International Journal of Plant & Soil Science

Volume 36, Issue 5, Page 589-593, 2024; Article no.IJPSS.115337
ISSN: 2320-7035

Influence of Sulphur and Zinc on Growth, Yield and Economics of Groundnut (*Arachis hypogea* L.)

Pawan [a++*], Prateek Kumar [a#], Biswarup Mehera [b†] and Vishal [a‡]

[a] Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj, Uttar Pradesh, India.
[b] Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2024/v36i54556

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/115337

Original Research Article

Received: 26/01/2024
Accepted: 30/03/2024
Published: 03/04/2024

ABSTRACT

A field trial was led during *Zaid* (summer) season of 2023 at Crop Research Farm Department of Agronomy. The treatments contained of 3 level of Sulphur (15, 30 & 45 kg/ha) and 3 level of zinc (20kg/ha, 0.50% and 0.25% foliar application) along with recommended dosages of N, P, K and a control (20:60:40 NPK kg/ha). The investigate was laid out in a RBD with ten treatments and replication thrice. Application of Sulphur (45 kg/ha) + Zinc (10kg/ha + 0.25% foliar application) (treatment 9) recorded maximum plant height (46.00 cm), & yield attributes namely more number of pod/plants (26.53), highest seed yield (2.65 t/ha) and haulm yield (6.37 t/ha). The treatment also recorded, net return (135076 INR/ha) and B:C ratio (2.61).

[++] M.Sc. Scholar;
[#] PhD Scholar;
[†] Dean;
[‡] M.Sc. (Agriculture);
**Corresponding author: E-mail: pawansundaa@gmail.com;*

Keywords: Groundnut; sulphur; zinc; growth; yield; economic; oilseeds crops; economic crops; feeder legume.

1. INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the self-pollinating eatable oil seed crops, cultivated throughout the world. It belongs to family Fabaceae. It is of South American origin. It is known as the king of oilseeds crops [1]. It is one of the main vegetable oil crops in the world and ranked 13th amongst the principle commercial crops of the world. It plays a vital role in sustainable agriculture because of its nitrogen fixing ability. In India, groundnut crop is being cultivated in zone of 4.73 Mha and accounts for 6.72 Mt of production with an average produce of 1422 kg/ha (India Stat, 2020-21). In Telangana, it is occupying an zone of 0.126 Mha with a production of 0.313 Mt and average produce of 2491 kg/ha. Groundnut requires only about 400-500 mm (500-700 mm evapotranspiration) of water. Its cultivation has been extended on almost all soil types in tropical countries.

Zinc is an essential component of a variety of dehydrogenases, proteinases and peptidases. All these enzymes show sensitivity to Zn deficiency. Zn is now being regarded as the third most limiting nutrient element in crop production after N and P. Critical level of zinc in groundnut leaves is 23 ppm [2].

Sulphur is now widely included in balanced fertilisation and nutrition for oilseed crops in general and groundnut crops in particular. Sulphur is currently recognised as the 4th main plant nutrient, after N, P & K. It is among the crucial prerequisites for improving groundnut quality and yield. Since sulphur is the master nutrient of all oilseed crops, its importance as a plant nutrient is growing in dry land agriculture. Pulses and oilseeds are particularly sensitive to sulphur among field crops. One of the fundamental nutrient elements, sulphur is crucial for the metabolism of carbohydrates and the creation of oils, glycosides, chlorophyll, and numerous other chemicals that are involved in plant photosynthesis and N-fixation. It is essential to crops' nutrition in terms of both quantity and quality. It causes some crops to contain less HCN, encourages nodulation in legumes, and results in heavier oilseed grains [3].

2. MATERIALS AND METHODS

The trial was led during the *Zaid* season 2023, at the Crop Research Farm (CRF), Department of Agronomy, NAI, SHUATS, Prayagraj (U.P.) which is located at 25° 39' 42"N latitude, 81° 67 56" E longitude, and 98 m altitude above the mean sea level (MSL). The experiment was laid out in Randomized Block Design Which consisting of ten treatments with T_1 – Sulphur 15 kg/ha + Zinc 20 kg/ha, T_2 – Sulphur 15 kg/ha + Zinc 0.50% foliar application, T_3 – Sulphur 15 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application, T_4 - Sulphur 30 kg/ha + Zinc 20 kg/ha, T_5 - Sulphur 30 kg/ha + Zinc 0.50% foliar application, T_6 - Sulphur 30 kg/ha + Zinc 10 kg/ha +Zinc 0.25% foliar application, T_7 - Sulphur 45 kg/ha + Zinc 20 kg/ha, T_8 - Sulphur 45 kg/ha + Zinc 0.50% foliar application, T_9 Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application, T_{10} - Control (RDF 20-60-40). Data recorded on different aspects of crop, *viz.,* growth, yield attributes were subjected to statistically analysis by analysis of variance method [4] and economic data analysis mathematical method.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

