*International Journal of Environment and Climate Change*

***Volume 13, Issue 9, Page 2507-2511, 2023; Article no.IJECC.103786***
***ISSN: 2581-8627***
*(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)*

# Influence of Sources of Sulphur and Zinc on Growth and Yield of Sesame (*Sesamum indicum* L.)

**Sovan Mondal [a++*], Shikha Singh [a#] and Anu Nawhal [a†]**

[a] *Department of Agronomy, SHUATS, 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/IJECC/2023/v13i92484

**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/103786

***Original Research Article***

***Received: 15/05/2023***
***Accepted: 22/07/2023***
***Published: 01/08/2023***

## ABSTRACT

A field experiment was carried out during *kharif* 2022 at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, (UP). The soil had a sandy loam texture, with a pH of 7.5, organic carbon (0.625%) and EC (0.564 m.m $cm^{-1}$), Nitrogen (278.48 kg $ha^{-1}$), Phosphorus (38.2 kg $ha^{-1}$) and Potassium (240.7 kg $ha^{-1}$). The experiment was laid out in Randomized Block Design with nine treatments and control which are replicated thrice based on one year of experimentation. The treatments consisted of 3 levels of source of sulphur (Gypsum 300 kg/$ha^{-1}$, Single super phosphate 20 kg/$ha^{-1}$, Elementary Sulphur 40 kg/$ha^{-1}$) and zinc (5, 10, 15 kg/$ha^{-1}$) as a Basal application and a control. The application of Gypsum 300 kg/$ha^{-1}$ + Zinc 15 kg/$ha^{-1}$ recorded significantly higher Plant height (110.73 cm), Plant dry weight (15.71 g/plant), number of Capsules/plant (51.40), Seeds/capsules (55.47), Test weight (2.70 g), Seed yield (1.07 t/ha) were recorded with the treatment of Gypsum 300 kg/ha + Zinc 15 kg/ha.

---

[++] *M. Sc student;*
[#] *Assistant Professor;*
[†] *Phd Scholar,*
**Corresponding author: E-mail: sovanmondal36703@gmail.com;*

*Keywords: Sesame; gypsum; single super phosphate; sulphur; zinc.*

## 1. INTRODUCTION

Sesame ranks first for having an oil content of 46-64% and 6355 kcal/kg dietary energy in seeds (Sanjay Kumar & Goel, 1994). Seeds of sesame are also rich sources of protein (20 - 28%), sugar (14 - 16%) and minerals (5-7%). This oil has 85% unsaturated fatty acid viz., is highly stable and has a washing effect on cholesterol & prevents coronary heart disease. Sesame as a valuated oil seed appears to have numerous industrial applications. The predicted results for the Sesame crop area, production, and productivity for 2020-21 were 51.66 thousand hectares, 17.64 thousand tonnes, and 323.43 kg/hectare, respectively. However, enhanced varieties and agro-production technologies capable of raising sesame productivity levels are now being developed for various agroecological circumstances in the country. A well-managed sesame crop can yield 1200 - 1500 kg/ha-1 under irrigated conditions and 800 - 1000 kg/ha-1 under rainfed conditions. The crop is grown in practically every region of the country. West Bengal, Madhya Pradesh, Rajasthan, Uttar Pradesh, Gujarat, Andhra Pradesh, and Telangana account for more than 85% of total sesame production [1]. Sufficient application of Sulphur fertilizer has been documented to improve sesame seed yield and yield-related traits [2,3,4,5], as well as oil and protein content in sesame.

Sesame oilcake is an excellent bovine feed because it includes high-quality protein as well as significant amounts of phosphate and potassium. The cake is also used as manure [6].

Gypsum can enhance overall plant growth since it is a soluble source of the vital plant nutrients calcium and sulfur. Gypsum supplements can also enhance some soils' physical qualities, particularly heavy clay soils. Such supplements encourage soil aggregation and can aid in preventing soil particle dispersion, decreasing the formation of surface crusts, promoting seedling emergence, and enhancing water infiltration rates and movement through the soil profile. Additionally, it can lessen the amount of soluble phosphorus present in surface water runoff as well as erosion losses of soil and nutrients. Gypsum treatment reduces the acidity of the subsoil and the toxicity of aluminum, among other chemical qualities. This improves deep roots and plants' capacity to absorb sufficient amounts of water and nutrients during drought conditions [7].

