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Nutrient Content and Uptake of Groundnut (*Arachis hypogaea* L.) as Influenced by Genotypes and Sulphur Levels

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ABSTRACT: Groundnut is a crucial oilseed crop in the Leguminosae family, but its productivity in India is lower than the global average. The primary reason for this low production is the unbalanced and inadequate use of nutrients. Variety is a key factor that affects the development, productivity, and quality of groundnut. As a legume-oilseed crop, groundnut requires significant amounts of phosphorus, calcium and sulphur. Therefore, this field experiment was conducted during the *Kharif* season of 2023 at crop physiology field lab, Department of Agronomy, CCS Haryana Agricultural University, Hisar. The experiment was laid out in split plot design with four genotypes (G_1-MH 4, G_2-HNG 10, G_3-HNG 69, G_4-GNH 804) in main plots and four sulphur levels (S_1-Control, S_2-20 kg S/ha, S_3-40 kg S/ha, S_4-60 kg S/ha) in sub-plots with three replications. Result revealed that among genotypes GNH 804 resulted in significantly higher nutrient content and uptake followed by HNG 69. Among sulphur levels, 60 kg S/ha recorded higher nutrient content and uptake followed by 40 kg S/ha. So, to obtain higher nutrient content and uptake, the genotype GNH 804 may be fertilized with 40 kg S/ha.

Keywords: Content, genotypes, groundnut, nutrient, sulphur, uptake.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a well-known oilseed crop from the family Leguminosae and sub-family Papilionaceae, thought to have originated in South America (Kamal *et al.,* 2023a; Hussainy *et al.,* 2023). Groundnut covers an area of 44.3 lakh ha with production of 86.5 lakh tonnes and productivity of 1953 kg ha^{-1} in India during 2023-24. The primary groundnut-producing states in India are Gujarat, Rajasthan, and Tamil Nadu. Groundnut makes up 31.7% of India's total oilseed production and approximately 28.3% of the cultivated area for oilseeds (Kamal *et al.,* 2024b; Ali *et al.,* 2021). In India groundnut is grown in both the seasons *i.e., Kharif* and *Rabi*. But in Haryana groundnut is grown only in *Kharif* season over an area of 0.07 lakh ha with production and productivity of 0.08 lakh tonnes and 1080 kg ha^{-1}, respectively during 2023-24 (Anonymous, 2024).

Variety and sulphur are crucial for the physiological growth and yield of crops like groundnut. Selecting the appropriate variety is crucial for groundnut production. The adoption of high-yielding varieties has surged in recent years, bringing the country close to self-sufficiency in groundnut. Varieties suited to early *Kharif* differ significantly in growth habits compared to those suited for other seasons.Certain varieties of groundnut have shown that a weak source-to-sink relationship results in the production of more unfilled pods and a reduced seed yield (Dileep *et al*., 2021; Chandrasekaran *et al*., 2007). Variety is a key factor that affects the development, productivity, and quality of groundnut.

Sulphur plays a crucial role in several metabolic enzyme processes in plants, it affects productivity both quantitatively and qualitatively (Sheoran *et al.,* 2013). Sulphur is crucial for the synthesis of sulphur-containing amino acids like methionine and cysteine, and it plays a vital role in the formation of proteins, chlorophyll, and oils. With these considerations in mind, the present investigation was undertaken. The objective of this study was to examine the nutrient content and uptake in groundnut as influenced by genotypes and different sulphur levels.

