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Genetic variability, heritability and genetic advance of yield and related traits in groundnut (*Arachis hypogaea* L.)

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Abstract
The current study examined the nature of genetic variability, heritability, and genetic advance in 30 groundnut genotypes. Table 1. shows the results of the analysis of variance for each of the ten characters. For all of the traits studied, the results revealed highly significant differences between genotypes. This suggested that there was enough variance in all of the traits to allow for effective selection in the material under examination. GCV and PCV estimates were high for kernel yield per plant, pod yield per plant, number of pods per plant, and plant height. Most of the characters studied had higher heritability estimates, with the exception of oil content, number of branches per plant, and oil content. However, for characteristics such as kernel yield per plant, pod yield per plant, number of pods per plant, plant height, and shelling %, considerable genetic advance as a percentage of mean was seen. While the number of branches per plant, 100 kernel weight, days to 50% flowering, days to maturity, and oil content were showed moderate to low genetic advance. Presented in the Table No. 2.
More variability exists in the content for all of the characters, which can be employed in the future by simple selection. According to the findings of this study, the number of pods per plant, pod yield per plant, kernel yield per plant, and 100 kernel weight are the primary yield contributing features in groundnut. As a result, due to the importance of these features in developing the criterion in the selection process to evolve high yielding genotypes of groundnut.

Keywords: Genetic variability, heritability, genetic advance, GCV, PCV

Introduction
The scientific name (*Arachis hypogaea* L.) is derived from the Greek words "*Arachis*" for legume and *"hypogaea*" for below ground. It also goes by the names peanut, earthnut, monkeynut, and Moongphali. Groundnut is valuable for both edible oil and confectionary. Groundnut is highly recognised for its high biological value protein content; it contains more protein than meat, roughly two and a half times more than eggs, and considerably more than any other food except yeast (Thakur *et al*. 2013) [10]. The groundnut kernels are a strong source of high-quality protein (25–28%) and edible oil (48–50%), carbohydrates (13.3%), crude fibre (2.8%), and all B vitamins (except from B12) and vitamin E (Wadikar *et al*., 2018) [12]. Although some accessions have been discovered to contain more than 55% oil, the oil concentration is typically around 50%. Plant breeders are guided in their understanding of the pattern of inheritance of various plant features by the genetic influence of heritable traits. Genetic advancement, heritability, and variability are the three main determinants of crop improvement.

Materials and Methods
Thirty groundnut genotypes provided from the Oilseed Research Station in Latur were grown in a rainfed Randomised block design at an experimental farm during *Kharif*-2022. Each genotype was seeded with 30 cm between rows and 10 cm between plants. Dibbling was the method that was used for sowing. Thinning done 15 days after sowing kept one plant per hill, and RDF for groundnut is 25kg N and 50 kg P/ha was applied at the time of seeding. Observations were made on five randomly chosen plants from each genotype, and the mean value was used for statistical analysis for ten characters: days to 50% flowering, days to maturity, plant height, number of branches per plant, number of pods per plant, pod yield per plant, kernel yield per plant, 100 kernel weight, shelling percentage, and oil content. The formula of Panse and Sukhatme (1985) [8] will be used to calculate variation for all of the features under consideration. The mean squares from the variance table will be used to determine genotypic and phenotypic variances (Johnson *et al*., 1955) [3].

The GCV and PCV will be determined using Burton (1952) approch. Heritability (in the broad sense) will be calculated using the method proposed by Allard (1960) [1]. Johnson *et al.* (1955) [3] proposed a formula for calculating genetic advance.

Results and Discussion

The results from the analysis of variance was reported in Table 1. for all 10 characters. For all of the traits studied, the results revealed highly significant differences between genotypes. This suggested that there was enough diversity in all of the features for effective selection in the material under examination.

Genetic variability is a crucial part of any system in which selection occurs to evolve superior genotype. As a result, the more the genetic variety in these traits, the greater the potential for improvement through selection. To improve any crop, particularly its yield, it is vital to understand genetic variability and the production-related characteristics. Table 2 displays the data.

The character kernel yield per plant and pod yield per plant have greater values of GCV and PCV, indicating that there is a significant degree of genetic variability and that the environment has less influence, making them appropriate for selection. Mahalakshmi *et al.* (2005) [6] and Nayak *et al.* (2018) [7] found similar results. Plant height, number of branches per plant, 100 kernel weight, and shelling percentage all revealed moderate values of GCV and PCV, indicating a medium range of variability and the effect of environment, which might be misleading at times. Similar findings have been found by Shobha *et al.* (2009) [9] and Vinithashri *et al.* (2019) [11]. The trait days to 50% flowering, days to maturity, and oil content estimates lower GCV and PCV, indicating low variability and substantial environmental influence, making selection undesirable. GCV and PCV have a significant trait difference, indicating that these traits are heavily influenced by environmental influences. And the lower difference between GCV and PCV showing environmental influence on trait expression and revealed that most of the features are mostly under genetic control.

