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Genetic variability studies for yield and yield related traits in groundnut (*Arachis hypogaea* L.)

Anil Kulheri, RS Sikarwar and Shyam Singh Rajput

Abstract
The Present investigation of experimental yield trial on genetic variability involving 36 genotypes of groundnut were carried out in kharif season 2018-19 at Research farm, Department of genetics and plant breeding, college of agriculture, RVSKVV, Gwalior (M.P.). The 14 traits were recorded and genetic parameters *viz.*, PCV, GCV, heritability and genetic advance as per cent of mean were studied. The analysis of variance revealed genotypes were significantly differed for all the characters, thereby, indicating variability for all the characters. The estimation of high heritability value coupled with high genetic advance was recorded for pod yield per hectare, followed by number of primary branches per plant, pod yield per plant, kernel yield per hectare, kernel yield per plant, number of secondary branches per plant, 100 pod weight, number of pod per plant, 100 kernel weight and plant height indicating that the inheritance of these characters were most likely due to additive gene effects and direct selection for these traits would be more effective for desired genetic improvement. The genotypes *viz*. ICGV-8705, ICGV-13564, ICGV-13565, PBS-12201, ICGV-13574 and ICGV-13555 demonstrated high mean performance for pod yield and its related traits.

Keywords: Groundnut, genetic variability, heritability and genetic advance

Introduction

Groundnut (*Arachis hypogaea* L.) is a member of *Papilionaceae*, subfamily of the *Fabaceae* family which comprises important edible oil seed crops in the world. The cultivated groundnut (*Arachis hypogaea* L.) originated in South America. It is popularly known as the "King" of oilseeds or "Wonder nut" or "Poor man's cashew nut" or "earthnut" (Thamaraikannan *et al.*, 2009) [14]. It is an important source of oil, food and feed legume, where groundnut seeds (kernels) contain 35.8 - 54.2% oil, 16.2-36.0% protein (Dwivedi *et al*. 1990) [6] and 10-20% carbohydrate (Salunkhe *et al.* 1992) [13]. It provides 564 kcal of energy from 100 g of kernels. The seeds are also a good source of minerals like calcium, phosphorus and iron and vitamins like E, niacin, folacin, riboflavin and thiamine. Groundnut haulms constitute nutritious fodder for livestock. They contain protein (8-15%), lipids (1-3%), minerals (9-17%) and carbohydrate (38-45%) at levels higher than those of the cereal fodders. The digestibility of nutrients in groundnut haulm is around 53% and that of crude protein is 88% in animals (Nagaraj, 1988) [10]. In India, it is grown over in area of 48.10 lakh hectares with total production of 66.9 lakh metric tonnes (Anonymous, 2019) [1]. Genetic variability is an essential prerequisite for crop improvement programmes for obtaining high yielding varieties, through the estimation of different genetic parameters like components of variances, genotype and phenotype coefficients of variability, heritability and genetic advance. The production of cultivars via selection and hybridization demands a large quantity of resources for the use of available genetic diversity to adapt to diverse environmental circumstances. The efficiency of the breeding material for the desired characteristic depends on the type, size and amplitude of its genetic variability. Genotypical variability estimate coefficient delivers strong implication for genetic potential enhancement of crops through selection (Johnson *et al*., 1955) [9]. Heritability and genetic advance for breeders are highly helpful biometric tools to determine the selection's direction and extent. High heritability alone is insufficient for effective selection in advanced generations and without significant genetic advance. The high heritability and genetic advance of a given characteristic display that it is driven by additive gene action and accordingly, the most efficient selection condition. It is important to identify plant characteristics that affect productivity for reproductive programmes to increase groundnut production. In order to improve the efficiency of seed-selection and pod yield, knowledge on the type and scale of genetic variability and transmission of characteristics is of crucial relevance.

