



Effect of Genotypes and Sulphur Levels on Yield Attributes, Yield and Quality of Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

Background: Groundnut is an important oilseed crop and belongs to the family Leguminosae. However, the productivity of groundnut in India is less as compared to the average productivity of the world. Variety and sulphur are crucial for the growth and yield of crops like groundnut.

Methods: The 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 (MH 4, HNG 10, HNG 69, GNH 804) in main plots and four sulphur levels (Control, 20, 40, 60 kg S/ha) in sub-plots with three replications.

Result: The results indicated the genotypes and sulphur significantly improved the pod yield and yield components except number of kernels per pod, harvest index and all the quality parameters. Among genotypes, the maximum increment was recorded at GNH 804 for most of the studied parameters followed by HNG 69. Among sulphur levels, the maximum increment was recorded at 60 kg S/ha for most of the studied parameters, closely followed by sulphur level 40 kg S/ha.

Key words: Groundnut, Oil, Protein, Quality, Sulphur, Yield.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the best-known oilseed crops and belongs to the family Leguminosae and sub-family Papilionaceae. It is believed that it originated in South America (Hussainy *et al.*, 2023; Kamal *et al.*, 2023; Monika *et al.*, 2024). The major groundnut producing states in India are Gujarat, Rajasthan and Tamil Nadu. Groundnut accounts for 31.7% of India total oilseed production and about 28.3 % of the cultivated area of total oilseeds (Kamal *et al.*, 2024a; Ali *et al.*, 2021). 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 groundnut varieties have demonstrated that a poor source-to-sink relationship leads to the formation of more unfilled pods and a lower seed yield (Chandrasekaran *et al.*, 2007). Variety is a key factor that affects the development, productivity and quality of peanuts.

Sulphur plays a crucial role in several metabolic enzyme processes in plants; it affects productivity both quantitatively and qualitatively (Kamal *et al.*, 2023a; Sheoran *et al.*, 2013). Sulphur is essential in the process of synthesis of amino acids that contain sulphur, such as methionine and cysteine and it plays an important role in the synthesis of proteins, chlorophyll and oil (Kamal *et al.*, 2024). The Sulphur containing enzyme is also responsible for the synthesis of vitamins (biotin and thiamine), as well as co-enzyme A and metabolism of carbohydrates, proteins and fats (Kamal *et al.*, 2024b). Keeping in mind the aforementioned facts, the present study was undertaken

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to know the impact of different genotypes and sulphur levels on yield attributes, yield and quality parameters of groundnut.

MATERIALS AND METHODS

The field experiment was conducted during the *Kharif* season of 2023 at Crop Physiology Field Lab, Department of Agronomy, CCS Haryana Agricultural University, Hisar. Geographically, Hisar is situated at 29°10'N latitude and 75°46'E longitude at an elevation of 215 m above mean sea level. The total rainfall received during the crop growing period was 176.1 mm. Weekly maximum and minimum temperatures remained under a suitable range for different crop growth stages. Average temperature on sowing date

for crop season was 35.2°C, while average temperature at harvesting 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 (MH 4, HNG 10, HNG 69, GNH 804) in the main plots and four sulphur levels (Control, 20, 40, 60 kg S/ha) in sub-plots with three replications. The soil of the field was sandy, 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 were followed for all treatments that were recommended in the groundnut crop. The data were recorded for yield components *i.e.*, number of pods per plant, number of kernels per pod, seed index (g); shelling percentage, pod yield (kg/ha), kernel yield (kg/ha), biological yield (kg/ha), haulm yield (kg/ha), harvest index (%); quality parameters *i.e.*, protein content (%), protein yield (kg/ha), oil content (%), oil yield (kg/ha). Data recorded were analyzed with the help of analysis of variance (ANOVA) technique (Gomez and Gomez, 1984) for split plot design. The least significance test was used to decipher the effect of treatments at the 5% level of significance.

