Electronic Journal of Plant Breeding, 8(4): 1288-1292 (Dec 2017)
ISSN 0975-928X
DOI: 10.5958/0975-928X.2017.00184.3

Research Note

Genetic variability studies in groundnut (*Arachis hypogaea* L.)

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(Received: 24 July 2017; Revised: 28 Dec 2017; Accepted 28 Dec 2017)

Abstract
Seventy groundnut genotypes were evaluated for quantitative and yield parameters. A wide range of variation was observed for important yield components. High estimates of the genotypic coefficient of variation (GCV) were observed for kernel yield per plant followed by the number of branches per plant, harvest index and biological yield per plant. The estimates of heritability were observed to be high for harvest index followed by biological yield per plant, kernel yield per plant, 100-kernel weight, plant height, 100-pod weight and number of branches per plant indicated that these characters were less influenced by the environmental fluctuations. High heritability along with high genetic advance was observed for 100-pod weight. High heritability along with moderate genetic advance was observed for biological yield per plant, 100-kernel weight and harvest index indicating that these traits were mainly governed by additive gene action and responsive for further improvement of these traits.

Keywords
Genetic variability, heritability, genetic advance, groundnut (*Arachis hypogaea* L.).

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. Genetic variability is the basic requirement for crop improvement as it provides wider scope for selection. Thus, effectiveness of selection is dependent upon the nature, extent and magnitude of genetic variability present in the material and the extent to which it is heritable. Hence, in present investigation an attempt was made to assess the variability of important pod yield and yield contributing traits, along with the indices of variability *i.e.* genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sense (h^2_{bs}), genetic advance (GA) and genetic advance as percentage of mean (GAM). This study had facilitated an understanding behind expression of character and also role of environment therein. Seventy genotypes of groundnut were sown in a Randomized Block Design (RBD) with three replications at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh during the summer season of 2015. Each genotype was accommodated in a single row of 2.0 m length with a spacing of 30 cm between rows and 10 cm between plants within the row. The experiment was surrounded by two guard rows to avoid damage and border effects. The fertilizers in the experimental area were applied at the rate of 25.0 N_2, 50.0 P_2O_5 and 50.0 K_2O kg per hectare, as it is a recommended dose for summer cultivation of groundnut in the region. Other recommended agronomical practices in vogue were followed for reaping good crop. Data were recorded on fifteen characters *viz*., days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, number of mature pods per plant, sound mature kernels, pod yield per plant (g), 100-pod weight (g), kernel yield per plant (g), 100-kernel weight (g), biological yield per plant (g), shelling out-turn (%), harvest index (%) and oil content (%). Except, days to 50% flowering and days to maturity where, data recorded on plot basis, data on rest of the morphological traits were recorded on randomly selected five competitive plants from each accession and average value was used for the statistical analysis. The data subjected to different statistical analysis *viz*., analysis of variance and magnitude of genetic variability were performed following the standard procedures, phenotypic and genotypic coefficient of variation as suggested by Burton (1952), heritability (broad sense) and genetic advance as followed by Allard (1960).

The analysis of variance showed significant differences among the accessions indicating sufficient variability exist among the accessions (Table 1). The present experimental material showed a wide range of variation for kernel yield per plant followed by number of mature pods per plant, pod yield per plant and number of branches per plant (Table 2). The highest genotypic coefficient of variation (GCV) was observed for kernel yield per plant followed by number of branches per plant, harvest index and biological yield per plant. Wide range of phenotypic coefficients of variation (PCV) observed for kernel yield per plant, pod yield per plant, number of mature pods per plant, harvest index and biological yield per plant. The highest phenotypic coefficient of variation was observed for kernel yield per plant

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followed by number of mature pods per plant, number of primary branches per plant, biological yield per plant, harvest index and 100-kernel weight. Narrow differences observed between the PCV and GCV in certain cases like days to 50% flowering, days to maturity, plant height, 100-pod weight, 100-kernel weight, biological yield per plant and harvest index indicated that these characters were less influenced by the environments. Similar results were also obtained for days to 50% flowering by Sonone *et al.*, 2011 and Choudhary *et al.*, 2013, for days to maturity by Choudhary *et al.*, 2013.

