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Effect of Nitrogen and Sulphur on Growth and Yield of Summer Groundnut (*Arachis hypogaea* L.)

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ABSTRACT: The present research trial was led during *Zaid* season of 2021, at crop research farm of Department of Agronomy, SHUATS, Prayagraj (U.P.) with the goal to evaluate the impact of different levels of nitrogen and sulphur on growth and yield of summer groundnut (*Arachis hypogaea* L.) under Randomized block design comprising of 9 treatments, with 3 different levels of nitrogen along with 3 different levels of sulphur that are replicated thrice. The results revealed that treatment T_9 (50 kg/ha N + 40 kg/ha S) has recorded maximum plant height (56.95 cm), number of nodules/plant (48.20), plant dry weight (42.98 g/plant), crop growth rate (7.11 g/m^2/plant), relative growth rate (0.005 g/g/day), number of pods/plant (20.60), kernels/pod (2.00), seed index (41.17g), pod yield (2741.00 kg/ha) and haulm yield (4371.00 kg/ha) at the time of harvest and harvest index (36.74%) was recorded highest with T_6 (40 kg/ha N + 40 kg/ha S).

Keywords: Groundnut, Nitrogen, Sulphur, Gypsum, Growth and Yield attributes.

INTRODUCTION

Groundnut is India's most important legume crop and it is the "King of Oilseeds". It accounts biggest wellspring of consumable oil in world and positions thirteenth situation among the food crops as well as fourth most significant oilseed yields of the world. The groundnut origin began in South America from there it stretched to Asia, Africa, USA, Nigeria and Sudan and different regions of the planet. Groundnut was brought into India in nineteenth century on east bank of the South Aricot area in Tamilnadu. India positions first in groundnut region with 4.94 million hectares representing 17.32% of the world region and second underway with 6.70 million tonnes representing 14.55% of the world's creation. It is a multipurpose harvest contains 45% to 51% top notch hydrogenated palatable oil along with 26% dietary proteins, 24.2% solvent carbs and minerals. The portions of kernel are additionally plentiful of E, K vitamins and all B nutrients with the exception of B_{12}. It is the richest plant source of thiamine and niacin, which is lowest in cereals. Haulm is utilized as animals feed. Groundnut oil contains a high bend of unsaturated fats *viz.*, oleic (50-65%) and linoleic corrosive (18-30%).

Adjusted sustenance is considered as one of the essential requirements to accomplish the expected yield (Yadav *et al.*, 2017). Among all other management practices, plant nutrition is considered to be the important one. It is a thorough yield and assimilates tremendous amount of supplement from soil during various phases of development. Among the essential nutrients, nitrogen and sulphur are the most important nutrients. Nitrogen is fundamental for enthusiastic vegetative and regenerative development of plant, photosynthesis and production of assimilates for pod filling. It is fundamental part of many mixtures of plant, like chlorophyll, proteins, nucleotides, chemicals, alkaloids, enzymes and nutrients (Sagvekar *et al.*, 2017). It is the key element that stimulates root and shoot growth. Though it fixes atmospheric nitrogen, to meet the requirement of plant the nitrogen supply to groundnut crop is very crucial. The impact of nitrogen fertilizer addition on soil natural matter status and soil substantial properties is critical to agrarian manageability and to build up crop yield. Besides, N fertilization influences dry matter generation as well as N collection and apportioning into different portions of yield plants for the development, advancement and other activities (Khaliq and Cheema 2005).

Besides NPK, Sulphur is one of the fundamental supplement component which assumes a significant part in carb digestion and genesis of chlorophyll, glycosides, oils and numerous different mixtures that are engaged in N- fixing process and photosynthesis of plants. Its nourishment to crop is important both according to quality and amount perspective. Sulphur is likewise progressively perceived as the fourth important plant supplement close to NPK (Tandon *et al.*, 2002). Oil crops expect about the similar amount of S or more than, phosphorous for high return and quality of crop (Jamal *et al.*, 2010). Sulphur is most popular for its job of oilseed crops in the blend of cysteine, methionine, chlorophyll and oil percentage. It is additionally liable for the union of specific oil development of seasoned

compounds. The use of sulphur nutrient on groundnut has been tracked down compelled through expanding the number of pegs and pods/plant, portion to shell proportion and so forth (Bharadwaj and Pathak 1987). The positive impact of sulphur nutrient application to groundnut has been accounted for by Ramdevputra *et al.* (2010).