RESULTS AND DISCUSSION

Effect of groundnut genotypes on yield attributes, yield and quality parameters

The data on yield attributes as influenced by genotypes are presented in Table 1. Number of pods per plant and seed index were significantly affected by genotypes, but non-significant differences were recorded between HNG 69 and GNH 804. GNH 804 recorded 71.63, 20.96 and 5.59 per cent higher pods per plant over MH 4, HNG 10 and HNG 69, respectively. GNH 804 recorded 20.55, 10.23 and 2.97 per cent higher seed index over MH 4, HNG 10 and

HNG 69 respectively. Genotypic variation progressively increased shelling percentage, but non-significant differences were recorded between HNG 10 and HNG 69, HNG 69 and GNH 804. A delve to data exhibited in Table 2 shows yield parameters as influenced by genotypes. Pod yield, kernel yield, biological yield and haulm yield were significantly affected by genotypes, but non-significant differences were recorded between HNG 69 and GNH 804. GNH 804 recorded 53.00, 16.21 and 2.66 per cent higher pod yield; 74.06, 21.32 and 3.73 per cent higher kernel yield; 44.74, 18.88 and 2.06 per cent higher biological yield; 40.69, 20.40 and 1.76 per cent higher haulm yield over MH 4, HNG 10 and HNG 69, respectively. A disquisition of the data given in Table 3 exhibited that quality parameters were significantly affected by genotypes, but non-significant differences were recorded between HNG 69 and GNH 804 for all the quality parameters. Genotype GNH 804 recorded 17.7, 104.9, 8.93 and 90.54 per cent higher protein content, protein yield, oil content and oil yield over MH 4, respectively; 7.17, 29.9, 3.44, 25.1 per cent higher protein content, protein yield, oil content and oil yield over HNG 10 respectively and 7.17, 5.10, 1.80, 5.92 per cent higher protein content, protein yield, oil content and oil yield over HNG 69, respectively. The preponderant effect of genotypic variation on various yield and component parameters of groundnut is due to increased utilization of carbohydrates for protein synthesis and physiological capacity to translocate them to organs of vegetative growth, resulting in increased plant growth, which ultimately leads to an increase in yield (Kalaiyaran *et al.*, 2019; Nurezannat *et al.*, 2019; Monika *et al.*, 2024b).

Effect of sulphur levels on yield attributes, yield and quality parameters

The data on yield attributes as influenced by sulphur levels are presented in Table 1. Number of pods per plant and seed index were significantly increased with the increase in sulphur levels up to 60 kg/ha, but non-significant

Table 1: Effect of genotypes and sulphur levels on yield attributes of groundnut.

Treatments	Yield attributes			
	Number of pods/plant	Number of kernels/pod	Seed index (g)	Shelling percentage
Genotypes				
MH 4	17.38	1.62	37.36	61.48
HNG 10	24.66	1.78	40.86	67.00
HNG 69	28.25	2.12	43.75	69.34
GNH 804	29.83	2.21	45.04	70.80
SEm±	0.50	0.10	0.43	1.24
CD at 5%	1.77	NS	1.53	4.39
Sulphur levels (kg S/ha)				
Control	21.33	1.59	39.21	62.42
20	24.50	1.89	41.19	66.30
40	27.16	2.02	43.12	69.25
60	27.58	2.24	43.33	69.73
SEm±	0.83	0.14	0.62	1.03
CD at 5%	2.44	NS	1.81	3.02

differences were recorded between 40 and 60 kg/ha. Number of pods per plant (27.58) and seed index (43.33 g) recorded with sulphur level of 60 kg/ha were significantly higher with a relative advantage of 29.30 and 10.51 per cent over control, respectively. Shelling percentage obtained with sulphur level of 60 kg/ha was found to be significantly higher over control, but non significant difference was recorded between 20-40 and 40-60 kg/ha. Shelling percentage (69.73) recorded with sulphur level of 60 kg/ha was significantly higher with a relative advantage of 11.71 per cent over control. A delve to data exhibited in Table 2 shows yield parameters as influenced by sulphur levels. Pod yield and kernel yield were significantly increased with increasing the sulphur levels up to 60 kg/ha. Sulphur levels of 60 kg/ha recorded 30.31, 11.85 and 3.38 per cent higher pod yield; 45.76, 18.08 and 4.32 per cent higher kernel yield, over control, 20 and 40 kg/ha sulphur levels, respectively. Increasing sulphur levels up to 60 kg/ha