The highest value of GCV was observed for kernel yield per plant followed by number of branches per plant, harvest index and biological yield per plant. High magnitude of GCV indicated the presence of wide variation for the characters under studied to allow further improvement by selection of the individual trait. High estimates of GCV in groundnut have been also reported for kernel yield per plant by Gupta *et al.*, 2015; Ramana *et al.* 2015 and Rao *et al.*, 2015; for number of branches per plant by Gupta *et al.*, 2015 and Vasanthi *et al.*, 2016; for harvest index by Yadav *et al.*, 2014; Ramana *et al.*, 2015, Vasanthi *et al.*, 2016 and Bhargavi *et al.*, 2016; for biological yield per plant by Vaddodariya *et al.*, 2014 and Gupta *et al.*, 2015.

In the present study, moderate values of GCV were observed for 100-kernel weight which was accordance with the earlier findings of Rao *et al.*, 2014 and Ramana *et al.*, 2015, for numbers of mature pod per plant by Rao *et al.*, 2014; for 100-pod weight by John *et al.*, 2013, for plant height by Maurya *et al.*, 2014 and Rao *et al.*, 2014; for pod yield per plant by Maurya *et al.*, 2014.

The low estimates of GCV were observed for days to 50% flowering akin with the findings of Kadam *et al.*, 2016 and Vasanthi *et al.*, 2016, for days to maturity by Sonone *et al.*, 2011, for sound mature kernels by Parmeshwarappa *et al.*, 2010, for shelling out-turn by Kadam *et al.*, 2016, for oil content by Korat *et al.*, 2009, thereby indicating narrow genetic variability for these characters in the material studied.

The high estimates of heritability were observed for harvest index followed by biological yield per plant, kernel yield per plant, 100-kernel weight, plant height, 100-pod weight and number of branches per plant. High heritability estimates have been reported for harvest index by Ramana *et al.*, 2015 and Bhargavi *et al.*, 2016, for biological yield per plant by Gupta *et al.*, 2015; Bhargavi *et al.*, 2016, kernel yield per plant by Ramana *et al.*, 2015 and Rao *et al.*, 2015 and Bhargavi *et al.*, 2016, for 100-kernel weight by Rao *et al.*, 2015; Bhargavi *et al.*, 2016, for plant height by Kadam *et al.*, 2016, for 100-pod weight by Gupta *et al.*, 2015, for number of branches per plant by Yadlapalli, 2014. The moderate heritability estimates were expressed by sound mature kernels, pod yield per plant, number of mature pods per plant, days to 50% flowering and days to maturity. The oil content and shelling out-turn exhibited low estimates of heritability. The moderate heritability estimates were earlier found to be for pod yield per plant by Savaliya, 2009 and Vasanthi *et al.*, 2016, for number of mature pods per plant by John *et al.*, 2013, for days to maturity by Savaliya, 2009. The estimates of heritability were low for oil content and shelling out-turn.

The highest genetic advance was observed for 100-pod weight. It was moderate for biological yield per plant, 100-kernel weight, sound mature kernels and harvest index.

High estimates of heritability coupled with high genetic advance expressed as percentage of mean was observed for kernel yield per plant, 100-kernel weight, plant height, 100-pod weight, biological yield per plant, harvest index and number of branches per plant. Which may be attributed to the preponderance of additive gene action and possessed high selective value thus, selection pressure could profitably be applied on these characters for their rationale improvement (Panse, 1957). Similar results were also obtained for kernel yield per plant by Choudhary *et al.*, 2013.

