International Journal of Environment and Climate Change

Volume 13, Issue 10, Page 670-674, 2023; Article no.IJECC.104478
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Response of Sulphur and Zinc on Growth and Yield Components of Cluster Bean

Deepthi Banothu [a++*] and Biswarup Mehera [a#]

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

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i102701

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/104478

Original Research Article

Received: 13/06/2023
Accepted: 17/08/2023
Published: 19/08/2023

ABSTRACT

Field test carried out during Zaid 2023 at Crop Research Farm, Department of Agronomy**,** Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P). The soil in the field was found to be sandy loam, neutral in soil reaction (pH 7.10), natural carbon (0.50%), accessible N (183.40 kg/ha), accessible P (37.56 kg/ha) and accessible K (200.06 kg/ha). The experiment was a randomized block design as the experiment consisting of nine treatments each repeated three times. The treatment combinations are 1: Sulphur 10 kg/ha + Zinc 3 kg/ha, 2: Sulphur 10 kg/ha + Zinc 6 kg/ha, 3: Sulphur 10 kg/ha + Zinc 9 kg/ha, 4: Sulphur 20 kg/ha + Zinc 3 kg/ha, 5: Sulphur 20 kg/ha + Zinc 6 kg/ha, 6: Sulphur 20 kg/ha + Zinc 9 kg/ha, 7: Sulphur 30 kg/ha + Zinc 3 kg/ha, 8: Sulphur 30 kg/ha + Zinc 6 kg/ha, 9: Sulphur 30 kg/ha + Zinc 9 kg/ha, 10: 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 30 kg/ha + Zinc 6 kg/ha, observed maximum Plant height (104.00 cm), highest number of nodules per plant (16.93) Plant dry

---

[++] *M.Sc. Scholar;*
[#] *Dean;*
**Corresponding author: E-mail: banothdeepthi666@gmail.com;*

weight (26.56 g/plant). Maximum pods/plant (41.07), Seeds/pod (10.00), Test weight (4.45g), Seed yield (2.03 t/ha), stover yield (3.98 t/ha), Harvest index (33.76%) were noted with the treatment combination of Sulphur 30 kg/ha + Zinc 6 kg/ha.

Keywords: Sulphur; zinc; cluster bean.

1. INTRODUCTION

Cluster bean categorized under Leguminosae family, also called as Guar. Botanically called as *Cyamopsis tetragonoloba*. It is mainly cultivated under rainfed conditions in arid and semi arid regions of tropical India. 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 (2n=14) is an annual legume crop. It is extensively cultivated for vegetable, green manure, and also for fodder purpose. West Africa and India are stated as the centre of origin for cluster bean by several authors. The crop is cultivated broadly in India, Pakistan, Indonesia, Myanmar, parts of Central Africa.

Kiran yadav and SR Naga [1] Application of sulphur @ 40 kg per hectare significantly increased the number of pods per plant ,number of seeds per pod, test weight , seed yield, straw yield, protein content, gum content and gum yield in cluster bean and proved significantly superior over lower levels of sulphur.

Hedge and Murthy, [2] stated that Sulphur is correlated with phosphorus, as phosphate ions are powerful than sulfate. Application of P fertilizer causes an increase in the adsorption site for phosphate anions, thereby releasing sulfate ions into the soil solution [3]. That is, if it is not absorbed by the roots, it is washed off. Studies have shown that there is a positive and negative relationship between sulfur and phosphorus, but their relationship depends on the application and the type of crop. Shivakumar et al. [4] in cluster bean concluded that by Sulphur (S) 20 kg/ha resulted highest plant height, branches per plant, pods/plant, pod length as well as yield and stover yield. Deo and Khandelwal [5] stated that for chickpea, Unfavourable relationship between P and S was observed in wheat and moong. Same in case of lentil and chickpea by Hedge and Murthy [2]. The collaboration of these nutrients affects the significant levels of accessible P and S below this response of their application can be examined. Report on effect of combinative treatment of zinc and Sulphur on yield, quality, and content of every nutrient in cluster bean is reasonably limited.