MATERIALS AND METHODS

The field experiment was carried out during the *Kharif* season of 2023 at the crop physiology field lab, Department of Agronomy, CCS Haryana Agricultural University, Hisar. Geographically, Hisar is located at 29°10' N latitude and 75°46' E longitude, with an elevation of 215 m above mean sea level. The total rainfall during the crop growing period was 176.1 mm. Weekly maximum and minimum temperatures were within a suitable range for the various crop growth stages. The average temperature on the sowing date for the crop season was 35.2°C, while the average temperature at harvest time was 24.9°C. On the other hand, mean weekly maximum and minimum temperatures ranged between 30.5-39.1°C and 15.6-28.3°C, respectively during crop season. The experiment was laid out in split plot design with four genotypes (G_1-MH 4, G_2-HNG 10, G_3-HNG 69, G_4-GNH 804) in main plots and four sulphur levels (S_1-Control, S_2-20 kg S/ha, S_3-40 kg S/ha, S_4-60 kg S/ha) in sub-plots with three replications. The soil of the field was sandy in texture, slightly alkaline in pH (8.1), EC (0.15 ds/m), low in organic carbon (0.12%), low in available N (130.8 kg/ha), medium in available P (17.9 kg/ha), medium in available K (138.8 kg/ha) and low in available S (21.4 kg/ha). Standard cultural practices recommended for groundnut cultivation were followed for all treatments. The nitrogen, phosphorus, potassium, and sulphur content in kernels and haulms at harvest were assessed. For this, oven-dried plant material (kernels and haulms) from each plot was ground separately and analyzed for nitrogen using the Nessler's reagent method (Lindner, 1944), phosphorus using the vanadomolybdo-phosphoric acid yellow color method (Jackson, 1973), potassium using the flame photometer method (Richards, 1954), and sulphur using the method described by Chesnin and Yien (1950). The uptake of each nutrient was computed as:

$$\text{NPKS uptake (kg ha}^{-1}) = \frac{\text{\% NPKS content in kernel and haulm} \times \text{Yield of kernel and haulm (kg ha}^{-1})}{100}$$

All recorded data were analyzed using the analysis of variance (ANOVA) technique for a split plot design as outlined by (Gomez and Gomez 1984). The least significant difference test was employed to determine the effects of treatments at a 5% level of significance.

RESULTS AND DISCUSSION

A. NPK and S content in kernel and haulm

A disquisition of the data given in Table 1 exhibited that a progressive significant increase in N, P, K and S content in the kernel was observed with genotypic variation. Non significant variation among HNG 69 and GNH 804 was observed regarding N content, while K content increased progressively with genotypic variation, and non significant variation was observed among GNH 804 and HNG 69, HNG 69 and HNG 10. GNH 804 recorded the highest N, P, K, and S content, while MH 4 recorded the minimum. A delve into the data exhibited in Table 1 revealed that a progressive significant increase in N, P, S content in haulm was recorded with genetic variation, while K content in haulm failed to produce significant variation among different genotypes. N content in GNH 804 was found to be significantly higher than other genotypes, but non-significant variation was recorded between GNH 804 and HNG 69, while P content in GNH 804 was found to be significantly higher than other genotypes, but non-significant differences were recorded between GNH 804 and HNG 69. The GNH 804 genotype recorded higher N, P, S content over other genotypes. A probe of the data presented in Table 1 revealed that progressive increase in N, P, K and S content in the kernel was obtained with an increase in sulphur levels from 0 to 60 kg/ha, while the K content in the kernel failed to produce significant variation among different sulphur levels. N content in kernels with sulphur levels of 60 kg/ha was found to be significantly higher than other sulphur levels, but non-significant variation was recorded among sulphur levels 20-40 kg/ha and 40-60 kg/ha. S content in kernels with sulphur levels of 60 kg/ha was found to be significantly higher than other sulphur levels, but non-significant variation was recorded among sulphur levels 40-60 kg/ha. The sulphur level of 60 kg/ha recorded 10.05, 9.43 and 18.75 percent higher N, P and S content over control in kernel, respectively. A probe of the data presented in Table 1 revealed that progressive increase in N, P, K and S content in haulm was obtained with increase in sulphur levels from 0 to 60 kg/ha, while K content in haulm failed to produce significant variation between different sulphur levels. Sulphur level of 60 kg/ha recorded 4.10, 8.69 and 19.04 per cent higher S content over 40 kg S/ha, 20 kg S/ha and control in haulm, respectively. The positive impact of sulphur fertilization on crop nutrient levels seems to stem from an improved nutritional environment within both the rhizosphere and the plant system. This enhancement leads to increased translocation of nitrogen (N), phosphorus (P), potassium (K), and sulphur (S) to the reproductive parts, resulting in higher nutrient concentrations in the kernels and haulm. The observed relationship aligns closely with the findings reported by Kamal *et al.* (2023b); Kumar *et al.* (2020).