MATERIALS AND METHODS

The present experiment was carried out during the *Zaid* season of 2021 at the CRF (Crop Research Farm) of Agronomy department, SHUATS, Prayagraj, (U.P.). To assess the effect of nitrogen and sulphur on growth and yield of summer groundnut (*Arachis hypogaea* L.). The experiment was conducted in Randomized complete block design with 9 treatments replicated thrice. Treatment combination consisted of two variables, one with three different levels of nitrogen *i.e.*, 30, 40 and 50 kg/ha and other with three different levels of sulphur *i.e.*, 0, 20 and 40 kg/ha. The treatment combination was given in Table 1. The requirement of Nitrogen, Phosphorous, Potassium and Sulphur nutrients were supplied through Urea, Di ammonium phosphate, Muriate of potash and Gypsum sources. After the land preparation and making of plots, soil samples were taken and the soil analysis was carried out. After the chemical analysis, the relatively available status of major nutrients are Nitrogen of 171.48 kg/ha, Phosphorous of 12.3 kg/ha and Potassium of 235.7 kg/ha. The pH of 7.2, organic carbon of 0.222% and EC of 0.315 d/Sm. Certain plant protection measures were followed to control pests and diseases with regards to the crop. In order to take the readings of plant height at 20, 40, 60, 80 days after sowing and at harvest five plants are taken randomly and tagging of these plants was carried out respectively from all the plots. Similarly, for recording the number of nodules per plant and dry weight randomly three plants are taken from all the plots. On attaining of harvesting stage, the crop was harvested for $1m^2$ area of plot and after pods were weighed and pod yield as well as haulm yield was computed and expressed in kg/ha. Later post- harvest practices were carried out and the required readings were taken as shown in the Table 2. Later pods were weighed and pod yield was computed and expressed in kg/ha. Later on statistical analysis was carried out as per method of analysis of variance (skeleton) at 5% level of significance for F-test.

Table 1: Details of treatment combination.

Sr. No.	Treatment No.	Treatment combination
1.	T_1	30 kg/ha Nitrogen + 0 kg/ha Sulphur
2.	T_2	30 kg/ha Nitrogen + 20 kg/ha Sulphur
3.	T_3	30 kg/ha Nitrogen + 40 kg/ha Sulphur
4.	T_4	40 kg/ha Nitrogen + 0 kg/ha Sulphur
5.	T_5	40 kg/ha Nitrogen + 20 kg/ha Sulphur
6.	T_6	40 kg/ha Nitrogen + 40 kg/ha Sulphur
7.	T_7	50 kg/ha Nitrogen + 0 kg/ha Sulphur
8.	T_8	50 kg/ha Nitrogen + 20 kg/ha Sulphur
9.	T_9	50 kg/ha Nitrogen + 40 kg/ha Sulphur

RESULTS AND DISCUSSION

Growth parameters. At the time of harvest, treatment T_9 has recorded significantly highest plant height of 56.95 cm. However, the treatments T_6 and T_3 were found at par to the maximum. The use of various levels of nitrogen hastened the plant tallness might be because of nitrogen at more significant level could have speed up photosynthetic process by improving the source size (plant stature and branches), along these lines furnishing the emerging bud with more photosynthates, which could have brought about increased stature of crop (Palsande *et al*., 2019). The outcomes related to groundnut are in congruity with those got by Thakare *et al*. (2003); Chandra *et al.* (2006); Elayaraja and Singaravel (2012). The increment in growth may be attributed to more readily root formation because of sulphur, which thusly stimulated higher assimilation of primary nutrients and Sulphur from soil and worked on metabolic movement inside the plant (Kalaiyarasan *et al.*, 2003).

