Original Research Article

"Influence of Sulphur and foliar application of iron on growth and yield of groundnut (*Arachis hypogea* L.)"

ABSTRACT

The field experiment was conducted at crop research farm in department of agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. during Kharif season of 2022 on Groundnut crop. The treatment considered of 3 levels of sulphur (20,40&60 kg) and iron (0.5,0.75&1%) as foliar spray and a control plot. The experiment was laid out in Randomised Block Design (RBD) with 10 treatments and replication thrice. The result showed that application of sulphur 60 kg/ha + FeSO4 1% was recorded significantly higher plant height (53.60 cm) at 80 DAS, dry weight (37.73 g), kernel yield (2.47 t/ha), gross return (157520.00 INR/ha), net return (106768.40 INR/ha) and B:C ratio (2.10).

Key words: *Sulphur, Iron, Growth, Yield.*

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is known to be a unique and important legume cum oilseed crop of India accounting 33% of world's groundnut area and about 27.3% production. It belongs to Leguminoseae family. It is also known as peanut, monkey nut, earthnut, manila nut and goober. It is world's largest source of edible oil and ranks 13th among the food crops as well as 4th most important oilseed crops of the world. It is a leading oilseed crop in India with an area of 5.95 million hectares and production of 8.254 million tone of groundnut at an average productivity of 1071 kg/ha during summer season (groundnut outlook report, 2020-2021). It is a multipurpose crop contains 45% to 51% high quality hydrogenated edible oil and 26% dietary proteins, 24.2% soluble carbohydrates and minerals. The kernels also rich in vitamin E, K and all B vitamins except B12 **(Naiknaware *et al.* 2015)**.

Groundnut is an important oilseed crop in India which occupies first position in terms of area and second position in terms of production after soyabean. China ranks first in

groundnut production with 17.57 million tonnes followed by India 6.73 million tonnes, Nigeria 4.45 lakh tonnes, Sudan 2.83 million tonnes and United States of America 2.49 million tonnes accounting for 36.01, 13.79, 9.12, 5.80 and 5.11 percent of total world production of 48.80 million tonnes in 2019-20. According to the 3rd advance estimates, groundnut production estimate (kharif and rabi) was 10.08 million tonnes for 2021-22 as against 10.24 million tonnes in 2020-21. (Groundnut Outlook - August 2022)

Sulphur is the fourth major nutrient and plays an important role in the nutritionof oil-seed crop and as a constituent of sulphur containing amino acids cystine,cysteine and methionine (**Gangadhara *et al.*, 1990**). In oil seed crops it is also involved in the formation of glucocides or glucosinolates which on hydrolysis increase the oil content. One of the main functions of sulphur in proteins or polypeptides is the formation of disulphide bonds between polypeptide chains. Disulphide linkages are important in stabilizing and determining the configuration of proteins. The application of sulphur increased the uptake of various macro and micro nutrients in groundnut *(***Patel *et al.* 2018**)

Iron is an essential micronutrient takes active part in the metabolic activities ofthe plant. It is an important part of the enzyme nitrogenase which is essential fornitrogen fixation bacteria. The ferredoxins are Fe-S proteins and are the first stable redox compound of the photosynthetic electron transport chain. Application of iron also found to improve the protein content in groundnut kernels. Application of Fe successfully increases pod yield and micronutrient uptake (**Yadav *et al.* 2019**).

Keeping all this review "**Influence of sulphur and Foliar application of Iron on growth and yield of groundnut (*Arachis hypogaea* L.)"** was conducted at Crop Research Farm, Department of Agronomy, Sam Higgingbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during *Kharif* season of 2022.

