

## Response of Sulphur and Zinc on Growth and Yield Components of Clusterbean

### Abstract:

A field experiment was conducted during *Zaid* 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.49 %), available N (183.30 kg/ha), available P (37.46 kg/ha) and available K (199.61 kg/ha). The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice on the basis of one year experimentation. The treatments which are T1: Sulphur 10kg/ha + Zinc 3kg/ha, T2: Sulphur 10kg/ha + Zinc 6kg/ha, T3: Sulphur 10kg/ha + Zinc 9kg/ha, T4: Sulphur 20kg/ha + Zinc 3kg/ha, T5: Sulphur 20kg/ha + Zinc 6kg/ha, T6: Sulphur 20kg/ha + Zinc 9kg/ha, T7: Sulphur 30kg/ha + Zinc 3kg/ha, T8: Sulphur 30kg/ha + Zinc 6kg/ha, T9: Sulphur 30kg/ha + Zinc 9kg/ha, T10: Control 20:40:25 (N:P:K) kg/ha are used. The important findings of the experiment have been summarized and concluded here under the objectives taken. The application of Sulphur 30kg/ha + Zinc 6kg/ha, recorded significantly higher Plant height (104.00 cm), number of nodules per plant (16.93) Plant dry weight (26.56g/plant). Significantly maximum pods/plant (41.07), Seeds/pod (10.00), Test weight (4.45g), Seed yield (2.03t/ha), stover yield (3.98 t/ha), Harvest index (33.76 %) were recorded with the treatment of Sulphur 30kg/ha + Zinc 6kg/ha.

**Key words:** *Sulphur, Zinc, Cluster Bean.*

### Introduction:

Cluster bean belongs to the family Leguminosae. It is also known as Guar. It is a highly important leguminous crop of the kharif season. Cluster bean is mainly grown under rainfed conditions in arid and semi arid regions of tropical India due to the hardy nature and suitability to poor soil and moisture stress conditions. Cluster bean is an important drought tolerant crop of drought prone area of Rajasthan. This crop has wider scope in reference to achieving sustainable production from very poor soil of erratic rainfall areas. Cluster bean or guar (*Cyamopsis tetragonoloba*) (2n=14) is an annual legume plant widely grown for its gum, vegetable, fodder and green manure values. West Africa and India are mentioned as centers of

origin for cluster bean by various authors. The crop is cultivated extensively in India, Pakistan, Indonesia, Myanmar, parts of Central Africa and in the arid South Western United States to tap its industrial potential, especially for the extraction of gum from the guar seed. India becomes the leading producer of gaur with 60 per cent of the world production followed by Pakistan with 35 per cent and remaining 5 per cent contributed by USA, Middle East and African countries.

Sulphur interacts with phosphorus as phosphate ion is more strongly bound than sulphate (Hedge and Murthy, 2005). Phosphorus fertilizer application results in increase of anion adsorption sites by phosphate, which releases sulphate ions into the soil solution (Tiwari and Gupta, 2006). Thus, it may be subjected to leaching if not taken up by plant roots. Studies have indicated both synergistic and antagonistic relationship between sulphur and phosphorus but their relationship depends on their rate of application and crop species. Deo and Khandelwal (2009) for chickpea. Antagonistic relationship between P and S was observed in moong and wheat by Islam et al. (2006) and in lentil and chickpea by Hedge and Murthy (2005). The interaction of these nutrient elements may affect the critical levels of available P and S below which response to their application could be observed. Information on effect of combined application of zinc and Sulphur on yield, quality and content of each nutrient in cluster bean is rather limited. Therefore, the present investigation.

#### **Material and Methods:**

The experiment conducted to know the Response of Sulphur and Zinc on Growth and Yield Components of Cluster bean was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh in 2022. The experiment was laid out in an RBD (Randomized Block Design) consisting of Ten treatments including Control with 3 replications, Clusterbean variety Pusa Navbahar was selected for sowing. Seeds were sown in line manually on 2023. Seeds were covered with the soil immediately after sowing. The spacing adopted was plant to plant 10 cm and row to row 45 cm according to the treatment details and the seeds were drilled at 3 - 4 cm depth. Gap filling & Thinning was done at 8 DAS to maintain the plant population according to treatment in order to attain recommended plant population for proper growth and yield of crop.

#### **Results and Discussion:**

Plant height: At 80 DAS, minimum plant height (97.33 cm) was recorded with the treatment Control 20:40:25 (N:P:K) kg/ha and maximum plant height (104.00 cm) was recorded with the application of Sulphur 30kg/ha + Zinc 6kg/ha, and there was significant difference among the treatments, whereas Sulphur 30kg/ha + Zinc 3kg/ha (103.00 cm), Sulphur 30kg/ha + Zinc 9kg/ha (102.67 cm) were statistically at par with Treatment 8. Zn and S application created a

balanced nutritional environment which enhanced metabolic activities and photosynthetic rate, resulting in improvement in plant height and ultimately increases plant dry weight. Similar types of results were reported by Meena *et al.* (2006), Ramawtar *et al.* (2013).

Number of nodules per plant: minimum number of nodules per plant (13.87) was recorded with the treatment Control 20:40:25 (N:P:K) kg/ha and maximum number of nodules per plant (16.93) was recorded with the application of Sulphur 30kg/ha + Zinc 6kg/ha, and there was significant difference among the treatments, whereas Sulphur 30kg/ha + Zinc 3kg/ha (16.33) was statistically at par with Treatment 8. due to availability of zinc might have stimulated the metabolic and enzymic activity and there by increases the plant growth attributes which increases the number of branches/plant and number of nodules per plant similar results have also reported by Kasturi krishna and Ahlawat (2000).