The magnitude of PCV values was greater than GCV for all traits, showing that all characters played a dominant role and that the environment had an influence on these traits. Variability is a requirement for any breeding effort aimed at increasing yield and other yield contributing characteristics.

Plant height, number of pods per plant, pod yield per plant, kernel yield per plant, and shelling percentage all demonstrated high hero as a percentage of mean. This suggests that heritability is caused by additive gene effects and that selection may be effective. Similar results were achieved by Korat *et al.* (2009) [5] and Shobha *et al.* (2009) [9]. There is opportunity for enhancement of these traits through selection, as seen by the low heritability and genetic advance as a percentage of mean for the trait number of branches per plant and 100 kernel weight. This suggests additive gene action. John *et al.* discovered comparable outcomes (2005).

Table 1: Analysis of variance (ANOVA) for yield and yield component traits studied in groundnut (*Arachis hypogaea* L.)

Sr. No.	Source of variation	D. F.	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches per plant	No. of pods per plant	Pod yield per plant (g)	Kernel yield per plant (g)	100 kernel weight (g)	Oil content (%)	Shelling (%)
1	Replication	1	0.150	0.817	1.249	1.620	1.802	0.150	8.512	3.611	4.924	20.768
2	Treatment	29	13.637**	49.437**	93.810**	1.760**	35.091**	60.131**	25.230**	53.931**	6.283**	108.842**
3	Error	29	1.150	7.713	6.144	0.596	6.621	8.882	2.272	18.583	1.906	7.715

* Indicates significance at 5% level
** Indicates significance at 1% level

Table 2: Parameters of genetic variability for yield and yield contributing traits in groundnut (*Arachis hypogaea* L.)

Name of the Character	Range	Mean	GV (σ^2g)	PV (σ^2p)	EV (σ^2e)	GCV	PCV	ECV	Heritability (%)	Genetic advance	GAM (%)
Days to 50%flowering	32.50-43.00	37.98	6.24	7.39	1.15	6.57	7.15	2.82	84.44	4.73	12.45
Days to maturity	99.00-118.00	110.21	20.86	28.57	7.71	4.14	4.85	2.52	73.00	8.04	7.29
Plant height(cm)	34.00-59.10	46.49	43.83	49.97	6.14	14.24	15.20	5.33	87.70	12.77	27.47
No. of branches per plant	6.00-9.10	7.56	0.58	1.17	0.59	10.08	14.34	10.20	49.40	1.10	14.59
No. of pods per plant (g)	15.90-31.80	23.28	14.23	20.85	6.62	16.20	19.61	11.05	68.25	6.42	27.57
Pod yield per plant (g)	18.70-38.00	25.61	25.62	34.50	8.88	19.76	22.93	11.63	74.30	8.98	35.08
Kernel yield per plant (g)	8.00-18.90	12.51	11.47	13.75	2.27	27.08	29.64	12.05	83.50	6.37	50.97
100 kernel weight (g)	32.50-54.00	42.77	17.67	36.25	18.58	9.82	14.07	10.07	48.73	6.04	14.13
Oil content (%)	48.05-56.90	52.03	2.18	4.09	1.90	2.84	3.88	2.65	53.49	2.22	4.28
Shelling (%)	34.77-63.95	51.34	50.56	58.27	7.71	13.84	14.86	5.41	86.80	13.64	26.57

GV- Genotypic variance, PV- Phenotypic variance, EV- Environmental variance, GCV- Genotypic coefficient of variation, PCV- phenotypic coefficient of variation, ECV- environmental coefficient of variation, GAM - Genetic advance as % mean

Conclusion

According to the findings of the current study, there is more variability in the material for all of the traits, which can be seen in the future through easy selection. All of the potential genotypes were obtained at a young age in terms of days to 50% flowering and days to maturity. While others had the most pods per plant, kernel yield per plant, 100 kernel weight, and pod yield per plant. Characters with a high GCV, PCV, heritability, and genetic progress as a percentage of the mean, such as the number of pods per plant, kernel yield per plant, 100 kernel weight, and pod yield per plant.

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