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Effect of Sulphur and Boron on Growth and Yield of Sunflower (*Helianthus annuus* L.)

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A B S T R A C T

A field Experiment was conducted during *kharif* 2019 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.). The experiment was laid out in Randomized Block Design, comprising of two factors and 9 treatments, each replicated thrice *viz*., Sulphur (30 kg/ha & 50 kg/ha) and two application methods of Boron as soil application (1 kg/ha) and as foliar application (0.2% boron spray) at ray floret stage and the effect was observed on growth and yield of sunflower. Application of Sulphur and Boron significantly influenced the growth parameters, Yield attributing characters, Yield and Oil content over control. Addition of (50 kg/ha Sulphur + 1 kg/ha Boron recorded highest Plant height (145.69 cm), Number of leaves per plant (23.20) Maximum stem girth (3.06 cm) at 60 DAS, whereas, maximum values of Capitulum diameter (15.5 cm), Seed yield (1476.71 kg/ha), Oil content (45.70 %) were recorded with application of (50 kg/ha Sulphur + 0.2% spray Boron) in Sunflower.

Introduction

Sunflower (*Helianthus annuus* L.) belongs to family Compositae, originated in Mexico and Peru, introduced into India in the 16th century. Sunflower is one of the most important oilseed crops; its oil is considered as premium because of its high polyunsaturated fatty acid (PUFA) content with high level of linoleic acid and absence of linolenic acid. Sunflower oil is rich source of (64%) of linoleic acid. The importance of sunflower as an oilseed crop in India is of very recent origin and date backs to three decades. But its contribution towards attaining self-sufficiency in edible oil as well as to "Yellow revolution" in the country is noteworthy (Rai, 2002). Sulphur is an essential plant nutrient for crop production.

In oil seeds, sulphur plays a vital role in the development of seed and improving quality (Naser *et al*., 2012).

Sulphur is increasingly being recognized as the fourth major plant nutrient after nitrogen, phosphorus and potassium (Tandon and Messick, 2003). Sulphur plays a predominant role in improving the grain quality of sunflower crop and also the use efficiency of nitrogen and phosphorus (Najer *et al*., 2011)

Sunflower is one of the most sensitive crop to B deficiency. One of the main reasons for low productivity of sunflower is poor seed setting and high per cent of chaffy seeds in the centre of the capitulum. Micronutrients have been reported to play a major role in increasing seed setting percentage in sunflower owing to their influence on growth and yield components (Theerthala, 2018).Therefore, the present experiment was laid out to find out the effect of sulphur and boron levels and methods of application of boron on growth and yield of sunflower.

Materials and Methods

A field experiment was conducted during *kharif* 2019 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 (0.58%), medium in available N (238 kg/ha), high in available P (32.10 kg/ ha) and low in available K (189 kg /ha). The treatment consisted of 2 levels of Sulphur *viz.* S_1 (30 Kg S/ha), S_2 (50 Kg S/ha) and 2 levels of Boron B_1 (1 Kg B/ha), B_2 (0.2% Spray B/ha).There were 9 treatments each replicated thrice. The experiment was laid out in Randomized Block Design .It was sown on 30th June 2019 with seed rate of 5-5.5 Kg/ha at spacing 45cm x30 cm. Recommended doses of nitrogen, phosphorus and potassium were applied.

Results and Discussion

The growth parameters like Plant height, No. of leaves/plant and Stem girth were significantly affected by the application of sulphur and boron. Sunflower crop fertilized with 50 Kg S/ha along with 1 Kg boron/ha resulted in significant increase in plant height (145.69 cm) at 60 DAS. Plant height increased with sulphur uptake as it increases cell multiplication, elongation and cell expansion throughout the entire period of crop growth, higher levels of sulphur in protein and carbohydrate metabolism, activating many enzymes which influences shoot length **(**Kumar *et al.,* 2011). The increase in plant height may be due to appropriate dose of boron as it plays important role in various enzymatic and other biochemical reactions. Similar results were reported by Gitte *et al.,* (2005) and Zahoor *et al.,* (2011). Where, Sunflower crop fertilized with of 50 Kg S/ha along with 1 Kg boron/ha resulted in higher number of leaves/plant (23.20) and Stem girth with a diameter of (3.06 cm). The application of Boron which resulted in the increase in growth attributes, may be due to the translocation of plant nutrients due to foliar application of it to growing plant parts and more photosynthesis which in turn may have promoted more number of leaves (Kader *et al.,* 2013). The vigorously growing stem reflects the potential growth of sunflower. 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.,* (2011). Yield and yield attributes were significantly affected by sulphur and boron application. Sunflower crop fertilized with 50 Kg S/ha along with 0.2% spray boron/ha resulted in significant increase in Capitulum diameter (15.5 cm), Seed yield (1476.71 kg/ha), and Oil content (45.70%). Sulphur application was also highly

beneficial in improving the capitulum diameter. Since it is an element which is inevitable for oilseed, its greater diversion is required towards the head and boron application had increased the head diameter, which might be due to higher pollen-production capacity of anthesis and pollen grain viability (Shekawat and Shivay, 2008). Seed Yield of sunflower was increased due to role of boron in increasing pollen viability and stigmatic receptivity, which brings an increased seed set and increased translocation of photosynthesis to sink which increases seed yield, as reported by Prasad in 2015 (Table 1 and 2).

Table.1 Effect on sulphur and boron on growth parameters of sunflower (60 DAS)

Treatments	Plant height (cm)	Stem girth (cm)	No. of Leaves/plant
T_1 - Control (RDF)	127.87	1.93	20.07
T_2 - 30 kg S/ha	133.30	2.08	20.80
T_3 - 50 kg S/ha	135.37	2.29	22.03
T_4 -1 kg B/ha	129.75	2.03	21.27
T_5 - 0.2% boron spray	121.74	2.01	20.33
T_6 -30 kg S/ha + 1kg B/ha	144.18	2.17	20.70
T_7 -30 Kg S/ha + 0.2% B spray	136.98	2.25	20.93
T_8 -50 Kg S/ha + 1 Kg B/ha	145.69	2.74	23.20
T_9 -50 Kg S/ha + 0.2% B spray	137.32	3.06	23.13
SEm (±)	3.96	0.11	0.50
CD (P=0.05)	11.87	0.33	1.51

Table.2 Effect of nitrogen and sulphur levels on yield attributes and yield

Treatments	Capitulum Diameter (cm)	Seed yield Kg/ha	Oil content (%)
T_1 - Control (RDF)	12.45	1035.01	35.17
T_2 - 30 kg S/ha	13.47	1232.30	36.73
T_3 - 50 kg S/ha	14.20	1267.73	37.83
T_4 -1 kg B/ha	12.55	1101.71	37.37
T_5 - 0.2% boron spray	13.45	1077.16	37.08
T_6 -30 kg S/ha + 1kg B/ha	14.27	1319.74	42.29
T_7 -30 Kg S/ha + 0.2% B spray	13.77	1414.72	43.28
T_8 -50 Kg S/ha + 1 Kg B/ha	14.33	1337.74	44.33
T_9 -50 Kg S/ha + 0.2% B spray	15.57	1476.71	45.70
SEm (±)	0.33	25.68	0.68
CD(P=0.05)	0.98	77.00	2.05

In conclusion, it is inferred from the present investigation that application of 50kg/ha sulphur along with 0.2% boron spray at ray floret stage of sunflower can be recommended in addition to the full doses of nitrogen, phosphorus and potassium for receiving higher growth, yield and oil content of Sunflower.

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