

## **Influence of sources of sulphur and zinc on growth and yield of Sesame (*Sesamum indicum* L.)**

### **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<sup>-1</sup>), Nitrogen (278.48 kg ha<sup>-1</sup>), Phosphorus (38.2 kg ha<sup>-1</sup>) and Potassium (240.7 kg ha<sup>-1</sup>). 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<sup>-1</sup>, Single super phosphate 20 kg/ha<sup>-1</sup>, Elementary Sulphur 40 kg/ha<sup>-1</sup>) and zinc (5, 10, 15 kg/ha<sup>-1</sup>) as a Basal application and a control. The application of Gypsum 300 kg/ha<sup>-1</sup> + Zinc 15 kg/ha<sup>-1</sup> 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.

**Keywords:** Sesame, Gypsum, single super phosphate, sulphur, zinc.

### **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 (Priyanka 2020). Sufficient application of Sulphur fertilizer has been

documented to improve sesame seed yield and yield-related traits [Raja 2007, Vaiyapuri 2004, Sarkar 2005, Shah 2013], 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 (Malik *et al.*, 2003).

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. Muhammad 2019.

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 (Tsonev 2012). 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 [Chattha 2017], 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. **Material 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<sub>1</sub>) Gypsum 300 kg/ha<sup>-1</sup> + Zinc 5 kg/ha<sup>-1</sup>, (T<sub>2</sub>) Gypsum 300 kg/ha<sup>-1</sup> + Zinc 10 kg/ha<sup>-1</sup>, (T<sub>3</sub>) Gypsum 300 kg/ha<sup>-1</sup> + Zinc 15 kg/ha<sup>-1</sup>, (T<sub>4</sub>) Single super phosphate 20 kg/ha<sup>-1</sup> + Zinc 5 kg/ha<sup>-1</sup>, (T<sub>5</sub>) Single super phosphate 20 kg/ha<sup>-1</sup> + Zinc 10 kg/ha<sup>-1</sup>, (T<sub>6</sub>) Single super phosphate 20 kg/ha<sup>-1</sup> + Zinc 15 kg/ha<sup>-1</sup>, (T<sub>7</sub>) Sulphur 40 kg/ha<sup>-1</sup> + Zinc 5 kg/ha<sup>-1</sup>, (T<sub>8</sub>) Sulphur 40 kg/ha<sup>-1</sup> + Zinc 10 kg/ha<sup>-1</sup>, (T<sub>9</sub>) Sulphur 40 kg/ha<sup>-1</sup> + Zinc 15 kg/ha<sup>-1</sup>, (T<sub>10</sub>) Control.

### **Results and Discussion:**

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 T<sub>3</sub>.

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 T<sub>3</sub>.

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.

### **Discussions:**

Sulphur through gypsum may have efficiently enhanced the absorption and translocation of food assimilates from source to sink, resulting in greater yield attributes viz, number of capsules/plant, weight of capsules/plant, and seed yield. These findings are consistent with those of Duhoon et al. (2005) and Ramakrishna (2013) in sesame. The increase in yield might be attributed to the easy availability of sulphate (SO<sub>4</sub>) sulphur present in gypsum compared to sulphide form in elemental sulphur, which essentially requires its oxidation to be converted into SO<sub>4</sub> 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 (2009) and Ramakrishna (2013). 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 (Christopher et al., 2019). 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 (2018).

### **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.

**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 <sup>-1</sup> )
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
<b>T10</b>	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

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