	4.90	17.59	4.45	8.42	27.90	2.41	4.83
11	Harvest index (%)	37.71	18.72	53.65	13.42	25.14	9.70	13.28	53.40	5.51	14.60
12	Kernel yield / plant (g)	8.51	5.19	15.59	5.46	9.03	27.46	35.32	60.40	3.74	43.98
13	SLA at 40 DAS ($cm^2 g^{-1}$)	188.71	164.46	224.30	186.54	691.70	7.24	13.94	27.00	14.61	7.74
14	SLA at 60 DAS ($cm^2 g^{-1}$)	181.66	149.55	237.85	677.54	1246.62	14.33	19.43	54.40	39.53	21.76
15	SCMR at 40 DAS	37.85	32.70	41.93	5.37	7.70	6.12	7.33	69.80	0.70	5.11
16	SCMR at 60 DAS	38.60	33.00	48.13	9.14	11.17	7.83	8.66	81.80	5.63	14.59
17	Relative water content (%)	75.82	68.17	92.60	15.13	30.44	6.39	9.06	49.70	5.65	9.28
18	Oil content (%)	47.16	45.15	49.05	0.99	1.07	2.12	2.20	93.30	1.99	4.22
19	Protein content (%)	25.61	24.10	26.60	0.002	0.003	0.95	1.12	71.00	0.08	1.64
20	Carbohydrate content (%)	16.68	7.00	24.50	0.27	0.34	12.62	14.21	78.90	0.95	23.11
21	Total free amino acids (mg g^{-1})	0.89	0.61	1.73	0.04	0.05	23.15	26.14	78.4	0.37	42.24
22	Pod yield/ plant (g)	14.49	8.94	24.49	9.89	19.20	21.71	30.25	51.5	4.65	32.11

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