MATERIAL AND METHODS

The field experiment was conducted during the *khaif* season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh. The soil in the experimental area was sandy loam with pH (7.4), organic carbon (0.306%), available N (171.48 kg ha^{-1}), available P (243.5 kg ha^{-1}), and available K (291.2 kg ha^{-1}). The experiment was laid out in Randomised Block Design with ten treatments which are replicated thrice with three levels of application of sulphur 20, 40, 60 kg ha^{-1} and three levels of foliar application of iron 0.5, 0.75, 1.0% and control. Treatment combinations are T1: Sulphur 2O kg/ha + FeSO4 0.5%, T2: Sulphur 2O kg/ha + FeSO4 0.75%, T3: Sulphur 2O kg/ha+ FeSO4 1.0%, T4: Sulphur 4O kg/ha + FeSO4 0.5%, T5: Sulphur 4O kg/ha + FeSO4 0.75%, T6: Sulphur 4O kg/ha + FeSO4 1.0%, T7: Sulphur 6O kg/ha + FeSO4 0.5%, T8: Sulphur 6O kg/ha + FeSO4 0.75%, T9: Sulphur 6O kg/ha + FeSO4 1.0%, T10: RDF: 20-40-20 NPK kg/ha (Control) are used. Seeds are sown at a spacing of 30cm×10cm according to a seed rate of 90 kg/ha. The recommended dose of nitrogen (20 kg/ha), Phosphorus(40kh/ha) and potassium (20 kg/ha) was applied as basal dose just before sowing and sulphur, and FeSO4 (Foliar spray at 30 DAS) were applied as per the treatments. Urea, SSP, and MOP were taken as fertilizer sources of N, P, and K respectively.

RESULT AND DISCUSSION

GROWTH ATTRIBUTES

Plant height (cm) The data revealed that a significant and maximum plant height (53.60 cm) was recorded in treatment 9 [Sulphur (60 kg/ha) + FeSO4 (1.0%)]. However, treatment 7 and treatment 8 were found to be statistically at par with treatment 9 in table no.1. The significant and highest plant height was with application of sulphur may be due to along with sulphur, other macro and micronutrients are also available which are considered important for the growth and development of plant. It seems to have promoted meristematic activities causing higher apical growth and expansion of the photosynthetic surface. (**Raja *et al.*2007**) & (**Dileep *et al.*2011**). Foliar spray of FeSO4 at 40 DAS results is significantly higher the plant height, number of

branches per plant, dry matter at 45 and 75 DAS, number of nodules per plant,pod weight,100 kernel weight, shelling per cent, pod and haulm yield. **Der *et al*. (2016).**

Plant dry weight (g) The data revealed that significant and maximum plant dry weight (37.73 g) was recorded in treatment [Sulphur (60 kg/ha) + FeSO4 (1.0%)]. treatment 7 and treatment 8 were found to be statistically at par with treatment 9 in table 1. The significant and highest Dry weight was the application of Sulphur plays plant metabolic activity, which may lead to the increase in photosynthesis. Similar results were observed by **Sisodiya *et al*. (2016).**

YIELD ATTRIBUTES

Kernel yield (t/ha) The data revealed that significantly higher kernel yield (2.47 t/ha) was recorded in treatment 9 [Sulphur (60 kg/ha) + FeSO4 (1.0%)]. treatment 8 and treatment 7 were found to be statistically at par with treatment 9 in table 2. Application of sulphur @ l5 kg/ha recorded an increase in kernel yield to the tune of 106.52% and 73.11% over control, respectively **Giri *et al.* (2011).**Average maximum number of pods/plant (45.0), no of kernel/pod (1.96) and yield (27.13 q/ha) was recorded with two foliar applications of ferrous sulphate 0.5 at 45 and 60days after sowing along with recommended dose of fertilizers **Kheravat *et al.* (2020).**

ECONOMICS Highest gross return (INR 157520.00/ha), net return (INR 110968.40 /ha) and Benefit-cost ratio (2.38) was obtained in the treatment 9 (Sulphur 60 kg/ha + FeSO4 1.0%) in table 3.

CONCLUSION It was concluded that application of sulphur and iron performs positively and improves the growth parameters and yield attributes of groundnut. Maximum kernel yield, gross return, net return and benefit cost ratio was recorded with the application of Sulphur 60 Kg/ha + FeSO4 1%.

REFERENCES

B. S. Kheravat, Naval Kishor , R.K. Shivran , Keshav Mehra , Richa Pant and Amit Kumar. (2020). Effect of Iron on Growth, Yield and Yield Attributing Parameters of

Groundnut (*Arachis hypogaea* L.) under Hyper Arid Partially Irrigated Zone of Rajasthan International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Special Issue-11 pp. 1978-1985.

Der, H. N., Vaghasia, P. M., & Verma, H. P. (2016). Effect of foliar application of potash and micronutrients on growth and yield attributes of groundnut.

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): 475-4

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): 475-4

Gangadhara, G. A., Manjunathaiah, H. M., & Satyanarayana, T. (1990). Effect of sulphur on yield, oil content of sunflower and uptake of micronutrients by plants. *Journal of the Indian Society of Soil Science*, **38**(4), 692-695.