High estimates of heritability coupled with high genetic advance expressed as percentage of mean was observed for kernel yield per plant, pod yield per plant, number of mature pods per plant, number of primary branches per plant, 100-kernel weight, 100-pod weight, biological yield per plant and harvest index, which may be attributed to the preponderance of additive gene action and these traits possessed high selective value. Therefore, it was amply clear that these traits were less influence by the environmental changes and hence improvement in these traits would be more effective through the selection owing to their additive gene effects. Similar results were also obtained for kernel yield per plant by Choudhary *et al.*, 2013, for pod yield per plant by Dewangan *et al.*, 2015, for number of mature pods per plant by Rao *et al.*, 2014, for harvest index by Ramana *et al.*, 2015 and for 100-kernel weight by Rao *et al.*, 2012. Moderate estimate of heritability with moderate GAM genetic advance expressed as percentage of mean was observed for sound mature kernels. Which revealed the presence of non-additive gene action and influence of environment in the expression of this character thus, the selection would be less effective.

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Table 1. Analysis of variance showing mean squares for 15 characters in 50 genotype of groundnut

Source	d. f.	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of mature pods per plant	Sound mature kernels (%)	Pod yield per plant (g)
		1	2	3	4	5	6	7
Replications	02	20.98*	8.64	63.25**	5.75**	41.55**	186.96*	43.56**
Genotypes	69	15.60**	14.73**	78.57**	6.40**	17.65**	195.07**	23.01**
Error	138	4.34	5.76	5.65	0.71	3.83	37.56	4.83

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

Table 1. (*Contd.*)

Source	d. f.	100-pod weight (g)	Kernel yield per plant (g)	100-kernel weight (g)	Biological yield per plant (g)	Shelling out-turn (%)	Harvest index (%)	Oil content (%)
		8	**9**	**10**	**11**	**12**	**13**	**14**
Replications	02	300.34*	69.18**	62.45*	75.23*	134.43*	20.76*	63.66*
Genotypes	69	548.03**	43.31**	183.46**	261.69**	38.94*	90.80**	21.99**
Error	138	56.89	2.37	12.74	12.62	24.19	3.70	11.64

*, ** Significant at 5% and 1% levels, respectively

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Table 2. Estimates of range of variation, mean, phenotypic (PCV) and genotypic coefficients of variation (GCV), heritability (h^2_{bs}), genetic advance (GA) and genetic advance expressed as per cent of mean (GAM) for 15 characters of groundnut

SI. NO.	Characters	Range of variation			Mean	PCV (%)	GCV (%)	Heritability in broad sense h^2(bs)	Genetic advance (GA)	GA expressed as % of mean (GAM)
		Mini.		Maxi.						
1.	Days to 50% flowering	31.40	-	42.23	36.15	7.87	5.36	46.31	2.71	7.50
2.	Days to maturity	113.00	-	122.33	117.31	2.52	1.47	34.13	2.08	1.77
3.	Plant height (cm)	21.87	-	40.40	29.88	18.31	16.49	81.12	9.14	30.61
4.	No. of branches/plant	4.07	-	10.00	6.62	24.40	20.78	72.56	2.41	36.47
5.	No. of mature pods/plant	6.00	-	18.60	11.55	25.15	18.57	54.53	3.26	28.25
6.	Sound mature kernels (%)	59.73	-	93.07	76.40	12.42	9.48	58.29	11.39	14.91
7.	Pod yield/plant (g)	6.75	-	23.00	15.20	21.70	16.18	55.63	3.78	24.86
8.	100-pod weight (g)	71.67	-	132.00	100.13	14.83	12.77	74.21	22.70	22.67
9.	Kernel yield/plant (g)	3.37	-	20.06	8.87	45.10	41.62	85.18	7.02	79.14
10.	100-kernel weight (g)	30.13	-	67.67	40.98	20.36	18.40	81.70	14.04	34.26
11.	Biological yield/plant (g)	31.80	-	69.33	44.25	22.09	20.58	86.80	17.48	39.51
12.	Shelling out-turn (%)	57.07	-	74.80	67.53	7.98	3.28	16.89	1.87	2.77
13.	Harvest index (%)	13.73	-	36.08	25.94	22.05	20.77	88.68	10.45	40.29
14.	Oil content (%)	44.07	-	56.16	48.32	8.04	3.84	22.85	1.82	3.78