Plant dry weight: At 80 DAS, minimum dry weight (23.78 g) was recorded with the treatment Control 20:40:25 (N:P:K) kg/ha and maximum dry weight (26.56 g) was recorded with the application of Sulphur 30kg/ha + Zinc 6kg/ha, and there was significant difference among the treatments, whereas Sulphur 30kg/ha + Zinc 3kg/ha (26.09 g), Sulphur 30kg/ha + Zinc 9kg/ha (25.94 g) were statistically at par with Treatment 8.

**Number of Pods/plants:** Maximum Number of Pods/plant (41.07) was recorded with the treatment of application of Sulphur 30kg/ha + Zinc 6kg/ha over all the treatments, and minimum was recorded in Control 20:40:25 (N:P:K) kg/ha (38.01). However, the treatments Sulphur 30kg/ha + Zinc 3kg/ha (40.01) which was found to be statistically at par with Sulphur 30kg/ha + Zinc 6kg/ha. Various yield attributing characters like number of pods plant, number of seeds pod and 100 seed weight increased significantly as the dose of sulphur was increased. This is probably due to its role in synthesis of sulphur containing amino acids, proteins and enhanced photosynthetic activity of plant with increased chlorophyll synthesis (Juszczuk and Ostaszewska, 2011).

**Number of Seeds/Pod:** Significantly Maximum Number of seeds/pods (10.00) was recorded with the treatment of application of Sulphur 30kg/ha + Zinc 6kg/ha over all the treatments, and minimum was recorded in Control 20:40:25 (N:P:K) kg/ha (6.00). However, the treatments Sulphur 30kg/ha + Zinc 3kg/ha (9.40) which was found to be statistically at par with Sulphur 30kg/ha + Zinc 6kg/ha.

**Seed index (g):** highest was (4.45 g) recorded with the treatment of application of Sulphur 30kg/ha + Zinc 6kg/ha over all the treatments, and minimum was recorded in Control 20:40:25 (N:P:K) kg/ha (2.70). However, the treatments Sulphur 30kg/ha + Zinc 3kg/ha (4.37 g) which was found to be statistically at par with Sulphur 30kg/ha + Zinc 6kg/ha. Similarly, application of sulphur increased pod, seed and stover yield significantly up to 45 kg ha, however, these results were at par with 30 kg ha. The improvement in yield due to increase in sulphur levels might be due to its important role in energy transformation, activation of enzymes and carbohydrate metabolism (Davidian and Kopriva, 2010).

**Conclusion:**

It is concluded that application of Sulphur 30kg/ha + Zinc 6kg/ha recorded higher growth and yield attributes and as compared to other treatments.

**Table 1: Response of Sulphur and Zinc application on growth and Yield attributes of Cluster bean.**

Treatments	Plant Height	Nodules per plant	Plant Dry weight	Pods/plant (No)	Seeds/pod (No)	Seed index (g)
T1	99.00	14.07	23.83	38.07	7.00	3.00
T2	99.67	14.53	24.10	38.33	7.33	3.00
T3	98.33	13.93	23.78	37.67	7.00	2.76
T4	101.00	14.87	25.25	39.01	8.00	3.61
T5	101.67	15.20	25.79	39.01	8.33	3.78
T6	100.67	14.53	24.84	38.67	8.00	3.13
T7	103.00	16.33	26.09	40.01	9.40	4.37
T8	104.00	16.93	26.56	41.07	10.00	4.45
T9	102.67	15.53	25.94	39.34	8.67	4.01
<b>T10</b>	97.33	13.87	23.78	38.01	6.00	2.70
Sem(±)	1.20	0.24	0.37	0.63	0.21	0.03
CD (p=0.05)	3.58	0.73	1.11	1.88	0.64	0.09

## References:

- Deo, C. and Khandelwal, R.B. (2009). Effect of P and S nutrition on yield and quality of chickpea (*Cicer arietinum* L.). *Journal of Indian society of soil science* vol; 57(3):352-356.
- Davidian J C and Kopriva S. 2010. Regulation of sulphate and variety on yield of summer groundnut in West Bengal. *Indian Journal of Agronomy*. 36: 604–5.
- Juszczuk, I.M. and Ostaszewska, M. 2011. Respiratory activity, energy and redox status in sulphur-deficient bean plants. *Environmental and Experimental Botany* 74: 245-254.
- Kasturikrishana S, Ahlawat IPS. Effect of moisture stress, phosphorus, sulphur and zinc fertilizers on growth and development of pea (*Pisum sativum*). *Indian Journal of Agronomy* 2000;45(2):353-356.
- Hedge, D.M. and Murthy, I.Y.L.N. (2005). Management of secondary nutrients. *Indian Journal of Fertilizer*, 1: 93-100.
- Islam, M., Mohsan, S. and Ali, S. (2013). Interactive effect of sulfur and phosphorus on nodulation, nitrogen fixation, and nutrient uptake by chickpea grown on calcareous soils in Pakistan. *Journal of Plant Nutrition*, 36(11):1649-1658.
- Meena, K. R., Dahama, A. K. and Reager, M. L. 2006. Effect of phosphorus and zinc fertilization on growth and quality of clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.). *Annals of Agricultural Research*. 27 (3): 224-226.
- Ramawtar AC, Shivran, Yadav BL (2013). Effect of NP fertilizers, vermicompost and sulphur on growth, yield and quality of cluster bean [*Cyamopsis tetragonoloba* (L.)] and their residual effect on grain yield of succeeding wheat [*Triticum aestivum* (L.)]. *Legume Research*;36(1):74-78.
- Tiwari, K.N. and Gupta, B.R. (2006). Sulphur for sustainable high yield agriculture in Uttar Pradesh. *Indian Journal of Fertilizer*, 2: 37-52.