Giri, U., Kundu, P., Chakraborty, A., & Bandyopadhyay, P. (2011). Effect of sulphur and different irrigation regimes on groundnut. *Journal of Crop and Weed*, *7*(2), 80-83.

Naiknaware, M. D., Pawar, G. R., & Murumkar, S. B. (2015). Effect of varying levels of boron and sulphur on growth, yield and quality of summer groundnut (Arachis hypogea L.). *International Journal of Tropical Agriculture*, **33**(2 (Part I)), 471-474.

Patel, P. K., Viradiya, M. B., Kadivala, V. H. and Shinde, R. D. (2018). Effect of Potassium and Sulphur on Yield Attributes, Yield and Quality of Summer Groundnut (*Arachis hypogaea* L.) under Middle Gujarat Condition. *International Journal of Current Microbiology and Applied Sciences.* **7**(9): 2268-2273.

Raja, A., Hattab, K.O., Gurusami, L., Vembu, G. and Suganya, S. (2007). Sulphur application on growth yield and quality of sesame (*Sesamum indicum* L.) varieties. *International Journal of Agricultural Sciences.* **2**(7): 599-606.

Sisodiya, R. R., Babaria, N. B., Parakhia, D. V., Parmar, K. B., and Vekaria, L. C. (2016). Effect of sulphur sources and levels on growth, yield and quality of groundnut (*Arachis hypogaea* L.). Trends in Biosciences **9**(5): 324-328.

Yadav, S., Verma, R., Yadav, P. K., & Bamboriya, J. S. (2020). Effect of sulphur and iron on nutrient content, uptake and quality of groundnut (Arachis hypogaea L.). *Journal of Pharmacognosy and Phytochemistry*, **9**(1), 1605-1609.

Table 1 Influence of sulphur and foliar application of iron on growth and yield of groundnut

S.no.	Treatment combinations	Plant height (cm)	Plant dry weight (g)	Kernel Yield (t/ha)
1.	Sulphur 20 kg/ha + FeSo4 0.5%	43.97	24.17	1.77
2.	Sulphur 20 kg/ha + FeSo4 0.75%	46.07	24.93	1.87
3.	Sulphur 20 kg/ha + FeSo4 1%	45.17	26.33	1.93
4.	Sulphur 40 kg/ha + FeSo4 0.5%	46.37	27.10	2.06
5.	Sulphur 40 kg/ha + FeSo4 0.75%	47.67	28.83	1.94
6.	Sulphur 40 kg/ha + FeSo4 1%	46.83	27.97	2.10
7.	Sulphur 60 kg/ha + FeSo4 0.5%	49.63	33.93	2.30
8.	Sulphur 60 kg/ha + FeSo4 0.75%	52.53	33.50	2.35
9.	Sulphur 60 kg/ha + FeSo4 1%	53.60	35.50	2.47
10.	Control RDF (20:40:20 kg/ha)	42.07	23.37	1.40
	F test	S	S	S
	SEm(±)	1.36	1.39	0.19
	CD (p=0.05)	4.03	4.13	0.57

Table 3 Influence of sulphur and foliar application of iron on Economics of groundnut

	Treatment Combination	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
1.	Sulphur 20 kg/ha + FeSo4 0.5%	46815.60	113470.00	66654.40	1.42
2.	Sulphur 20 kg/ha + FeSo4 0.75%	47583.60	119749.00	72165.40	1.52
3.	Sulphur 20 kg/ha + FeSo4 1%	48315.60	123570.00	75218.40	1.56
4.	Sulphur 40 kg/ha + FeSo4 0.5%	48015.60	132130.00	84114.40	1.75
5.	Sulphur 40 kg/ha + FeSo4 0.75%	48783.60	125408.00	76624.40	1.57
6.	Sulphur 40 kg/ha + FeSo4 1%	49551.60	134330.00	84778.40	1.71
7.	Sulphur 60 kg/ha + FeSo4 0.5%	49215.60	147049.00	97833.40	1.99
8.	Sulphur 60 kg/ha + FeSo4 0.75%	49983.60	150236.00	100252.40	2.01
9.	Sulphur 60 kg/ha + FeSo4 1%	50751.60	157520.00	106768.40	2.10
10.	Control RDF (20:40:20 kg/ha)	43479.60	90280.00	46800.40	1.08