3.1.1 Plant height (cm)

The data revealed that a significantly and maximum plant height (46.00 cm) was observed in T_9 [Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application]. However, the treatment 6 [Sulphur 30 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (44.30 cm), treatment 3 [Sulphur 15 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (43.67 cm), were found to be statistically at par with treatment 9.

The results of the present investigation revealed that, the groundnut treatments differed significantly with respect to the plant height. Plant height improved with the application of Zn both at flowering and pegging stage. Micronutrients are known for their specific ability to enhance plant height by increased internodal length, Plant height was significantly increased with the combined application of 0.2% $ZnSO_4$ when compared to control [5]. Throughout all growth stages, there was a rising trend in the height of the plants and a commensurate rise in the sulphur content. The tallest plants were generated by applying 60 kg/ha of sulphur, which outperformed all other sulphur application doses

Table 1. Effect of Sulphur and Zinc on Growth, Yield and Economics of Groundnut

S.N.	Treatment combinations	Plant height (cm) (80 DAS)	Number of pods/plant	Seed Yield (t/ha)	Haulm Yield (t/ha)	Net return (INR/ha)	B:C
1	Sulphur 15 kg/ha + Zinc 20 kg/ha	39.29	23.04	1.70	4.50	72309	1.46
2	Sulphur 15 kg/ha + Zinc 0.50% foliar application	40.16	23.71	1.68	4.47	72512	1.50
3	Sulphur 15 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application	43.67	25.60	2.37	5.71	118688	2.43
4	Sulphur 30 kg/ha + Zinc 20 kg/ha	41.25	23.38	1.66	4.86	70491	1.38
5	Sulphur 30 kg/ha + Zinc 0.50% foliar application	40.84	23.98	1.82	5.00	81646	1.64
6	Sulphur 30 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application	44.30	25.87	2.45	5.94	122683	2.44
7	Sulphur 45 kg/ha + Zinc 20 kg/ha	43.89	22.92	1.61	4.86	66231	1.26
8	Sulphur 45 kg/ha + Zinc 0.50% foliar application	42.31	24.00	2.01	4.71	90171	1.76
9	Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application	46.00	26.53	2.65	6.37	135076	2.61
10	Control (RDF)	39.12	22.74	1.50	4.12	63089	1.39
	F-test	**S**	**S**	**S**	**S**	**-**	**-**
	SEm(±)	1.24	0.68	0.16	0.22	**-**	**-**
	CD (p=0.05)	3.67	2.03	0.47	0.68	**-**	**-**

throughout the whole development cycle. Additionally, sulphur has been shown to aid in reducing the pH of the soil, which is the main cause of increased nutrient availability and mobility, particularly for Phosphorus, Iron, Manganese, and Zinc. The present examination is in knowledge with the results Gowthami and Ananada [6] and Kamera et al. [7].

3.2 Yield and Yield Attributes

Number of pods/plant: The data revealed that T_9 [Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] was recorded significant and maximum number of pods/plant (26.53) which was superior over all other treatments. Though, the T_6 [Sulphur 30 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (25.87), T_3 [Sulphur 15 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (25.60) was found to be statistically at par with the treatment 9.

Applying sulphur & Zinc together increased the number of pods/plant. This could be because of the enhanced primary vegetative growth, which resulted in larger leaf area, the growth of dry matter, and a vigorous root system that produced more branches, which greatly increased the number of pods bearing branches [8].

Seed yield (t/ha): The data revealed that T_9 [Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] was recorded significant and higher seed yield (2.65 t/ha) which was superior over all other treatments. However, the treatment 6 [Sulphur 30 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (2.45 t/ha), treatment 3 [Sulphur 15 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (2.37 t/ha) was found to be statistically at par with the treatment 9.