At the time of harvest, treatment T_9 has recorded maximum number of nodules per plant (48.20) and minimum with treatment T_7 and there was no significant difference between different treatment combinations. Results proposed that nitrogen as well as sulphur could further develop nodulation and vegetative development in soybean (Sharma and Sharma 2014). The combined analysis of variance of nodulation assessment at 50% flowering stage revealed that the main factors N, P and Vermicompost and their interactions significantly influenced nodulation (Bekele *et al.*, 2019). Sulphur is associated with the improvement of S containing amino acids, vitamins and plays direct part in root development and nodulation (Jat and Ahlawat 2009).

At the time of harvest, treatment T_9 has recorded the maximum plant dry weight of 42.98 g/plant, and the treatment T_6 was at par with the maximum. The impact of sulphur on dry matter was huge. It was noted that dry matter increment was dynamically with higher level of sulphur *i.e.*, 60 kg/ha. The increase of shoot length, the sum of primary and secondary branches/plant and leaf region were predominantly answerable for the increment in dry matter (Nurezannat *et al*., 2019). Dry matter generation per plant improved significantly with higher levels of sulphur (Kalaiyarasan, 2003). Moreover, N fertilizer application influences dry matter creation as well as N assemblage and apportioning into

different parts of plants for the development, enhancement and different cycles (Khaliq and Cheema 2005). During 80 DAS-at harvest, treatment T_9 has recorded maximum crop growth rate which was significantly higher over other treatments and minimum with treatment T_5 and all other treatments are at par to the maximum. The higher percentage of sulphur in crop plants is shown to play part in better turn of events and widening of xylem and collenchyma tissues. The better nourishing nutritional content at the cell level and leaf chlorophyll content seem to have improved the photosynthetic rate. Improving the levels of sulphur produced increased crop growth rate contrasted with low levels. The outcomes are in congruity with the discoveries of Rao *et al.* (2013).

During 80 DAS-at harvest, relative growth rate data shown there is no significant difference observed among the treatment combinations and minimum has been recorded with T_5. Highest relative growth rate was recorded when the sulphur level increased up to 40 kg/ha in contrast with low levels. The conclusions are similar with the research of Das *et al.* (2017). The data was presented in Table 2.

Table 2: Effect of nitrogen and sulphur on growth parameters of summer groundnut.

Sr. No.	Treatment No.	Plant height (cm)	No. of nodules/plant	Plant dry weight (g/plant)	Crop growth rate (g/m^2/plant)	Relative growth rate (g/g/day)
1.	T_1	51.65	41.33	34.48	5.84	0.005
2.	T_2	52.95	43.07	37.57	5.92	0.005
3.	T_3	54.96	45.33	40.10	6.18	0.005
4.	T_4	51.48	39.07	35.63	5.51	0.005
5.	T_5	53.25	44.13	38.17	4.45	0.003
6.	T_6	55.88	47.07	42.36	6.94	0.005
7.	T_7	52.28	40.07	35.86	5.17	0.004
8.	T_8	54.17	44.67	38.97	4.98	0.004
9.	T_9	56.95	48.20	42.98	7.11	0.005
	CD (P=0.05) **Sem±**	2.72 0.91	6.06 2.02	1.87 0.62	- 0.86	- 0.0006

Effect on yield and yield attributes of summer groundnut. Maximum no. of pods/plant were seen in the treatment T_9 of 20.60 and the treatments T_6 and T_3 are found at par to the maximum. The highest no. of kernels/pod was recorded by the treatment T_9, T_8 and T_3 of 2 and the treatments T_5 and T_2 are found at par to the maximum. The highest seed index was recorded with the treatment T_9 of 41.17g and there was found no significant difference among various treatment combinations. The treatment T_9 has recorded maximum pod yield of 2741 kg/ha while the lowest with the treatment T_1. The highest haulm yield was recorded with treatment T_9 of 4371 kg/ha and the treatments T_6, T_8 were found statistically at par with the treatment T_9 and the treatment T_1 has recorded lowest. The highest harvest index was recorded with treatment T_6 of 36.74% and lowest with T_4 and there was no significant difference among various treatment combinations. The strengthening in yield credits of groundnut may be because of improved nutritional climate in root zone for development and enhancement.