Materials and Methods

The experiment consisting of 36 groundnut genotypes for 14 traits was conducted in a randomized block design (RBD) with three replication at Research Farm, Department of Genetics and Plant Breeding, RVSKVV, College of Agriculture, Gwalior (M.P.) during the *Kharif* season 2018-19. In each replication each genotype was sown in one rows of 5m length with a spacing of 30 cm x 10 cm. The 14 quantitative characters *viz*., Days to maturity, Days to 50% flowering, plant height (cm), Number of primary branches per plant, Number of secondary branches per plant, Number of pods per plant, Pod yield per plant (gm), 100 pod weight (gm), Kernel yield per plant (gm), 100-kernel weight (gm), Shelling percentage (%), Sound mature kernel (%), Pod yield per hectare (kg) and Kernel yield per hectare (kg) were recorded on five randomly selected plants from each genotype in each replication. The mean values were used for analysis for variance. The statistical analysis for variance was worked out according to Panse and Sukhatme (1985) [11]. The phenotypic and genotypic coefficients of variation were estimated according to the method suggested by Burton (1952) [4]. Heritability in broad sense was estimated by using the formula given by Hanson *et al*. (1956) [7] and was expressed in percentage. Genetic advance and genetic advance as per cent of mean were computed and categorized as low (< 10%), moderate (10 - 20%) and high (> 20%) according to the method suggested by Johnson *et al*. (1955) [9].

Results and Discussion

Analysis of variance

Analysis of variance revealed that genotypes were significant for all the fourteen characters *viz*. plant height (cm), days to 50% flowering, days to maturity, number of primary branches per plant, number of secondary branches per plant, number of pod per plant, pod yield per plant (gm), 100 pod weight (gm), kernel yield per plant (gm), 100 kernel weight (gm), shelling percentage (%), sound mature kernel (%), pod yield per hectare (kg) and kernel yield per hectare (Table 1).

Table 1: Analysis of variance for 14 characters in 36 groundnut genotypes

S. N.	Source of variation	d.f	Plant height (cm)	Days to 50% flowering	Days to maturity	Number of primary branches per plant	Number of secondary branches per plant	Number of pods per plant	Pod yield per plant(gm)	100 pod weight (gm)	Kernel yield per plant (gm)	100 kernel weight (gm)	Shelling %	Sound mature kernel	Pod yield per ha.(kg)	Kernel yield per ha.(kg)
1	Replications	2	15.2568	0.2500	0.4537	0.0045	0.0019	60.0278	0.3073	432.2500	0.3584	32.5278	36.6520	0.2500	28748.48	39028.59
2	Treatments	35	35.8149***	11.4952***	11.3355***	0.9726***	1.0391***	111.3048***	33.2492***	1406.6762***	14.1338***	97.2476***	23.129**	40.5595***	3751021.27***	1566367.18***
3	Error	70	2.8921	2.3262	2.4347	0.0117	0.01909	4.6849	0.4451	33.5643	0.1929	6.5278	10.9397	1.9167	44898.4339	21079.64
4	S. Ed ±	-	0.9818	0.8806	0.9009	0.0624	0.0798	1.2497	0.3852	3.3449	0.2536	1.4751	1.9096	0.7993	122.3362	83.8245
5	CD 5%	-	2.7693	2.4837	2.5409	0.1760	0.2250	3.5247	1.0865	9.4344	0.7152	4.1606	5.3861	2.2545	345.0576	236.4327
6	CD 1%	-	3.6767	3.2975	3.3735	0.2337	0.2987	4.6796	1.4424	12.5255	0.9496	5.5238	7.1509	2.9932	458.1129	313.8980

*** Significant at .1%, **Significant at 1%, *Significant at 5%

Mean Performance

Mean performance revealed that six genotypes showed significantly higher kernel yield per hectare compared to other genotypes. Genotypes ICGV-8705 showed significantly higher kernel yield with pods yield per plant, kernel yield per plant, pod yield per hectare and sound mature kernel. The increased kernel yield in genotypes ICGV-13564 was due to number of primary branches per plant, number of pods per plant, kernel yield per plant, pod yield per plant and pod yield per hectare. Similarly, ICGV-13565 also observed the high kernel yield potential as it had 100 pods weight, 100 kernel weight, pod yield per plant, kernel yield per plant and pod yield per hectare. The genotypes PBS-12201 recorded fairly high kernel yield potential which was due to fairly higher performance kernel yield per plant, pod yield per plant and sound mature kernel. ICGV-13574 registered superior performance for number of primary branches per plant, kernel yield per plant and sound mature kernel, while ICGV-13555 showed higher mean values for 100 pods weight and kernel yield per plant. These result suggested that the genotypes ICGV-8705, ICGV-13564, ICGV-13565, PBS-12201, ICGV-13574 and ICGV-13555 could be used as donors for kernel yield improvement in groundnut.