Haulm yield (t/ha): The data revealed that Treatment 9 [Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] was recorded significant and maximum haulm yield (6.37 t/ha) which was superior over all other treatments. However, the treatment 6 [Sulphur 30 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (5.94 t/ha), treatment 3 [Sulphur 15 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] (5.71 t/ha) was found to be statistically at par with the treatment 9.

The administration of micronutrients caused significant differences in the data on haulm yield as well. $ZnSO_4$ applied to the soil at a rate of 25 kg/ha plus 0.5% applied topically on leaves resulted in a noticeably greater haulm produce (3080 kg/ha). [6]. Like outcomes were also experimental by Meena et al. [9]. The overall improvement in vigour and crop growth, as evidenced by growth parameter, may be responsible for the notable gains in pod, kernel, and haulm yields brought about by applying sulphur. The notable rise in groundnut yields may have been caused by enhanced growth brought about by S fertilisation, increased photosynthesis, and increased mobilisation of photosynthates towards reproductive structures [10].

3.3 Economics

3.3.1 Net return (INR/ha)

Net return (135076) was found to be highest in treatment 9 [Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] as compared to other treatment.

3.3.2 B: C ratio

Benefit Cost Ratio (2.61) was found to be highest in treatment 9 [Sulphur 45 kg/ha + Zinc 10 kg/ha + Zinc 0.25% foliar application] as compared to other treatment.

The improved yield of seeds and stover under foliar application of sulphur 4% with zinc at 1.5% was the cause of the higher gross returns, net returns, and b:c ratio. The findings are in close conformity with those of Durgude et al. [11,12].

4. CONCLUSION

It is concluded that the application of Sulphur 45 kg/ha along with Zinc 10 kg/ha along with Zinc 0.25% foliar application (treatment-9) was recorded maximum plant height, no. of pods/plant, seed yield, Haulm yield and benefit cost ratio in groundnut crop.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Hammons RO, Branch WD. Pedigreed natural crossing to identify peanut testa genotypes. Peanut Science. 1982;9(2):90-93.

2. Sarangi DR, Jena D, Chatterjee AK. Assessment of critical limit of zinc for rice, groundnut and potato in red and laterite soils of Odisha; 2016.
3. Tandon HL. Sulphur research and agricultural production in India. FDCO, New Delhi (3rd Ed.); 1991.
4. Gomez KA, Gomez AA. Statistical procedures for agriculture research, 2nd edition, John Wiley and Son, New York. 1976;680p.
5. Sale RB, Nazirkar RB. Response of soybean [*Glycine max* L. Merill.] yield, nutrient uptake and quality to micronutrients (Zn, Fe and Mo) under Khandesh region of Maharashtra. An Asian Journal of Soil Science. 2013;245-248.
6. Gowthami VS, Ananada N. Dry matter production, yield and yield component of groundnut (*Arachis hypogaea* L.) genotypes as influenced by zinc and iron through fertifortification. Indian Journal of Agricultural Research. 2017;51(4): 339-344.
7. Kamera, EG, Olympio NS, Asibuo JY. Effect of calcium and phosphorus fertilizer on the growth and yield of groundnut (*Arachis hypogaea* L.) International Research Journal of Agricultural Science and Soil Science. 2011;1(8):326-331.
8. Singh MV. Detrimental effect of zinc deficiency on crops productivity andhuman health. First Global Conference on Biofortification, Harvest Plus, Washington, USA; 2010.
9. Meena S, Malarkodi M, Senthilvalavan P. Secondary and micronutrients for groundnut - A review. Agric. Rev. 2007;28(4):295-300.
10. Yadav N, Yadav SS, Yadav N, Yadav MR, Kumar R, Yadav LR, Yadav VK, Yadav A. Sulphur management in groundnut for higher productivity and profitability under Semi-Arid condition of Rajasthan. Legume Res; 2018.
ISSN: 0250- 5371
11. Durgude AG, Kadam SR, Pharande AL. Response of hybrid maize to soil and foliar application of iron and zinc on entisols. An Asian Journal of Soil Science. 2014;9(1):36-40.
12. Area, Production and Productivity of Groundnut; 2020-21.
Available:https://www.indiastat.com

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/115337