significantly increased biological and haulm yield, but non-significant differences were recorded between 40-60 kg/ha for biological yield and 20-40, 40-60 kg/ha for haulm yield. Sulphur levels of 60 kg/ha recorded 23.34, 11.07 and 3.34 per cent higher biological yield; 19.82, 10.65 and 3.30 per cent higher haulm yield, over control, 20 and 40 kg/ha sulphur levels, respectively. The application of 60 kg S/ha enhanced biological yield significantly due to the higher plant growth and biomass production. Moreover, increased nutrient uptake and better utilization of radiant energy resulted in increased vegetative growth and reproductive development, thereby increasing the biological yield in the presence of sulphur (Kamal *et al.*, 2024c; Monika *et al.*, 2024a). A disquisition of the data given in Table 3 exhibited that quality parameters were significantly affected by sulphur levels. Increasing sulphur levels up to 60 kg/ha progressively increased protein content, protein yield, oil content and oil yield, but non-significant differences

Table 2: Effect of genotypes and sulphur levels on yield (kg/ha) of groundnut.

Treatments	Yield (kg/ha)				
	Pod yield	Kernel yield	Biological yield	Haulm yield	Harvest index (%)
Genotypes					
MH 4	1911	1180	5770	3858	33.00
HNG 10	2516	1693	7025	4508	35.58
HNG 69	2848	1980	8183	5334	34.91
GNH 804	2924	2054	8352	5428	35.16
SEm $\pm$	48	52	208	177	0.69
CD at 5%	171	185	736	606	NS
Sulphur levels (kg S/ha)					
Control	2157	1357	6464	4307	33.33
20	2513	1675	7178	4664	34.75
40	2719	1896	7715	4996	35.25
60	2811	1978	7973	5161	35.33
SEm $\pm$	35	29	167	152	0.65
CD at 5%	103	86	490	447	NS

Table 3: Effect of genotypes and sulphur levels on quality parameters of groundnut.

Treatments	Quality parameters			
	Protein content (%)	Protein yield (kg/ha)	Oil content (%)	Oil yield (kg/ha)
Genotypes				
MH 4	20.3	240.8	41.4	489.8
HNG 10	22.3	379.6	43.6	746.0
HNG 69	23.6	469.6	44.3	881.1
GNH 804	23.9	493.4	45.1	933.3
SEm $\pm$	0.32	9.3	0.41	20.6
CD at 5%	1.15	32.8	1.44	72.8
Sulphur levels (kg S/ha)				
Control	21.1	292.4	40.5	556.0
20	22.7	383.4	43.0	728.2
40	23.	441.3	44.8	855.1
60	23.2	466.4	45.8	911.0
SEm $\pm$	0.29	8.3	0.42	11.5
CD at 5%	0.85	24.4	1.25	33.9

regarding protein content and oil content were recorded between 40 and 60 kg/ha. Sulphur level of 60 kg/ha recorded 9.95, 59.5, 13.08 and 63.84 per cent higher protein content, protein yield, oil content and oil yield over control, respectively. Sulphur is best known in plants for its function in protein, oil, vitamins and flavor component synthesis. It is a component of three amino acids found in plants, namely cystine, cysteine and methionine, all of which are essential components of proteins. Sulphur increases the oil content and adds pungency to oil by forming disulphide linkages. The oilseeds require more sulphur than cereals because their oil-storing organs are mostly sulphur containing proteins. Sulphur deficiency is known to impair N metabolism in plants as well as the production of S-containing amino acids and thus has a negative impact on both seed yield and oil yield (Kamal *et al.*, 2024; Kamal *et al.*, 2024a).

CONCLUSION

The results of the present study revealed that genotypes and sulphur application significantly improved the yield and component parameters in groundnut. Among genotypes, the maximum increment was recorded at GNH 804 for most of the studied parameters, followed by HNG 69. Among sulphur levels, the maximum increment was recorded at 60 kg S/ha for most of the studied parameters, closely followed by sulphur level 40 kg S/ha. So, based on the results of the present study, it could be concluded that the genotype GNH 804 fertilized with 40 kg S/ha was most suitable for obtaining higher yield and better quality of groundnut produce.

Conflict of interest

All authors declare that they have no conflicts of interest.

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