B. NPK and S uptake by kernel and haulm

A delve into the data exhibited in Table 2 unveiled the progressive, significant increase in N, P, K and S uptake observed by kernel and haulm with genotypic variation. N, P, K and S uptake by kernel and haulm with GNH 804 was found to be significantly higher over other genotypes, while non-significant variation was recorded between GNH 804 and HNG 69. According to the data given in Table 2, a progressive and significant increase in N, P, K and S uptake by the kernel was recorded with an increase in sulphur levels from 0 to 60 kg/ha. N, P, K and S uptake by kernels with a sulphur level of 60 kg/ha was found to be significantly higher than other sulphur levels. Sulphur levels of 60 kg/ha recorded 59.40, 60.29, 52.84, 72.10 per cent higher N, P, K, S uptake over control, respectively. An attentive perception of the data given in Table 2 indicated a progressive significant increase in N, P and S uptake by haulm with increase in sulphur levels from 0 to 60 kg/ha. N and K uptake by haulm produced non-significant differences between sulphur levels 20 and 40 kg/ha and 40 and 60 kg/ha, S and P uptake by haulm produce non-significant differences between sulphur levels 40 and 60 kg/ha. Sulphur levels of 60 kg/ha recorded 20.10, 6.40 and 42.14 per cent higher S uptake over 20 kg S/ha, 40 kg S/ha and control, respectively. The increase in food availability in the root zone, coupled with elevated metabolic activity at the cellular level, likely enhanced nutrient uptake and accumulation across various plant parts. This higher nutrient accumulation in vegetative sections, combined with improved metabolism, resulted in greater nutrient transfer to the reproductive areas of the crop. This observed pattern is consistent with the results reported by Kamal *et al.* (2023b); Kumar *et al.* (2020).

Table 1: Effect of genotypes and sulphur levels on N, P, K and S content (%) in kernel and haulm.

Treatments	N content		P content		K content		S content	
	Kernel	Haulm	Kernel	Haulm	Kernel	Haulm	Kernel	Haulm
Genotypes								
MH 4	3.24	1.64	0.50	0.21	0.62	1.43	0.32	0.20
HNG 10	3.56	1.71	0.55	0.25	0.65	1.48	0.34	0.22
HNG 69	3.78	1.75	0.58	0.28	0.67	1.50	0.37	0.24
GNH 804	3.82	1.77	0.60	0.30	0.68	1.51	0.38	0.25
SEm ±	0.051	0.010	0.001	0.006	0.010	0.044	0.003	0.002
CD at 5%	**0.181**	**0.036**	**0.034**	**0.020**	**0.034**	**NS**	**0.011**	**0.007**
Sulphur levels (kg S/ha)								
Control	3.38	1.68	0.53	0.23	0.64	1.44	0.32	0.21
20	3.62	1.71	0.55	0.25	0.65	1.48	0.35	0.23
40	3.68	1.73	0.58	0.27	0.66	1.49	0.37	0.24
60	3.72	1.74	0.58	0.28	0.67	1.50	0.38	0.25
SEm ±	0.047	0.012	0.012	0.009	0.010	0.041	0.004	0.003
CD at 5%	**0.137**	**0.034**	**0.035**	**0.027**	**NS**	**NS**	**0.013**	**0.010**

Table 2: Effect of genotypes and sulphur levels on N, P, K and S uptake (kg/ha) by kernel and haulm.

Treatments	N uptake		P uptake		K uptake		S uptake	
	Kernel	Haulm	Kernel	Haulm	Kernel	Haulm	Kernel	Haulm
Genotypes								
MH 4	38.5	63.4	6.2	8.4	7.4	55.6	3.8	7.9
HNG 10	60.7	77.3	9.5	11.6	11.1	66.9	5.8	10.3
HNG 69	75.1	93.4	11.5	15.1	13.3	80.0	7.5	13.1
GNH 804	78.9	96.4	12.5	16.5	13..9	82.1	7.9	14.1
SEm ±	1.48	3.11	0.38	0.33	0.44	3.05	0.19	0.39
CD at 5%	**5.24**	**10.9**	**1.36**	**1.17**	**1.57**	**10.7**	**0.67**	**1.40**
Sulphur levels (kg S/ha)								
Control	46.8	73.0	7.3	10.4	8.7	62.6	4.4	9.2
20	61.3	80.2	9.4	12.1	10.9	69.2	5.9	10.9
40	70.6	86.9	11.1	14.1	12.6	75.1	7.1	12.3
60	74.6	90.4	11.8	15.0	13.4	77.7	7.6	13.1
SEm ±	1.32	2.53	0.28	0.62	0.21	3.32	0.14	0.35
CD at 5%	**3.90**	**7.43**	**0.84**	**1.83**	**0.63**	**9.77**	**0.41**	**1.04**