SSP is an excellent source of three plant nutrients ($P_2O_5$ 16%, Calcium 20%, Sulphur 12%). The P component responds in soil in the same way that other soluble fertilizers do. Where both P and sulfur (S) are deficient, the availability of both in SSP can be an agronomic advantage. When SSP is shown to be superior to other P fertilizers in agronomic research, it is mainly owing to the S and/or Ca it contains. When SSP is locally available, it is widely used to fertilize pastures that require both P and S. SSP is less popular as a source of P alone since it is sometimes more expensive than other more concentrated fertilizers. Zinc is an essential element for crop growth, as it is a component of carbonic anhydrase and a stimulant of aldolase, a carbon metabolism enzyme [8]. Zn is also an essential component of various biomolecules, including lipids, proteins, and auxin cofactors, and hence plays a significant part in plant nucleic acid metabolism. Zn application has been shown to improve agricultural yield and quality [9], but Zn deficiency diminishes yield and degrades crop quality. Furthermore, higher Zn concentrations are hazardous to plants and decrease cell division and elongation, decreasing biomass output.

## 2. MATERIALS AND METHODS

The experiment conducted to know the Influence of sources of sulphur and zinc on the growth and yield of Sesame (*Sesamum indicum* L.) was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh in 2022, which is located at 25°39’ 42’’N latitude, 81°67’56” E longitude and 98 m altitude above the mean sea level. The soil had a sandy loam texture, with a pH of 7.5, organic carbon (0.625%) and EC (0.564 m.m $cm^{-1}$), Nitrogen (278.48 kg $ha^{-1}$), Phosphorus (38.2 kg $ha^{-1}$) and Potassium (240.7 kg $ha^{-1}$). The experiment was laid out in an RBD consisting of Ten treatments with 3 replications, with the treatment combinations ($T_1$) Gypsum 300 kg/$ha^{-1}$ + Zinc 5 kg/$ha^{-1}$, ($T_2$) Gypsum 300 kg/$ha^{-1}$ + Zinc 10 kg/$ha^{-1}$, ($T_3$) Gypsum 300 kg/$ha^{-1}$ + Zinc 15 kg/$ha^{-1}$, ($T_4$) Single super phosphate 20 kg/$ha^{-1}$ + Zinc 5 kg/$ha^{-1}$, ($T_5$) Single super phosphate 20 kg/$ha^{-1}$ + Zinc 10 kg/$ha^{-1}$, ($T_6$) Single super phosphate 20 kg/$ha^{-1}$ + Zinc 15 kg/$ha^{-1}$, ($T_7$) Sulphur 40 kg/$ha^{-1}$

+ Zinc 5 kg/ha$^{-1}$, ($T_8$) Sulphur 40 kg/ha$^{-1}$ + Zinc 10 kg/ha$^{-1}$, ($T_9$) Sulphur 40 kg/ha$^{-1}$ + Zinc 15 kg/ha$^{-1}$, ($T_{10}$) Control.

## 3. RESULTS

At Harvest, there was a significant difference among the treatments. However, the highest plant height (110.73 cm) was recorded with the application of Gypsum 300 kg/ha + Zinc 15 kg/ha, whereas minimum plant height (97.57 cm) control, and Gypsum 300 kg/ha + Zinc 10 kg/ha (109.60 cm) was statistically at par with T3.

At Harvest, there was a significant difference among the treatments. However, the highest dry weight (15.71 gm) was recorded with the application of Gypsum 300 kg/ha + Zinc 15 kg/ha, whereas minimum dry weight (13.23 gm) control, and Gypsum 300 kg/ha + Zinc 10 kg/ha (15.48 gm) was statistically at par with T3.

The perusal of the data of the Number of Capsules/plants recorded at harvest is presented in Table 1. The data reveals that there was a significant effect among different treatments on the Number of Capsules/plants. A significantly Maximum Number of Capsules/plants (51.40) was recorded with the treatment of application Gypsum 300 kg/ha + Zinc 15 kg/ha over all the treatments and the minimum was recorded in (37.40) control. However, treatment Gypsum 300 kg/ha + Zinc 10 kg/ha (50.67) was found to be statistically at par with Gypsum 300 kg/ha + Zinc 15 kg/ha.

