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Genetic Variability, Heritability and Genetic Advance for Quality Traits in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT: Quality traits and mineral composition play crucial role in determining the nutritional quality of groundnut. Health related problems increased the interest of researchers to increase the mineral contents and improve the quality traits in groundnut. Groundnut oil is recognized as a health-promoting oil with the potential to lower the risk of cardiovascular diseases. Additionally, it supports a more favorable ratio of high-density lipoprotein (HDL) to low-density lipoprotein (LDL) and lowers levels of triacylglycerol and blood glucose. In this experiment, thirty one genotypes of groundnut were evaluated for quality traits to study the genetic variability parameters. Analysis of variance indicated that the existence of significant differences among the genotypes for different characters. This indicating a considerable amount of genetic variability among the genotypes evaluated. High GCV and PCV values were observed for the trait like oleic acid. While, low GCV and PCV were observed for zinc, iron, protein and oil content. High heritability was observed for oleic acid, zinc, iron, protein and oil content. High heritability coupled with high genetic advance as per cent of mean was observed for oleic acid which indicates the presence of additive gene action and it would be more rewarding to bring quality improvement in groundnut.

Keywords: Groundnut, GCV, PCV, Heritability, Genetic advance.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the major oilseed crop in India. It is native to South America *i.e.* Brazil. It is widely cultivated in the tropical, sub-tropical and warm temperate zones. It is allotetraploid (2n= 40) and self-pollinated crop. The plant is herbaceous and typically grows to a height of 30 to 50 cm (1.0 to 1.6 feet). It is an annual legume crop grown, mainly for its high-quality edible oil (44-56 %) and easily digestible protein (22-30%) in its seeds (Shendekar *et al.*, 2023). Due to the rich digestible proteins, groundnut is often known as the 'king' among oilseed crops. Groundnut oil contains high amount of oleic and linoleic acid (Engin *et al*., 2017). The relative proportion of oleic acid and linoleic acid in groundnut oil determines oil quality and storage life (Worthington and Hammons 1977). It also contains saturated and polyunsaturated fatty acids, iron and zinc. Groundnut oil and groundnut based food products with the high-oleic content can be used in confectionaries, for making flour, cake and butter which offering an extended shelf-life compared to regular groundnut products. High oleic groundnuts hold significant value in both domestic and international markets due to their enhanced shelf-life and associated health benefits. It is considered health-oil as it has potential to reduce the risk of cardio-vascular diseases, promotes a healthier ratio of high density lipoprotein (HDL) to low density lipoprotein (LDL) and reduces triacylglycerol and blood glucose levels. Vegetable oil with high levels of oleic acid are preferred for food and industrial purposes (Gangadhara and Nadaf 2018). Iron and zinc are essential minerals in human and animal nutrition (Upadhyaya *et al.*, 2012). These qualities make it an appealing choice for health-conscious consumers. In plant breeding programme, knowledge of genetic parameters such as genetic variability, heritability and genetic advance is essential for effective selection of desirable genotypes for quality improvement.

MATERIAL AND METHODS

The experimental material for the variability studies comprised of 31 genotypes of groundnut. The material was made available for study by Agricultural Research Station, Kasbe Digraj, Dist. Sangli (Maharashtra). Field study was conducted at Post Graduate Research Farm, Rajarshi Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur, during *kharif* 2022. The experiment was laid out in a randomized block design

and replicated thrice. Biochemical analysis *viz.*, percentage of oil content, protein content, oleic acid content, iron and zinc in seed was estimated by NIR (Near-Infrared Spectroscopy) technique on instrument (Near-Infrared Spectrometer) available at Mahatma Phule Krishi Vidyapeeth, Rahuri. Analysis of variance for each character was done as per the standard statistical procedure, given by Panse and Sukhatme (1985). Variability parameters was measured by the formula suggested by Johnson *et al*. (1955). Phenotypic and genotypic coefficient of variation was calculated by using the formula given by Burton (1952). The heritability in broad sense was estimated according to method given by Allard (1960). The expected genetic advance expressed as per cent of mean was calculated by the method suggested by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The results of the analysis of variance for various quality characters for thirty one genotypes of groundnut is presented in the Table 1. The results indicated that there is highly significant differences among genotypes for all the characters *viz.*, oil content, protein content, oleic acid content, iron and zinc content. Mean performance of genotypes for these characters presented in Table 2.

