Journal of Experimental Agriculture International

Volume 46, Issue 5, Page 884-887, 2024; Article no.JEAI.115512
ISSN: 2457-0591
(Past name: American Journal of Experimental Agriculture, Past ISSN: 2231-0606)

Influence of Sulphur and Boron on Growth and Yield of Zaid Sunflower

Abhishek Kumar [a++*], Saurabh Raj [a++], Asmita Kumari [a++] Sachin Kumar Singh [a++] and Hariom Saran Singh [a++]

[a] Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh 211007, 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/JEAI/2024/v46i52443

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/115512

Original Research Article

Received: 05/02/2024
Accepted: 10/04/2024
Published: 17/04/2024

ABSTRACT

A field experiment was conducted during *Zaid* (summer) season of 2023 at Crop Research Farm Department of Agronomy, SHUATS, Prayagraj (U.P). The experiment was laid out in Randomized Block Design with ten treatments which are replicated thrice on the basis of one year experimentation. The treatment consisted of 3 levels of sulphur (20 kg/ha, 40 kg/ha and 60 kg/ha) and boron (0.5%, 1% and 1.5%) along with recommended dose of nitrogen, phosphorus, potassium and control (60:45:45 NPK kg/ha), this experiment was laid out in a Randomized Block Design with 10 treatment and replications thrice application sulphur The application of Sulphur - 60 kg/ha + Boron-1.5% (Treatment 9) recorded significantly maximum number of flowers per plant (3.00), seeds/capitulum (308.00), test weight (50.87 g), seed yield (1111.20 kg/ha), stover yield (3126.90 kg/ha), harvest index (26.23%) was obtained in the treatment of sulphur-60 kg/ha Boron-1.5%. It was concluded that for obtaining higher yield components with better quality of Sunflower application of Sulphur – 60 kg/ha + Boron – 1.5% was recommended.

[++] *M.Sc. Scholar;*
**Corresponding author: E-mail: abhishek.ramani6048@gmail.com;*

Keywords: Sulphur; boron; yield attributes.

1. INTRODUCTION

Sunflower is one of four major oil crops worldwide. It is considered as one of the essential oil crops in Egypt. Sunflower can be used as an oil crop for human nutrition, in oil industry and as animal feed. Sunflower is considered to be one of the most photoperiodic crops in Egypt. It has broad climatic tolerance and high tolerance to drought. Sunflower has an advantage over soybeans as it has a higher per unit area yield. It accounts for approximately 13 % of the total vegetable oils produced worldwide. In Egypt, many initiatives have been undertaken to increase the total yield of oil crops in order to bridge the gap between the production of edible oils and the consumption of them by increasing the yield of sunflower. Karnataka accounts for almost half of the total area covered by sunflower in India and ranks first in terms of area and production. AP ranks second in terms of production, followed by UP. UP has the highest productivity while Tamil Nadu has the lowest productivity.

Sunflower oil is considered premium in comparison to other vegetable oils. Sunflower oil is the preferred oil among consumers all over the world because of its health benefits. Sunflower oil in India is the biggest selling oil in branded oil segment. The sunflower oil content ranges from 48-53%. Sunflower oil is a premium oil with a pale yellow colour used for cooking purposes and margarine. Sunflower oil contains 64% linoleic acid which helps in lowering cholesterol levels in the coronary artery of the heart. The oil contains high levels of Alpha tocopherol which is a form of vitamin E.

“World sunflower production in 2021-22 increased to 56.96 million tonnes from 50.74 million tonnes in 2020-21. Imports increased from 2.86 million tons to 3.68 million tons. Exports increased from 3.06 million tons to 3.88 million tons. The consumption also increased from 50.00 million tons to 56.51 euros. From 2022-23, the stock of goods also increased to2.61 from 2.35 million tonnes. In India, the sunflower crop covered 1,502 lakh hectares (3,712 lakh acres) during the old kalam (kharif) season of 2021-22, compared to 1,191 lakh hectares (2,943 lakh acres) during the same period in 2020-21. Karnataka 1.093 lakh ha (2.550 lakh ha), Maharashtra 0.150 lakh ha (0.371 lakh ha) and Andhra Pradesh 0.019 lakh ha (0.047 lakh acre) are the major sunflower-growing states in India, along with old kalam (khar.2 -220). lakh ha). According to the government's first preliminary estimate, India's total kharif sunflower production in 2021-22 is 0.95 lakh tonnes against 0.77 lakh tonnes last year. The state government has increased the minimum support price of sunflower by Rs 130 in 2021-22. 5885 to Rs 6015 per cent” [1].