CONCLUSIONS

The results of the present study revealed that genotypes and sulphur levels significantly enhanced the nutrient content and uptake of groundnut. Among genotypes, GNH 804 resulted in significantly higher nutrient content and uptake in groundnut, followed by HNG 69. Among sulphur levels, 60 kg S/ha recorded higher nutrient content and uptake, closely followed by 40 kg S/ha. Therefore, to optimize nutrient content and uptake, the groundnut genotype GNH 804 could be fertilized with 40 kg S/ha.

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Conflict of Interest. None.

REFERENCES

Ali, M. A., Pal, A. K., Baidya, A. and Gunri, S. K. (2021). Variation in dry matter production, partitioning, yield and its correlation in groundnut (*Arachis hypogaea* L.) genotypes. *Legume Research- An International Journal*, *44*(6), 706-711.

Anonymous (2024). Department of Economics and Statistics, Ministry of Agriculture Cooperation and Farmers Welfare, Government of India.

Chandrasekaran, R., Somasundaram, E., Amanullah, K., Thirukumaran, K. and Sathyamoorthi, K. (2007). Influence of varieties and plant spacing on the growth and yield of confectionery groundnut (*Arachis hypogaea* L.). *Research Journal of Agriculture and Biological Sciences*, *3*(5), 525-528.

Chesnin, L. and Yien, C. H. (1950). Turbidimetric determination of available sulphates. *Proceedings Soil Science Society of America, 14*, 149-151.

Dileep, D., Singh, V., Tiwari, D., George, S. G. and Swathi, P. (2021). Effect of Variety and Sulphur on Growth and Yield of Groundnut (*Arachis hypogaea* L.). *Biological Forum- An International Journal*, *13*(1), 475-478.

Gomez, K. A. and Gomez, A. A. (1984). Statistical procedures for agricultural research, IRRI: *A Wiley Pub*., New York. pp. 199-201.

Hussainy, S. A. H., Brindavathy, R. and Vaidyanathan, R. (2023). Influence of irrigation regimes on the performance of groundnut (*Arachis hypogaea*) under intercropping situation. *Legume Research- An International Journal, 46*(4), 496-501.

Jackson, M. L. (1973). Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi, pp 214-221.

Kamal, Dhaka, A. K., Prakash, R., Sharma, A. and Dhaka, B. K. (2023b). Effect of Phosphorus and Sulphur Levels on Nutrient Content and Uptake of Groundnut (*Arachis hypogaea* L.). *Biological Forum–An International Journal*, *15*(2), 1023-1026.

Kamal, Dhaka, A. K., Singh, B., Kamboj, E., Preeti and Sharma, A. (2024b). Effect of phosphorus and sulphur levels on biomass partitioning in groundnut (*Arachis hypogaea* L.). *Research on Crops*, *25*(1), 57-64.

Kamal, Kamboj, E., Sharma, A., Ravi, Dhaka, B. K. and Preeti (2023a). Effect of Phosphorus Application on Groundnut (*Arachis hypogaea* L.): A Review. *International Journal of Plant & Soil Science*, *35*(18), 1536-1544.

Kumar, C. R., Ariraman, R., Ganapathy, M. and Karthikeyan, A. (2020). Effect of different sources and levels of sulphur on growth and nutrient uptake of irrigated summer groundnut (*Arachis hypogaea* L.) CV.VRI-2 for loamy soil. *Plant Archives*, *20*(1), 1947-1952.

Lindner, R. C. (1944). Rapid analytical methods for some of the more common inorganic constituents of plant tissues. *Plant Physiology, 19,* 76-86.

Richards, L. A. (1954). Diagnosis and improvement of saline and alkali soils; USDA Handbook no. 60. United State Salinity Laboratory.

Sheoran, P., Sardana, V., Singh, S., Sheoran, O. P. and Raj, D. (2013). Optimizing Sulphur application in sunflower (*Helianthus annuus*) under irrigated semi-arid tropical conditions. *Indian Journal of Agronomy*, *58*(3), 384-390.

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