A. GCV and PCV

The results regarding the genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability and genetic advance as per cent of mean for quality traits were estimated and computed in the Table 3. The magnitude of genotypic coefficient of variation (GCV) was lower than phenotypic coefficient of variation (PCV) for all the characters under study. High genotypic and phenotypic coefficient of variation was recorded for the character oleic acid (21.09 and 21.15). Similar results were reported by Chauhan *et al.* (2008) in rapeseed-mustard (*Brassica species*) and Farooq *et al*. (2022) in Sunflower (*Helianthus annus* L.). GCV and PCV were lower for zinc content (5.56 and 5.71) followed by iron content (5.16 and 5.39), protein content (3.34 and 3.65) and oil content (2.05 and 2.51). Lower GCV and PCV for zinc content was similar with findings of Sala *et al*. (2015) in rice. Lower GCV and PCV for oil and protein content in groundnut were comparable with findings of Mukri *et al*. (2014); Vasanthi *et al.* (2015); Omprakash and Nadaf (2017); Mahesh *et al*. (2018); Patil *et al*. (2020). The findings were matching with the results reported by Zekeria *et al.* (2019) for oil content.

B. Heritability

Highest estimate of heritability was recorded for the character oleic acid (99.48%) followed by zinc content (94.76%), iron content (91.81%), protein content (83.70%) and oil content (66.77%). In the present study, high heritability was observed for oleic acid followed by zinc content, iron content, protein content and oil content which indicates the least influence of environment on these characters. High heritability for oil, protein and oleic acid were also reported by Deepthi *et al.* (2022), for iron and zinc were reported by Amoah *et al.* (2023).

C. Genetic advance

The estimates of genetic advance were ranged from 1.62 to 14.74. Maximum estimate of genetic advance was recorded for oleic acid (14.74) followed by zinc content (4.55), iron content (2.74), oil content (1.65) and protein content (1.62). High estimates of genetic advance as per cent of mean were observed for the characteroleic acid (43.35%) while, moderate GAM was observed for zinc content (11.15%) and iron content (10.19%). Low genetic advance as per cent of mean were observed for protein content (6.30%) and oil content (3.45%).

High heritability coupled with high genetic advance as per cent of mean was observed for the character oleic acid which indicates presence of additive gene action and selection for such trait may be rewarding Similar results were reported by Chauhan *et al.* (2008) in rapeseed-mustard (Brassica species) and Farooq *et al*. (2022) in Sunflower (*Helianthus annus* L.). High heritability coupled with moderate genetic advance as per cent of mean were observed for iron and zinc content which indicated the presence of additive gene action. Similar results were reported by Sala *et al.* (2015) for zinc content in rice. While high heritability coupled with low genetic advance as per cent of mean were observed for oil content and protein content. High heritability coupled with low genetic advance as per cent of mean, which indicated the presence of non-additive gene action and high environment interaction. Hence selection for such traits may not be rewarding. Similar results were reported by Kumar *et al.* (2019); Deepthi *et al*. (2022) for oil and protein content.

Table 1: Analysis of variance for different characters of groundnut.

Sr. No.	Characters	Mean sum of square		
		Replication df=2	Treatment df=30	Error df=60
1.	Oil content (%)	0.05	4.36**	1.45
2.	Protein content (%)	0.88	2.67**	0.43
3.	Oleic acid (%)	1.08	155.34**	0.81
4.	Iron (mg/kg)	1.60	6.30**	0.51
5.	Zinc (mg/kg)	0.07	16.31**	0.85

(*, ** - significant at 5 and 1 per cent, respectively)

Table 2: Mean performance 31 genotypes of groundnut for different characters.