Significantly Maximum Number of seeds per capsule (55.47) was recorded with the treatment of application Gypsum 300 kg/ha + Zinc 15 kg/ha over all the treatments and the minimum was recorded (45.20) in control. However, treatment Gypsum 300 kg/ha + Zinc 10 kg/ha (54.40) was found to be statistically at par with Gypsum 300 kg/ha + Zinc 15 kg/ha.

The perusal of the data of Test weight was recorded at harvest, which is presented in Table 1. The data reveals that there was a non-significant effect among different treatments on Test weight (g).

Non-significant Maximum test weight (2.70 g) was recorded with the treatment of application Gypsum 300 kg/ha + Zinc 15 kg/ha over all the treatments and minimum was recorded (2.27 g) in control.

Significantly Maximum seed yield (1.07 t/ha) was recorded with the treatment of application Gypsum 300 kg/ha + Zinc 15 kg/ha over all the treatments and minimum was recorded (0.88 t/ha) in control. However, treatment Gypsum 300 kg/ha + Zinc 10 kg/ha (1.06 t/ha) was found to be statistically at par with Gypsum 300 kg/ha + Zinc 15 kg/ha.

**Table 1. Effect of sulphur and zinc on growth and yield parameters of Sesame**

| Treatments | Plant Height (cm) | Dry weight (g/plant) | No. of capsules/ plant | No. of seeds/ capsule | Test weight (g) | Grain Yield (t ha$^{-1}$) |
|---|---|---|---|---|---|---|
| T1 | 107.50 | 14.82 | 46.33 | 51.60 | 2.57 | 1.01 |
| T2 | 109.60 | 15.48 | 50.67 | 54.40 | 2.67 | 1.06 |
| T3 | 110.73 | 15.71 | 51.40 | 55.47 | 2.70 | 1.07 |
| T4 | 98.80 | 13.40 | 39.40 | 46.60 | 2.40 | 0.91 |
| T5 | 99.60 | 13.55 | 41.20 | 47.53 | 2.43 | 0.93 |
| T6 | 103.80 | 14.20 | 43.07 | 49.47 | 2.50 | 0.98 |
| T7 | 101.70 | 13.99 | 42.53 | 47.93 | 2.47 | 0.96 |
| T8 | 104.73 | 14.49 | 44.87 | 51.33 | 2.53 | 0.99 |
| T9 | 108.20 | 15.06 | 48.27 | 53.27 | 2.60 | 1.04 |
| T10 | 97.57 | 13.23 | 37.40 | 45.20 | 2.27 | 0.88 |
| Sem(±) | 0.76 | 0.09 | 0.61 | 0.51 | 0.08 | 0.01 |
| CD (p=0.05) | 2.27 | 0.27 | 1.82 | 1.52 | - | 0.03 |

## 4. DISCUSSION

Sulphur through gypsum may have efficiently enhanced the absorption and translocation of food assimilates from source to sink, resulting in greater yield attributes vi, number of capsules plant, weight of capsules plant, and seed yield. These findings are consistent with those of Duhoon et al. [10] and Ramakrishna [11] in sesame. The increase in yield might be attributed to the easy availability of sulphate (SO) sulphur present in gypsum compared to sulphide form in elemental sulphur, which essentially requires its oxidation to be converted into SOS before its absorption by the plants. Among sources of sulphur, gypsum proved significantly superior to other sources for seed yield have been reported by Chaurasia Era [12] and Ramakrishna [11]. Zinc acts as an enzyme activator in plants and is directly engaged in the manufacture of growth chemicals such as auxin, resulting in more plant cells and more dry matter [13]. It has been found that Sulphur treatment boosts not only Sulphur availability but also the availability of other nutrients that are needed for plant growth and development. It has also been noted that Sulphur helps to reduce soil pH, which increases the availability and mobility of nutrients, particularly P, Fe, Mn, and Zn. The reason for the enhancement of growth parameters might be due to adequate ready supply and increased uptake of sulphur which have resulted in a larger photosynthesizing surface and accelerated the process of formation and translocation of photosynthates and hence overall development of the plant Higher growth with gypsum source was also reported by Warkad [14].

