International Journal of Plant & Soil Science

Volume 35, Issue 19, Page 65-69, 2023; Article no.IJPSS.101291
ISSN: 2320-7035

Effect of Sulphur and Foliar Application of Boron on Growth and Yield Attributes of Lentil (*Lens culinaris* L.)

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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/2023/v35i193522

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/101291

Original Research Article

Received: 15/04/2023
Accepted: 19/06/2023
Published: 14/08/2023

ABSTRACT

A field experiment was performed at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, UP, during the *Rabi* season of 2022, to determine the "Effect of sulphur and foliar application of Boron on growth and yield of lentil (*Lens culinaris* L.)". The experiment consists of three replications in which there were three levels of Sulphur (15, 30 and 45 kg/ ha) and three levels of boron (0.1%, 0.2% and 0.3%) and one control. Among the various treatment combinations in Treatment-9 with the application of Sulphur 45 kg/ ha along with boron 0.3% foliar spray at 35 DAS significantly recorded higher plant height (41.25 cm), maximum number of nodules/plant (25.07), maximum dry weight (16.43 g/plant), maximum number of pods/plant (118.67), maximum number of seeds/pod (2.00) in lentil crop.

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Keywords: Boron; growth; lentil; sulphur; yield attributes.

1. INTRODUCTION

Lentil, well known as “The poor man meat” because of its protein content and cheap availability. Lentil has been one of the world's oldest legume crops [1], resistant to drought and cultivated across the world. Lentil is one of the legume crops and plays a great role in rotation to maintain soil fertility and through root nodules, lentil, crop fixes atmospheric nitrogen by symbiotic association of rhizobium. Therefore fertilizers that maintain soil fertility and has a major role in obtaining higher yields. Lentil seed is a rich source of protein, minerals (K, P, Fe, Zn) and vitamins for human nutrition [2]. In the current situation, global lentil production is 6.5 million tonnes, with India accounting for 18% of the total. Lentil is cultivated in India with an area of approximately 1.32 million hectares, a production of 118 million tonnes, and an average productivity of approximately 894 kg/ha, and Uttar Pradesh contributes an area of approximately 0.46 million hectares with a 31.46% in all of India, a production of approximately 0.45 million tonnes (38.47% in all of India), and productivity is 978 kg/ha [3]. Sulphur is one of the most significant secondary nutrients and is required for the synthesis of several amino acids, including cysteine, cystine, and methionine, in addition to being involved in a number of metabolic and enzymatic activities in plants [4]. Addition of sulphur to nodulated legumes not only helps in increases of S-containing amino acids but also increases the amount of N in leaves and stems and amounts of N fixed in the soil [5]. Sulphur is a crucial macronutrient that aids in the production of vitamins and amino acids including cysteine, cystine, methionine, and cystine [6]. Foliar application of micro nutrients would be more appropriate, efficient and economical than soil application because micro nutrients, when used as foliar application, they get very quickly and directly to the leaf cells, and because of that, effect it is very high. Foliar use of boron has exposed the seed set, produce and excellence of seed in various crops [7]. Foliar applied boron causes increases in yield more than soil applied boron because boron is more required at reproductive stage and when foliar applied is instantly present for crops in comparision to soil application of boron. Foliar nutrition is designed to eliminate problems like fixation and immobilization of nutrients. Compared to most field crops, legume crops need more boron because it is essential for the healthy development of reproductive organs. Through distortion of reproductive organs that disrupt pollen germination and cause greater flower drops and decreased fruit sets, its lack causes sterility in plants [8]. Keeping in view the immense importance of sulphur and boron fertilization, the present study “Effect of sulphur and foliar application of Boron on growth and yield of lentil (*Lens culinaris* L.)” was undertaken

2. MATERIALS AND METHODS

The experiment was laid out during the *Rabi* season (December – March, 2022), at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj Uttar Pradesh, which was located at 25°39’ 42’’N latitude, 81°67’56” E longitude and it is having 98 m altitude above the mean sea level. The soil had sandy loam texture, having pH 7.3, electrical conductivity 0.762 mm /cm and organic carbon 0.987%. In experimental field five plants were selected and tagged randomly from every treatment. The observations like Plant height, number of nodules/ plant, plant dry weight, number of pods/plant, number of seeds/pod, test weight were recorded from tagged plants. The data collected for different parameters were statistically analyzed using Gomez and Gomez [9] analysis of variance for randomized block design. The results are presented at the 5% level of significance (p=0.05) for making comparison among the various treatments.

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

Growth attributes like Plant height, number of nodules/ plant, dry weight were embodied in the Table 1.