Sr. No.	Genotypes	Oil (%)	Protein (%)	Oleic Acid (%)	Iron (mg/kg)	Zinc (mg/kg)
1.	KDG-216	47.10	25.76	35.47	25.40	43.65
2.	TPG-41	47.73	24.96	38.41	28.06	43.78
3.	KDG-266	47.06	25.41	38.38	26.44	43.45
4.	ICGV-14421	47.72	23.31	32.28	27.06	40.34
5.	KDG-244	47.73	25.52	27.62	26.79	39.08
6.	KDG-220	46.82	27.43	25.07	24.45	39.19
7.	ICGV-181024	46.90	26.74	39.55	26.22	42.26
8.	KDG-217	47.69	26.03	34.69	26.73	40.66
9.	KDG-215	47.25	25.98	26.33	30.88	38.59
10.	KDG-219	47.83	25.59	29.32	26.88	40.55
11.	ICGV-181051	47.23	26.30	37.42	27.43	42.68
12.	ICGV-181059	46.49	24.85	30.77	24.62	45.53
13.	KDG-128	49.67	26.41	30.79	27.16	40.49
14.	KDG-160	51.46	24.04	36.78	28.84	42.45
15.	KDG-245	47.51	26.00	30.29	27.05	41.20
16.	KDG-272	47.99	27.43	39.32	26.28	39.16
17.	JL-776	50.82	25.79	22.55	27.67	39.78
18.	JL-1255	47.58	26.44	34.14	26.52	40.37
19.	ICGV-13207	49.62	26.17	45.42	28.45	36.75
20.	ICGV-10698	47.59	25.85	24.38	26.10	39.30
21.	ICGV-171046	47.18	25.11	36.85	26.83	41.53
22.	GPBD-4	50.01	27.32	50.84	27.97	33.87
23.	ICGV-181057	47.65	26.45	27.86	23.01	42.41
24.	ICGV-181069	46.69	26.86	36.53	27.39	39.82
25.	KDG-218	47.93	26.14	42.34	26.99	40.06
26.	KDG-222	47.61	24.90	27.33	25.80	44.08
27.	KDG-123	48.07	26.02	27.28	28.56	38.59
28.	KDG-243	47.34	25.40	27.12	26.66	39.49
29.	JL-24	49.03	24.49	40.35	27.71	41.74
30.	TKG-BOLD	47.33	26.27	29.56	25.84	42.54
31.	JL-286	48.96	25.01	49.45	27.93	41.73
	Mean	**47.99**	**25.80**	**34.01**	**26.89**	**40.81**
	Range	46.49- 51.46	23.31- 27.43	22.55- 50.84	23.01- 30.88	33.87- 45.53
	S.E.	0.69	0.38	0.52	0.41	0.53
	C.D. (5%)	1.96	1.07	1.47	1.17	1.50
	C.V. (%)	2.50	2.55	1.96	1.56	2.00

Table 3: The estimates of genetic variability parameters for quality characters in groundnut.

Sr. No.	Character	Mean	Range		GCV (%)	PCV (%)	h^2 (%) bs	GA	GAM (%)
			Min.	Max.					
1.	Oil content (%)	47.99	46.49	51.46	2.05	2.51	66.77	1.65	3.45
2.	Protein content (%)	25.8	23.31	27.43	3.34	3.65	83.70	1.62	6.30
3.	Oleic acid (%)	34.01	22.55	50.84	21.09	21.15	99.48	14.74	43.35
4.	Iron (mg/kg)	26.89	23.01	30.88	5.16	5.39	91.81	2.74	10.19
5.	Zinc (mg/kg)	40.81	33.87	45.53	5.56	5.71	94.76	4.55	11.15

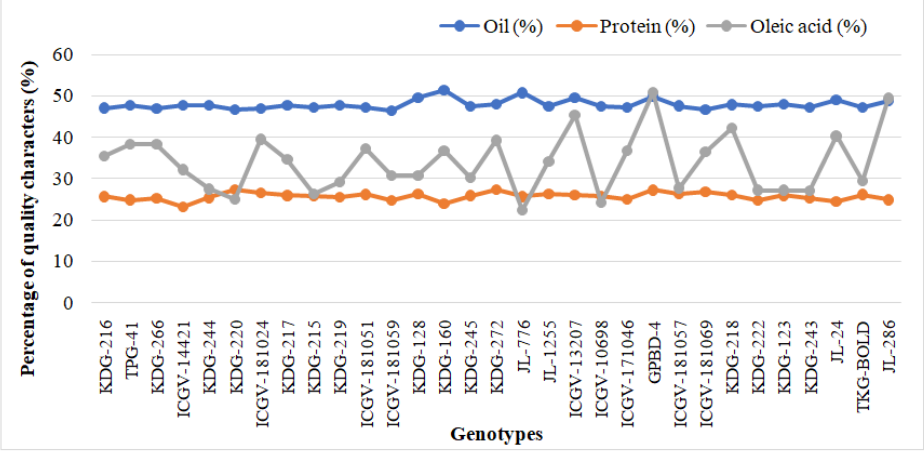

Fig. 1. Comparative mean performance of groundnut genotypes for oil (%), protein (%) and oleic acid (%).