## 5. CONCLUSION

It was concluded that for obtaining higher yield components with better quality of Sesame by application of Gypsum 300 kg/ha + Zinc 15 kg/ha was recorded a significantly higher number of Capsules/plant (51.40), Seeds/capsules (55.47), seed yield (1.07 t/ha), as compared to other treatments. Since, the finding based on the research done in one season.

## ACKNOWLEDGEMENT

I express my gratitude to the Department of Agronomy & all higher authorities of university for providing us with all facilities for the study. The Authors are thankful to the staff of Agronomy department and staff of Post graduate seed Testing laboratory for their cooperation during the study.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Priyanka Evangilin N, Ramana Murthy B, Mohan Naidu G, Aparna B. Statistical Model for Forecasting Area, Production and Productivity of Sesame Crop (*Sesamum indicum* L.) in Andhra Pradesh, India, Int. J. Curr. Microbiol. App. Sci. 2020;9(7):1156-1166.
2. Raja A, Hattab KO, Gurusamy L, Vembu G, Suganya S. Sulphur application on growth and yield and quality of sesame varieties. Int. J. Agric. Res. 2007;2:599–606.
3. Vaiyapuri V, Amudha A, Sriramachandrasekharan M, Imayavaramban V. Effect of sulphur levels and organics on growth and yield of sesame. Adv. Plant Sci. 2004;17:681–685.
4. Sarkar RK, Saha A. Analysis of growth and productivity of sesame (*Sesamum indicum* L.) about nitrogen, sulphur and boron. Indian Journal of Plant Physiology. 2005;10(4): 333-337
5. Shah MA, Manaf A, Hussain M, Farooq S, Zafar-ul-Hye M. Sulphur fertilization improves the sesame productivity and economic returns under rainfed conditions. Int. J. Agric. Biol. 2013;15:1301–1306.
6. Malik MA, Saleem MF, Cheema MA, Shamim A. Influence of different nitrogen levels on the productivity of sesame (*Sesamum indicum* L.) under varying planting patterns. International Journal of Agriculture and Biology. 2003;5(4):490-492.
7. Muhammad Arshad Ullah, Syed Ishtiaq Hyder and Rizwan Ahmed, “Effect of Gypsum Application on Groundnut Growth And Nodules Under Rainfed Condition”, International Journal of Research in Agriculture and Forestry. 2019;6(10):8-13.
8. Tsonev T, Lidon FJC. Zinc in plants—An overview. Emir. J. Food Agric. 2012 ;24:322–333.
9. Chattha MU, Hassan MU, Khan I, Chattha MB, Mahmood A, Chattha MU, Nawaz M, Subhani, MN, Kharal M, Khan S.

Biofortification of Wheat Cultivars to Combat Zinc Deficiency. Front. Plant Sci. 2017;8:281.
10. Duboon SS, Deshmukh MR, Jyotishi A, Jam HC. Effect of sources and levels of sulphur on seed and oil yield of sesame (*Sesamum indicum* L.) under different agro-climatic situations of India Journal of Oilseed Research. 2005;21(1):199-200.
11. Ramakrishna B. Growth and yield of sesame (*Sesamum indicum* L.) as Influenced by Sources and levels of sulphur (Master thesis) University of Agriculture Science Dharma Karnataka (India) lit pknshikochw Granth ac in handle 1 $6993 Accessed on March 21.2021; 2013.
12. Chaurasia SK, Jain N, Jain N. Effects of integrated use of fertilizer, organic manure and micronutrients on the productivity of sesame (*Secconum indicum* L.) Annale Agriculture Research New Series. 2009; 30(384):91-94.
13. Christopher A, Oluwagbenga D, Aruna O, Adekiya CC, Khadijat O, Suleiman FO, Okunlola CO, Aremu IO, Owolabi C, Temidayo AJ. Zinc Sulphate and Boron-Based Foliar Fertilizer Effect on Growth, Yield, Minerals, and Heavy Metal Composition of Groundnut (*Arachis hypogaea* L) Grown on an Alfisol. International J. Agronomy. 2019;3:123-127.
14. Warkad SV. Response of Kharif Sesamum (*Sesamum indicum* L.) to different sources and levels of sulphur (Master's thesis) Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani; 2018.



*Peer-review history:*
*The peer review history for this paper can be accessed here:*
*https://www.sdiarticle5.com/review-history/103786*