2. MATERIALS AND METHODS

The experiment performed to understand the Response of Sulphur and Zinc on Growth and Yield Components of Cluster bean was done at Crop Research Farm of Sam Higginbottom University, Formerly Allahabad Agriculture Institute, Prayagraj, Uttar Pradesh in 2023. The experiment was a randomized block design as the experiment consisting of nine treatments each repeated three times, Clusterbean variety Pusa Navbahar was selected for sowing. Seeds were sown in line manually on 2023. Seeds were covered with the soil instantly after sowing. The spacing implemented was plant to plant 10 cm and row to row 45 cm according to the treatment details and the seeds were sown at 3 - 4 cm deep. Gap-filling and thinning at 8 DAS to maintain the plant population as a treatment for the plant population that promotes crop growth and development.

3. RESULTS AND DISCUSSION

Plant Height: At 80 DAS, least (97.33 cm) was recorded with the treatment Control 20:40:25 (N:P:K) kg/ha and highest plant height (104.00 cm) was observed with the application of Sulphur 30 kg/ha + Zinc 6 kg/ha, and significant difference among the treatments, whereas Sulphur 30 kg/ha + Zinc 3 kg/ha (103.00 cm), Sulphur 30 kg/ha + Zinc 9 kg/ha (102.67 cm) were statistically at par with Treatment 8. Ramawtar et al. [6] stated that application Zn and S generated a balanced nutritional environment that boosted metabolic behavior and photosynthetic rate, lead to in development in plant height and eventually increases plant dry weight. Alike types of conclusions were informed by Meena et al. [7]. Anuradha [8] observed maximum plant height (45.1 cm) when treated with100% recommended dose of fertilizers + PSB + Zinc (5 kg/ha) .Plant height increases with the application of zinc [9].

Number of Nodules per Plant: Lowest amount of nodules per plant (13.87) was recorded with

the treatment Control 20:40:25 (N:P:K) kg/ha and highest number of nodules per plant (16.93) was recorded with the application of Sulphur 30 kg/ha + Zinc 6 kg/ha, and there was substantial variance among the treatments, whereas Sulphur 30 kg/ha + Zinc 3 kg/ha (16.33) was statistically at par with Treatment 8. Kasturi Krishna and Ahlawat [10] reported that due to accessibility 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.

Plant Dry Weight: At 80 DAS, minimum dry weight (23.78 g) was observed 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 30 kg/ha + Zinc 6 kg/ha, and there was significant difference among the treatments, whereas Sulphur 30 kg/ha + Zinc 3kg/ha (26.09 g), Sulphur 30 kg/ha + Zinc 9 kg/ha (25.94 g) were statistically at par with Treatment 8.

Weldua et al., [11] observed the Zinc application on yield Zinc fertilization also significantly increased the above ground biomass at maturity stage.

Number of Pods/Plants: Maximum Number of Pods/plant (41.07) was recorded with the treatment of application of Sulphur 30 kg/ha + Zinc 6 kg/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 30 kg/ha + Zinc 3 kg/ha (40.01) which was found to be statistically at par with Sulphur 30 kg/ha + Zinc 6 kg/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. It may be due to its role in synthesis of sulphur having amino acids, proteins and developed photosynthetic activity of plant with better chlorophyll synthesis [12]. Baviskar et al. [13] found that application of sulphur 50 kg/ha registered higher green pod yield.

Number of Seeds/Pod: Highest Number of seeds/pods (10.00) was observed with application of Sulphur 30 kg/ha + Zinc 6 kg/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 30 kg/ha + Zinc 3 kg/ha (9.40) which was observed to be statistically at par with Sulphur 30 kg/ha + Zinc 6 kg/ha.