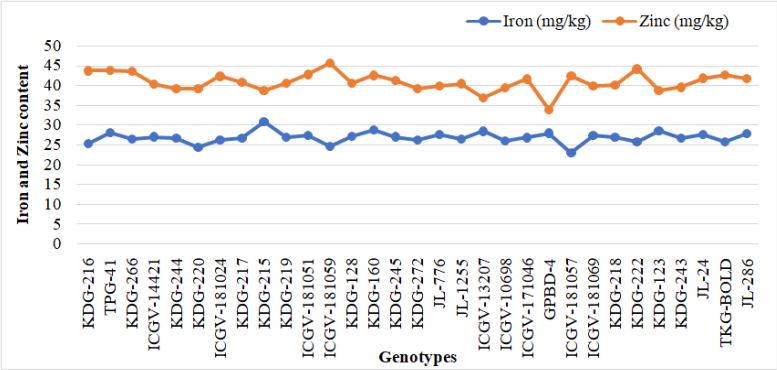

Fig. 2. Comparative mean performance of groundnut genotypes for iron and zinc (mg/kg).

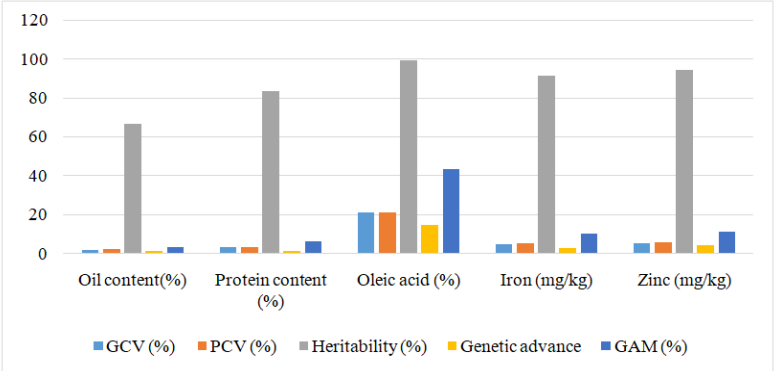

Fig. 3. Genetic variability parameters for quality characters in 31 genotypes of groundnut.

CONCLUSIONS

From the present investigation, the results of the analysis of variance revealed significant differences among the genotypes for traits like oil content, protein content, oleic acid, iron content and zinc content. The magnitude of genotypic coefficient of variation (GCV) were lower than phenotypic coefficient of variation (PCV) for all the characters under study. Highest genotypic and phenotypic coefficient of variation was recorded for the character oleic acid. Highest estimate of heritability was recorded for all the characters. High magnitude of heritability (b.s.) along with high genetic advance as a per cent mean observed in oleic acid. This indicates that this character was under additive genetic action and selection for genetic improvement will be effective and may contribute to quality improvement in groundnut.

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REFERENCES

Allard, R. W. (1960). Principles of plant breeding, John Willey and Sons, New York.

Amoah, R. A., Asibuo, J. Y., Akromah, R., Bediako, K. A., Lamptey, M., Osei, C. Y., Awuah, S. and Boampong, R. (2023). Genetic variability and heritability estimates among nutritional traits of groundnut breeding lines. *Academia Biology*, 2023, 1.

Burton, G. W. (1952). Quantitative inheritance in grasses. *Proceedings of Sixth International Grassland Congress*, *1*, 277-283.

Chauhan, J. S., Singh, K. H., Singh, M., Bhadauria, V. P. S. and Kumar, A. (2008). Studies on Genetic Variability and Path Analysis for Quality Characters in Rapeseed-Mustard (*Brassica species*) *J. Plant Genet. Resour.*, *21*(2), 113-117.

Deepthi, K., John, K., Bharathi, D. & Sudhakar, P. (2022). Genetic Variability Studies in large Seeded Genotypes of Peanut (*Arachis hypogaea* L.). *Biological Forum – An International Journal*, *14*(2), 1146-1151.