Furthermore, sulphur is engaged in the development of S consisted amino acids, vitamins and plays direct part in root development and formative activities (Jat and Ahlawat 2009). Watering and Patrick, 1975 likewise detailed that increment in yields was credited to redirection of more worthy extent of absorbs to the emerging pods because of greater sink strength reversed through its bigger interest of photosynthates. Addition of sulphur in sufficient sum likewise helps in the advancement of floral botany *i.e.*, reproductive parts, which brings about the improvement of pods and kernels in crop plants. Similar findings have also been reported earlier by Patel *et al.* (2009).

Table 3: Effect of nitrogen and sulphur on yield and yield attributes of summer groundnut.

Sr. No.	Treatment No.	Pods/plant (No.)	Kernels/pod (No.)	Seed index (g)	Pod yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)
1.	T_1	13.60	1.53	35.13	2005.00	3739.00	31.84
2.	T_2	16.21	1.87	38.10	2240.00	3915.00	34.52
3.	T_3	18.73	2.00	40.03	2502.00	4126.00	36.19
4.	T_4	14.33	1.60	36.10	2126.00	3832.00	31.30
5.	T_5	17.27	1.93	38.53	2317.00	4024.00	35.50
6.	T_6	19.93	2.00	40.73	2630.00	4288.00	36.74
7.	T_7	14.87	1.73	36.43	2163.00	3930.00	31.76
8.	T_8	18.40	2.00	39.80	2451.00	4142.00	34.31
9.	T_9	20.60	2.00	41.17	2741.00	4371.00	34.84
	CD(P=0.05) **Sem±**	1.90 0.63	0.26 0.09	- 1.39	170.39 56.83	234.09 78.08	- 1.51

Comparative discoveries have additionally been accounted for by Palsande *et al.* (2019); Meena *et al.* (2011); Venkatesh *et al.* (2002). The synergistic impact of nitrogen along with sulphur on the availability of majorly all the nutrients further add in the enhancement of these yield parameters. The research was found similar to the discoveries of Meena and Shivay, 2010. Similar conclusions are also given by Dileep *et al.* (2021).

CONCLUSION

On the basis of the present experiment on groundnut crop in zaid season, it is concluded that treatment T_9 with the application of 50 kg/ha nitrogen along with 40 kg/ha sulphur has recorded significantly highest plant height, dry weight, pods/plant, pod yield and haulm yield respectively.

FUTURE SCOPE

The conclusion drawn are based on one season data only which needs further confirmation for recommendations.

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Conflict of Interest. None.

REFERENCES

Bharadwaj, S. P. and Pathak, A. N. (1987). Performance of kharif groundnut cultivars with different sources of sulphur in West Bengal. *Indian Journal of Agriculture 42*(3): 41-46.

Bekele, G., Dechassa, N., Tana, T. and Sharma, J. J. (2019). Effects of nitrogen, phosphorous and vermicompost fertilizers on productivity of groundnut (*Arachis hypogaea* L.) in Bablie, Eastern Ethiopia. *Agronomy Research, 17*(4): 1532-1546.

Chandra, P., Samui, R. C. and Bordolui, S. K. (2006). Growth, yield attributes and yield of different cultivars of groundnut as affected by potassium application. *Journal of Crop and Weed* 2(1): 37-39.

Das, S., Das, A., Idapuganti, R., Layek, J. and Chowdary, S. (2017). Growth and physiology of groundnut as influenced by micronutrients and liming in acid soil of North East India. *Indian Journal of Hill farming, 29*, 40-47.

Dileep, D., Singh, V., Tiwari, D., George, G. S. 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.

Elayaraja, D. and Singravel, R. (2012). Optimization of zinc levels for groundnut in coastal sandy soil. *Asian Journal of Soil Science, 7*(1): 43-46.

Jamal, A., Yong-Sun, M. and Zainul, Z.A. (2010). Sulphur- a general overview and interaction with nitrogen. *Australian Journal of Crop Science, 47*(7): 523-529.

Jat, R. A. and Ahlawat, I. P. S. (2009). Effect of farm yard manure, source and level of sulphur on growth attributes, yield, quality and total nutrient uptake in pigeon pea and groundnut intercropping system. *Indian Journal of Agricultural Sciences, 79*(12): 1016-1019.