3.1.1 Plant height (cm)

Significantly the higher plant height (41.25 cm) was recorded in treatment receiving Sulphur 45 kg/ ha + Boron 0.3%. However, application of Sulphur 45 kg/ ha + Boron 0.2% (40.70 cm) was statistically at par with Sulphur 45 kg/ ha + Boron 0.3%. The Significant increase in plant height might be due to the progressive response of lentil crop to graded levels of sulphur and boron foliar spray. Aparna and Dawson [10] reported that application of sulphur increased the plant height

Table 1. Influence of sulphur and boron on growth parameters and yield attributes of lentil

S. No.	Treatments	Plant height (cm)	Number of nodules/plant	Plant dry weight (g/plant)	Pods/plant	Seeds/pod	Test weight (g)
1.	Sulphur 15 kg/ ha + Boron 0.1%	36.84	22.73	14.32	107.67	1.13	18.00
2.	Sulphur 15 kg/ ha + Boron 0.2%	37.71	23.00	14.58	108.33	1.27	18.07
3.	Sulphur 15 kg/ ha + Boron 0.3%	37.93	23.53	14.91	112.00	1.40	18.20
4.	Sulphur 30 kg/ ha + Boron 0.1%	38.77	23.20	15.36	112.33	1.47	18.27
5.	Sulphur 30 kg/ ha + Boron 0.2%	38.92	23.53	15.69	113.00	1.53	18.33
6.	Sulphur 30 kg/ ha + Boron 0.3%	39.36	23.33	15.77	115.00	1.67	18.47
7.	Sulphur 45 kg/ ha + Boron 0.1%	39.64	23.60	16.07	115.33	1.73	18.47
8.	Sulphur 45 kg/ ha + Boron 0.2%	40.70	24.47	16.20	115.67	1.80	18.53
9.	Sulphur 45 kg/ ha + Boron 0.3%	41.25	25.07	16.43	118.67	2.00	18.73
10.	20-40-20 NPK kg/ ha (Control)	36.56	22.13	14.30	110.33	1.07	18.07
	F-Test	S	S	S	S	S	NS
	SEm (+)	0.43	0.35	0.10	1.03	0.06	0.18
	CD (p=0.05)	1.30	1.04	0.32	3.07	0.20	-

in lentil due to the fact that sulphur plays a vital role in photosynthetic process of plant which improves growth and development. These findings are in line with Bindu et al., [11]; Sahay et al., [12]; Reddy et al., [13].

3.1.2 Number of nodules/plant

Significantly higher number of nodules (25.07) was observed in treatment receiving Sulphur 45 kg/ha + Boron at 0.3%. However, application of Sulphur 45 kg/ ha + Boron 0.2% (24.47) was statistically at par with Sulphur 45 kg/ ha + Boron at 0.3%. The significant increase in number of nodules/plant with the application of sulphur and boron foliar spray might be due the fact that sulphur increases the amount of glucose flowering to the roots and ATP biosynthesis. Bindu et al. [11] reported that application of sulphur significantly increases the P uptake by the roots which helps in nodule formation and root elongation. Similar results were also reported by Aparna and Dawson [10]; Kumari et al., [14].

3.1.3 Plant Dry Weight (g/plant)

Significantly higher dry weight (16.43 g) was observed in treatment receiving Sulphur 45 kg/ ha + Boron at 0.3%. However, application of Sulphur 45 kg/ ha + Boron 0.2% (16.20) was statistically at par with Sulphur 45 kg/ha + Boron at 0.3%. Increase in plant dry weight in different stages of growth of crop might be due the role of sulphur in absorption of nutrients by plant and role of boron which have led to vigorous shoot growth and accumulation of photosynthates due to higher photosynthetic rate and metabolic activity. Similar findings were reported by Reddy et al. [13]; Kumari et al. [15]; Sahay et al. [12].

3.2 Yield Attributes

Number of pods/ plant, number of seeds/plant, test weight were embodied in Table 1.

Significant and higher number of pods/plant (118.67) was observed in treatment receiving Sulphur 45 kg/ha + Boron at 0.3%. However, application of Sulphur 45 kg/ ha + Boron 0.2% (115.67) was statistically at par with Sulphur 45 kg/ ha + Boron at 0.3%. significant and higher number of seeds/pod (2.00) was observed in treatment receiving Sulphur 45 kg/ ha + Boron at 0.3%. However, application of Sulphur 45 kg/ ha + Boron 0.2% (1.80) was statistically at par with Sulphur 45 kg/ ha + Boron at 0.3%. significant and higher number of seeds/pod (2.00) was observed in treatment receiving Sulphur 45 kg/ ha + Boron at 0.3%. However, application of Sulphur 45 kg/ ha + Boron 0.2% (1.80) was statistically at par with Sulphur 45 kg/ ha + Boron at 0.3%. This might be due to the synergistic effect of sulphur and foliar spray of boron. Boron which plays a key role in pollination and fertilization. The improved availability of sulphur and favourable environment for various nutrients might have helped the plants at peak growth period and flowering stages which have augumented the number of pods/ plant, number of seeds/pod that enhances yield. Similar findings were reported by Teja et al. [16]; Reddy et al. [13]; Aparna and Dawson [10] and Bindu et al. [11].

4. CONCLUSION

Based on the findings of the study, it is concluded that the application sulphur 45kg/ha and boron 0.3% foliar spray at 35 DAS recorded higher plant height, number of nodules/plant, growth, yield parameters and also proven economically viable.

ACKNOWLEDGEMENT

I express my gratitude to my advisor Dr. Rajesh Singh sir and all the faculty members of the Department of agronomy for the constant supply to carry out the whole experimental research study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/101291