Seed index (g): Maximum was (4.45 g) observed with the treatment of application of Sulphur 30kg/ha + Zinc 6 kg/ha among all the treatments, and minimum was recorded in Control 20:40:25 (N:P:K) kg/ha (2.70). However, the treatments Sulphur 30 kg/ha + Zinc 3 kg/ha (4.37 g) which was observed to be statistically at par with Sulphur 30 kg/ha + Zinc 6 kg/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. Davidian and Kopriva, [14] stated that the increase in yield due to rise in sulphur amounts may be due to its vital role in energy transformation, activation of enzymes and carbohydrate metabolism [15].

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
T10	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

4. CONCLUSION

It was determined that application of Sulphur 30 kg/ha + Zinc 6 kg/ha observed higher growth and yield attributes as compared to other treatments.

ACKNOWLEDGEMENT

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

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anuradha, Rajendra K, Singh, Bheem Pareek, Deepak Kumar, Suman Meena, Dubey SK. Kiran Yadav, SR Naga. Response of phosphorus and sulphur on yield attributes, yield and quality of cluster bean [*Cyamopsis tetragonoloba* (L.) Taub]. The Pharma Innovation Journal 2021;10(9):2349-8242.
2. Hedge DM, Murthy IYLN. Management of secondary nutrients. Indian Journal of Fertilizer. 2005;1:93-100.
3. Tiwari KN, Gupta BR. Sulphur for sustainable high yield agriculture in Uttar Pradesh. Indian Journal of. Fertilizer. 2006;2:37-52.
4. Shivakumar Naik E, Balachandra Y, Joy Dawson, Sai Kiran Munagala. Influence of Phosphorus and Sulphur Levels on Evolution and Yield of Cluster bean (*Cyamopsis tetragonoloba* L.). Biological Forum. 2021;13(3):2249-3239.
5. Deo C, Khandelwal RB. Effect of P and S nutrition on yield and quality of chickpea (Cicer arietinum L.). Journal of Indian Society of Soil Science. 2009;57(3):352-356.
6. Ramawtar AC, Shivran, Yadav BL. 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. 2013; 36(1):74-78.
7. Meena KR, Dahama AK, Reager ML. Effect of phosphorus and zinc fertilization on growth and quality of clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.). Annals of Agricultural Research. 2006;27(3):224-226.
8. Anuradha, Rajendra K, Singh, Bheem Pareek, Deepak Kumar, Suman Meena, Dubey SK. Different Levels of Fertilizers on Growth and Yield of Cluster Bean (*Cyamopsis tetragonoloba* L.) in rainfed area of Uttar pradesh. Int. J. Curr. Microbiol. App. Sci. 2017;6(4):2029-2036.
9. Singh R, Kumar A, Kumar P. Performance of Indian mustard (*Brassica juncea* L.) in response to integrated nutrient management. Journal of Agriculture Research. 2014;1(1):9-12.
10. Kasturi Krishana 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.
11. Weldua Y, Haileb M, Habtegebrielb K. Effect of zinc and phosphorus fertilizers application on yield and yield components of fababean (*Vicia faba* L.) grown in calcaric cambisol of semi-arid northern Ethiopia. Journal of Soil Science and Environmental Management. 2012;3(12): 320-326.
12. Juszczuk IM, Ostaszewska M. Respiratory activity, energy and redox status in sulphur-deficient bean plants. Environmental and Experimental Botany. 2011;74:245-254.
13. Baviskar VS, Damame HS, Raj VC, Shete PG. Influence of organic fertilizers and different levels of sulphur on growth, yield and quality of cluster bean (*C. tetragonoloba*). Green Farming. 2011;2(5): 546-547.
14. Davidian JC, Kopriva S. Regulation of sulphate and variety on yield of summer groundnut in West Bengal. Indian Journal of Agronomy. 2010;36: 604–5.

15. Islam M, Mohsan S, Ali S. 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. 2013; 36(11):1649-1658.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/104478