Kalaiyarasan, C., Vaiyapuri, V. and Chandrasekharan, M.V.S. (2003). Effect of sulphur sources and levels on the nutrient uptake, crop quality and sulphur use efficiency in groundnut. *Annals of Agricultural Research New Series, 24*(3): 478-480.

Khaliq, A. and Cheema, Z. A. (2005). Influence of irrigation and nitrogen management on some agronomic traits and yield of hybrid sunflower. *International Journal of Agricultural Botany, 7*: 915-919.

Meena, B. P., Kumavat, S. M. and Yadav, R. S. (2011). Effect of planting geometry and nitrogen management on groundnut in loamy sand soil of Rajasthan. *Indian Journal of Agricultural Sciences, 81*(1): 86-88.

Meena, H. N. and Shivay, Y. (2010). Productivity of short-duration summer forage crops and their effect on succeeding aromatic rice in conjunction with gypsum enriched urea. *Indian Journal of Agronomy, 55*(1): 11-15.

Nurezannat, Sarkar, Md. A.R., Uddin, Md. R., Sarkar, U.K., Kaysar, Md.S. and Saha, P. K. (2019). Effect of variety and sulphur on yield and yield components of groundnut. *Journal of Bangladesh Agricultural University, 17*(1): 1-8.

Palsande, V. N., Nagrale, M.R., Kasture, M. C., Gokhale, N.B., Dhekele, J. S. and Salvi, V. G. (2019). Growth, yield and quality of groundnut as affected by different levels of nitrogen, potassium and zinc in lateritic soils of Konkan. *Journal of Pharmacognosy and Phytochemistry, 8*(5): 790-794.

Patel, G. N., Patel, P., Patel, D. M., Patel, D. K. and Patel, R. M. (2009). Yield attributes, yield, quality and uptake of nutrients by summer groundnut, (*Arachis hypogaea* L.) as influenced by sources and levels of sulphur under varying irrigation schedule. *Journal of Oilseed Research, 26*(2): 119-122.

Rao, K. T., Rao, A. U. and Sekhar, D. (2013). Effect of sources and levels of sulphur on groundnut. *Journal of Academia and Industrial Research, 2*(5): 268-270.

Ramdevputra, M. V., Akbari, K. N., Sataria, G. S., Vora, V.D. and Padmani, D. R. (2010). Effect of sulphur application on yield of groundnut and soil fertility under rainfed conditions. *Legume Research, 33*(2): 143-145.

Sagvekar, V. V., Waghmode, B. D. and Kamble, A. S. (2017). Effect of nitrogen and phosphorous management on productivity and profitability of groundnut. *Indian Journal of Agronomy, 62*(3): 338-340.

Sharma, A. and Sharma, S. (2014). Effect of Nitrogen and Sulphur nutrition on Nitrogen assimilating Enzymes in Soybean Roots and Nodules. *International Journal of Agriculture, Environment & Biotechnology, 7*(3): 471-480.

Tandon, H. L. S. and Messick, D. L. (2002). Practical Sulphur Guide. The Sulphur Institute, Washington, D.C.

Thakare, G. V., Ulemale, R. B., Shivankar, R. S. and Dahiphale, A.V. (2003). Morphological indices and yield attributes as influenced by integrated nutrient management in summer groundnut. *Annals of Plant Physiology, 17*(1): 1-5.

Venkatesh, M. S., Majumdar, B., Lal, B. and Kumar, K. (2002). Relative performance of sulphur sources on sulphur nutrition of groundnut in acid Alfisol of Meghalaya. *Indian Journal of Agricultural Sciences, 72*(4): 216-219.

Watering, P. F. and Patrick, J. (1975). Sources-sink relation and partitions of assimilates in the plant. Photosynthates and productivity in different environment (Ed. J.P. Copper) Cambridge University Press, London 481-499.

Yadav, M. R., Kumar, R., Parihar, C.M., Yadav, R.K., Jat, S. L., Ram, H., Meena, R. K., Singh, M., Birbal, Verma, A. P., Kumar, U., Ghosh, A. and Jat, M. L. (2017). Strategies for improving nitrogen use efficiency. A review. *Agricultural Reviews, 38*(1): 29-41.

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