“Sulfur plays a dominant role in improving sunflower grain quality and nitrogen and phosphorus use efficiency” [2]. “Sulfur is considered a high-quality food because it affects not only yield, but also crop quality by affecting protein metabolism, oil synthesis and amino acid formation. On average, sulfur application increases oil content in larger oilseeds by 11.3 percent in peanuts, 9.6 percent in mustards, 6.0 percent in linseeds, and 3.8 percent in sunflowers” (Sharma et al. 2009).

Sunflower is one of the most sensitive crops to Boron deficiency. One of the main reasons for the low productivity of sunflower is poor seed attachment and a high percentage of chaff seeds in the center of the capitulum. It has been reported that micronutrients play an important role in increasing the germination percentage of sunflower seeds by influencing growth and yield components. Therefore, the purpose of this experiment was to determine the effect of sulfur and boron levels and boron application methods on sunflower growth and yield.

2. MATERIALS AND METHODS

Experiments on the effect of sulfur and boron on foliage at different concentrations of sulfur and the effect of recommended rates of fertilizer (RDF) on sunflower growth and yield were conducted at the Crop Research Farm of Nain Agricultural Institute in Zaid season 2023-2024. , SHUATS, Prayagraj, located at 250 24 42 N, 810 50 56 E and 98 m above mean sea level. This area is located on the right side of the Yamuna river along the Prayagraj Rewa road, about 5 km from Prayagraj town. . A composite soil sample was collected from a depth of 0-30 cm. It was air dried, crushed and tested for physical and chemical properties. The soil was sandy clay with soil reaction (pH 7.6), organic matter 0.69 (0.72%), nitrogen (152.7 kg/ha), phosphorus. (10.4 kg/ha), potassium (174.0 kg/ha), sulfur (7.2 mg/kg), Zn (0.72 mg/kg) and available B (0.56 mg/kg). Experiments were carried out in a

randomized block design with nine treatments (T1- S 20 kg/ha + Boron - 0.5% , T2- Sulphur 20 kg/ha + Boron - 1% , T3- Sulphur 20 kg/ha + Boron - 1.5%, T4- Sulphur 40 kg/ha + Boron - 0.5%, T5- Sulphur 40 kg/ha + Boron - 1, T6- Sulphur 40 kg/ha + Boron - 1.5% , T7- Sulphur 60 kg/ha + Boron - 0.5% , T8- Sulphur 60 kg/ha + Boron - 1, T9- Sulphur 60 kg/ha + Boron - 1.5% , T10 - Control (60-45-45) NPK kg/ha. Experimental plots consisted of three levels of sulphur (20kg, 40 kg hand 60 kg/ha) as soil application and B (0.5 %, 1% and 1.5%) as foliar application and control i.e., recommended N, P and K (60:45:45 kg/ha) alone as soil application. All the treatments were applied by balancing to the initial soil test values and crop requirements to justify the crop response to the supplied nutrients in both years.

3. RESULTS AND DISCUSSION

Number of flowers per plant: Significantly higher number (3.00) was recorded in the application of Sulphur – 60 kg/ha + Boron – 1.5%, Sulphur – 40 kg/ha + Boron – 1.5%, Sulphur – 40 kg/ha + Boron – 0.5% and minimum was recorded in Control (RDF): 60:45:45 (NPK) kg/ha (1.22). The increase in stem diameter by boron application at sowing time might be the result of efficient carbohydrates and sugar translocation which might have increased by borate sugar complex formation, as also reported by Silva *et al.,* [3].

Seeds per capitulum: Significantly higher number of seeds per capitulum (308.00) was recorded in the application of Sulphur – 60 kg/ha + Boron – 1.5%, Sulphur – 40 kg/ha + Boron – 1.5% (301.00) was statistically at par with T9 and minimum was recorded in Control (RDF): 60:45:45 (NPK) kg/ha (291.00).

Test weight: Significantly highest was recorded in the application of Sulphur – 60 kg/ha + Boron – 1.5% (50.87 g), Sulphur – 40 kg/ha + Boron – 1.5% (50.56 g) was statistically at par with T9 and minimum was recorded in Control (RDF): 60:45:45 (NPK) kg/ha (43.85 g).

Seeds yield (kg/ha): maximum number of seed yield (1111.20) was recorded in the application of Sulphur – 60 kg/ha + Boron – 1.5%, Sulphur – 40 kg/ha + Boron – 1.5% (1091.31) was statistically at par with T9 and minimum was recorded in Control (RDF): 60:45:45 (NPK) kg/ha (1024.21).