Engin, Y., Ustun, R., Golukcu, M. and Uzun, B. (2017). Oil content, oil yield and fatty acid profile of groundnut germplasm in Mediterranean climates. *Journal of American oil chemists Society*, *94*(6).

Farooq, M. S. U., Uma, M. S., Nehru, S. D., and Manjula, C. P. (2022). Characterization of High Oleic Gene Pool and Validation of the Identified Genomic Regions Controlling Oleic Acid Content in Sunflower (*Helianthus annus* L.). *International Journal of Plant & Soil Science*, *34*(23), 82-88.

Gangadhara K. and Nadaf, H. L. (2018). Genetic analysis of oleic acid and linoleic acid content in relation to oil quality in groundnut. *Electronic Journal of Plant Breeding*, *9*(1), 283–294.

Johnson, H. W., Robinson, H. F. and Comstock, R. E. (1955). Genotypic and phenotypic correlation in soybean and their implications in selection. *Agronomy Journal*, *47*, 477-483.

Kumar, N., Ajay, B. C., Rathanakumar, A. L., Radhakrishnan, T., Mahatma, M. K., Kona, P. and Chikani, B. M. (2019). Assessment of genetic variability for yield and quality traits in groundnut genotypes. *Electronic Journal of Plant Breeding*, *10*(1), 196-206.

Mahesh, R. H., Hasan, K., Temburne, B. V., Janila, P. and Amaregouda, A. (2018). Genetic variability, correlation and path analysis studies for yield and yield attributes in groundnut (*Arachis hypogaea* L.). *Journal of Pharmacognosy and Phytochemistry*, *7*(1), 870-874.

Mukri, G., Nadaf, H. L., Gowda, M. V. C., Bhat, R. S. and Upadhyaya, H. D. (2014). Genetic diversity analysis based on nutritional, oil quality and yield component traits in mini core collection of groundnut (*Arachis hypogaea* L.). *Karnataka J. Agric. Sci*., *27*(2), 219-221.

Omprakash, P. and Nadaf, H. L. (2017). An assessment of genetic variability and traits association among high oleic advanced breeding lines for yield and quality traits in groundnut (*Arachis hypogaea* L.). *Electronic Journal of Plant Breeding*, *8*(1), 201-205.

Panse, V. G. and Sukhatme, P. V. (1985). Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research Publication, pp., 87-89.

Patil, R., Viswanatha, K. P., Upadhyaya, H. D., Lokesha, R., Khan, H., Gururaj S. and Somasekhar (2020). Genetic diversity, association and principle component analyses for agronomical and quality traits in genomic selection training population of groundnut (*Arachis hypogaea* L.). *Indian J. Genet*., *80*(3), 282-290.

Shendekar, S. A., Nagesh Kumar M. V., Meshram, M. R., Gadpayale, D. P., Venu Yadav, T. and Sudini H. K. (2023). Genetic Parameters, Correlation and Path Analysis for Yield and Yield Contributing Traits in Post Rainy Groundnut (*Arachis hypogaea* L.). *Biological Forum – An International Journal*, *15*(4), 400-404.

Sala, M. and Geetha, S. (2015). Variability studies for quality traits in rice with high iron and zinc content in segregating population. *Journal of Cereals and Oilseeds*, *6*(7), 39-42.

Upadhyaya, H. D., Dronavalli, N., Singh, S. and Dwivedis, L. (2012). Variability and Stability for Kernel Iron and Zinc Contents in the ICRISAT Mini Core Collection of Peanut. *Crop Sci.*, *52*, 2628–2637.

Vasanthi, R. P., Suneetha, N. and Sudhakar, P. (2015). Genetic variability and correlation studies for morphological, yield and yield attributes in groundnut (*Arachis hypogaea* L.). *Legume Research*, *38*(1), 9-15.

Worthington and Hammons (1977). Variability in fatty acid composition among Arachis genotypes: A potential source of product improvement, *Journal of American oil chemists society*, *54*, 105A-108A.

Zekeria, Y., Habtamu, Z., Wassu M., Shimelis H., Arno, H. (2019). Genetic Variability for oil quality traits in Groundnut (*Arachis hypogaea* L.) *cultivars. Acad. Res. J. Agri. Sci. Res*., *7*(2), 57-62.

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