Phenotypic and genotypic coefficient of variation:

In present investigation among all the characters studied, Pod yield per hectare recorded the highest PCV and GCV followed by pod yield per plant, kernel yield per hectare, kernel yield per plant and number of pods per plant. Whereas, 100 pod weight,100 kernel weight, number of primary branches per plant, number of secondary branches per plant and plant height observed as moderate estimates of PCV and GCV values which suggested that these characters were least affect by environment. High proportion of GCV to PCV is desirable in process because it depicts that traits are much under the genetic control rather than the environment. The results are in confirmation with Zaman *et al*. (2011) [16] and Bhargavi *et al*. (2017) [2]. The minimum GCV and PCV was exhibited by the characters days to 50%, flowering by shelling percentage, sound mature kernel and days to maturity indicates that selection for these characters is less effective, these result were in agreement with Rao *et al*. (2015) [12], Zaman *et al*. (2011) [16] and Bhargavi *et al*. (2017) [3].

Heritability (broad sense) and genetic advance

Estimation of high heritability value coupled with high genetic advance was recorded for pod yield per hectare, followed by number of primary branches per plant, pod yield per plant, kernel yield per hectare, kernel yield per plant, number of secondary branches per plant, 100 pod weight, number of pod per plant, 100 kernel weight and plant height indicating that the inheritance of these characters were most likely due to additive gene effects. Similar result finding has been reported Zamen *et al*. (2011) [16], Bharagavi *et al*. (2017) [3] and Chavadhari *et al*. (2017) [5]. High heritability with moderate genetic advance was observed for sound mature kernel, indicating that the inheritance of these trait were likely due to non additive gene effect and further limited scope of improvement for this traits. Low heritability with low genetic advance was observed for shelling percentage indicating that these character was highly affect by environment and selection for these character is not effective. Similar result earlier reported by Vishnuvardhan *et al*. (2012) [15]. Moderate heritability and low genetic advance was observed for days to 50% flowering and days to maturity, indicating the influence of both additive and non additive gene action.

Table 2: Parameters of genetic variability for yield traits in genotypes of groundnut

S.N.	Character	Mean	Range		PCV (%)	GCV (%)	h^2b (%)	GA as % of mean
			Min.	Max.				5%
1	Plant height	27.19	20.40	34.10	13.69	12.18	79.14	22.33
2	Days to 50% flowering	35.39	29.67	39.0	6.56	4.94	56.78	7.67
3	Days to maturity	110.41	104.67	114.00	2.11	1.56	54.93	2.38
4	Number of primary branches per plant	3.67	3.00	5.40	15.68	15.40	96.48	31.17
5	Number of secondary branches per plant	3.68	2.40	4.77	16.28	15.84	94.68	31.76
6	Number of pods per plant	24.72	15.00	37.00	25.65	24.11	88.35	46.69
7	Pod yield per plant (gm)	11.09	5.83	20.03	30.41	29.81	96.09	60.20
8	100 pod weight	115.28	80.00	152.00	19.23	18.56	93.17	36.90
9	Kernel yield per plant	7.37	3.93	13.50	29.86	29.27	96.01	59.08
10	100 kernel weight	36.39	27.00	49.00	16.66	15.11	82.25	28.23
11	Shelling %	65.17	60.53	70.07	5.94	3.10	27.08	3.32
12	Sound mature kernel	86.58	79.33	92.00	4.44	4.15	87.05	7.97
13	Pod yield per ha (kg)	3699.82	1942.67	6671.00	30.58	30.04	96.49	60.79
14	Kernel yield per ha (kg)	2451.32	1309.67	4495.67	29.87	29.28	96.07	59.12

Conclusion

Significant mean sums of squares due to genotypes were observed for all the traits through analysis of variance. It was revealed that genetic variability analysis will be able to distinguish traits among genotypes. The estimation of high heritability value coupled with high genetic advance was recorded for pod yield per hectare, followed by number of primary branches per plant, pod yield per plant, kernel yield per hectare, kernel yield per plant, number of secondary branches per plant, 100 pod weight, number of pod per plant, 100 kernel weight and plant height indicating that the inheritance of these characters were most likely due to additive gene effects and direct selection for these traits would be more effective for desired genetic improvement. Among the 36 entries, six genotypes ICGV-8705, ICGV-13564, ICGV-13565, PBS-12201, ICGV-13574 and ICGV-13555 were show higher yield. Hence, these entries used as donors for kernel yield improvement in groundnut.

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