The use of sulfur was also very useful in improving the diameter of the capitula. Since it is an essential element for oilseeds, its greater channeling into the head is required and

Table 1. Effect of sulphur and boron on yield attributes and yield of Sunflower

S No	Treatments	Number of flowers per plant (no.)	Seeds/ capitulum (no.)	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
1.	Sulphur – 20 kg/ha + Boron –0.5%	1.20	296.00	45.83	1044.00	2897.3	26.51
2.	Sulphur – 20 kg/ha + Boron –1%	2.07	298.00	47.78	1063.50	2979.2	26.30
3.	Sulphur – 20 kg/ha + Boron –1.5%	2.07	297.00	47.42	1059.90	2950.1	26.45
4.	Sulphur – 40 kg/ha + Boron –0.5%	3.00	298.00	48.28	1068.50	3032.8	26.05
5.	Sulphur – 40 kg/ha + Boron –1%	2.00	295.00	44.78	1033.50	2853.4	26.60
6.	Sulphur – 40 kg/ha + Boron –1.5%	3.00	301.00	50.56	1091.31	3091.8	26.09
7.	Sulphur – 60 kg/ha + Boron –0.5%	2.00	297.00	46.90	1054.70	2932.9	26.45
8.	Sulphur – 60 kg/ha + Boron –1%	1.20	295.00	45.46	1040.30	2871.4	26.60
9.	Sulphur – 60 kg/ha + Boron –1.5%	3.00	308.00	50.87	1111.20	3126.9	26.23
10.	Control (RDF) : 60:45:45 NPK kg/ha	1.22	291.00	43.85	1024.21	2835.4	26.54
	F – Test	S	S	S	S	S	NS
	SE m (±)	0.36	2.76	0.57	15.85	45.80	0.517
	CD (p=0.05)	1.07	8.20	1.72	47.11	136.08	1.536

application of boron increased seed diameter, which may be due to greater anthezopollen production capacity and pollen grain viability [4]. Sunflower seed yield was enhanced by the role of boron in enhancing pollen viability and stigma susceptibility, which increases seed quantity and increases photosynthetic transfer to sink, which increases seed yield, as reported by Prasad et al. [5].

Stover yield (kg/ha): maximum number of stover yield (3126.90) was recorded in the application of Sulphur – 60 kg/ha + Boron – 1.5%, Sulphur – 40 kg/ha + Boron – 1.5% (3091.80) was statistically at par with T9 and minimum was recorded in Control (RDF): 60:45:45 (NPK) kg/ha (2835.40) [6,7].

Harvest index (%): maximum (26.6 %) was recorded in the application of Sulphur – 60 kg/ha + Boron – 1%, minimum was recorded in Sulphur – 40 kg/ha + Boron –0.5% (26.05 %) [8,9].

4. CONCLUSION

On the basis of one season experimentation, from the results, it can be concluded that application of (Sulphur – 60 kg/ha + Boron – 1.5%) Treatment 9 in Sunflower has recorded highest seed yield, gross return, net return and benefit cost ratio.

ACKNOWLEDGEMENT

I am grateful to my advisor as well as all the faculty members of Department of Agronomy for their unwavering support and advice throughout the entire experimental research study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Aditya Kondalamahanty. Sunflower oil set to be the major growth driver for India's 2021-22 vegoil imports; 2021.
2. Najar GR, Singh SR, Akthar F, Hakeem SA. Influence of sulphur levels on yield, uptake and quality of soybean (Glysine max) under temperate conditions of Kashmir valley. Indian journal of Agricultural Sciences. 2011;81(4):340-3.
3. Silva HRF, Aquino LA, Batista CH. Residual effect of phosphate fertilizer on sunflower productivity in succession to cotton. Bioscience Journal. 2011;25(5) :786-793.
4. Shekhawat K, Shivay YS. Effect of nitrogen sources, sulphur and boron levels on productivity, nutrient uptake and quality of sunflower (Helianthus annuus). Indian Journal of Agronomy. 2008;53 (2):129-134.
5. Prasad, R., Shivay, Y.S., Kumar, D. and Sharma, S.N. (2015). Learning by Doing Exercises in Soil Fertility- A Practical Manual of Soil Fertility. Division of Agronomy, Indian Agricultural Research Institute New Delhi.
6. Anjaiah T and Jyothi P. Effect of boron and potassium on performance of Sunflower (Helianthus annuus L.) Multi logic in Sciences; 2018.
7. Gokhan D, Gokman V. Impact of roasting oily seeds and nuts on their extracted oils. Lipid Tech. 2010;22 (8):179-188.
8. Nobre RG, Gheyi HR, Soares FAL, Cardoso JAF. Sunflower Production under saline stress and nitrogen fertilization. Rev. Bras. Ciênc. Solo. 2011;35 (3):929- 937.
9. Zobiole LHS, Castro C, Oliveria FA, Oliveira Junior A. Macronutrient uptake of sunflower (Helianthus annuus L.). Rev. Bras. Ciênc. Solo. 2010;34 (2): 425- 433.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/115512