Original Research Article

Influence of Sulphur and Boron on growth and yield of Zaid Sunflower.

Abstract

A field experiment was conducted during *Zaid* (summer) season of 2023 at Crop ResearchFarm 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, 40kg/ha and 60 kg/ha) and boron (0.5%, 1% and 1.5%) along with recommended dose ofnitrogen, phosphorus, potassium and control (60:45:45 NPK kg/ha), this experiment was laidout in a Randomized Block Design with 10 treatment and replications thrice applicationsulphurTheapplicationofSulphur-60kg/ha+Boron-1.5%(Treatment9)recordedsignificantlymaximumnumberofflowersperplant(3.00),seeds/capitulum (308.00), test weight (50.87 g), seed yield (1111.20 kg/ha), stover yield(3126.90kg/ha),harvestindex(26.23%)was obtained in the treatment of sulphur-60kg/ha Boron-1.5%. It was concluded that for obtaining higher yield components with betterqualityofSunflowerapplicationofSulphur–60kg/ha+Boron–1.5%wasrecommended.

Keywords: Sulphur, Boron, Yield Attributes.

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is one of the four important oil crops in the world. This crop is a very important oil crop in Egypt because it can be used in human nutrition, oil industry and animal fodder (Gokhan and Gokman, 2010). Sunflower is considered insensitive to photoperiod with broad climatic adaptability and high drought tolerance. It has advantage over other oil crops such as soybeans, because of its higher oil yield per unit area (Zobiola *et al*., 2010) and it accounts for about 13 % of all vegetable oils produced in the world (Nobre *et al*., 2011). In Egypt, many attempts have been made to maximize total production of oil crops to overcome the gap between production and consumption of edible oils by improving sunflower yield. Karnataka accounts for nearly half the area under sunflower inthe country and ranks first with respect to area and production followed by AP. The highestproductivitywasrecordedbyUPfollowedbyTamilNadu.Sunfloweroilisconsideredasprem iumwhencomparedtoothervegetableoils.Sunfloweristheoilofpreferenceamongtheconsumers the world over due to its health appeal and in India too, sunflower oil is the largestselling oil in the branded oil segment. Sunflower oil content varies from 48-53% and it ispremium oil with pale yellow in colour used for cooking and margarine. Sunflower is a richsource of linoleic acid (64%) which helps in reducing cholesterol deposition in the coronaryarteriesoftheheart.Oil containshigh levelof alphatocopherol, aformofvit. E.

World sunflower production in 2021-22 has increased to 56.96 million tonnes from 50.74million tonnes in 2020-21. Imports have increased to 3.68 million tonnes from 2.86 milliontonnes.Exportshaveincreasedto3.88milliontonnesfrom3.06milliontonnes.

Alsoconsumptionincreasedto56.51from50.00milliontonnes.Carryoutstockalsoincreasedto 2.61 from 2.35 million tonnes for the year 2022-23. In India during vanakalam (kharif) 2021-22sunflowercrophasoccupied1.502lakhhectares(3.712lakhacres)asagainst1.191lakhha(2.943 lakh acres) during the same period in 2020-21. Karnataka 1.093 lakh ha (2.550 lakhacres),Maharashtra0.150lakhha(0.371lakhacres)andAndhraPradesh0.019lakhha(0.047lakh acres) are major sunflower growing states in India during vanakalam (kharif) 2021-22.According to Government 1st advance estimates, all India kharif sunflower production in2021-22 is at 0.95 lakh tonnes compared to the 0.77 lakh tonnes in previous year. The centralgovernment has increased the minimum support price of sunflower for the year 2021-22 byRs.130fromRs. 5885 to Rs. 6015 per quintal (Aditya 2021).

Sulphur plays a predominant role inimprovingthegrainqualityofsunflowercropandtheuseefficiencyofnitrogenandphosphorus(Najer*et al*.,2011).Sulphurisregardedasaqualitynutrientbecauseitaffectsnotonly crop yield but also crop quality through its effects on protein metabolism, oil synthesis,and amino acid formation. The average increase in oil content due to sulphur application inmajor oilseeds is 11.3 percent in groundnut, 9.6% in mustard, 6.0% in linseed and 3.8% insunflower (Sharma *et al*. 2009). 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. 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.

MATERIALSANDMETHODS

The experiments on the effect of S and B as foliar application with different levels of sulphuralong with recommended dose of fertilizers (RDF) on the growth and yield enhancement ofsunflowerwereconductedat*Zaid*seasonof2023-2024atCropResearchFarm,DepartmentofAgronomy, Naini Agricultural Institute, SHUATS, Prayagraj which is located at 25^0 24 42 Nlatitude,$81^0$5056Elongitudeand98maltitudeabovethemeansealevel.Thisareaissituatedon the right side of the river Yamuna by the side of Prayagraj Rewa Road about 5 km awayfrom Prayagraj city. . A composite soil sample was collected at a depth of 0-30 cm. It was airdried, crushed, and tested for physical and chemical properties .The soil was sandy clay loamintexturewithsoilreactionof(pH7.6),0.69organicmatter(0.72%),availablenitrogen(152.7kg /ha), phosphorus (10.4 kg/ha), potassium (174.0 kg/ha) , sulphur (7.2 mg/kg), Zn (0.72mg/kg) and available B (0.56 mg/kg).Experiments were carried out in a randomized blockdesign withnine treatments(T1-S 20kg/ha+ Boron- 0.5%,T2- Sulphur20kg/ha +Boron -1%,T3-Sulphur20kg/ha+Boron-1.5%,T4-Sulphur40kg/ha+Boron-0.5%,T5-Sulphur40 kg/ha + Boron - 1, T6- Sulphur 40 kg/ha + Boron - 1.5% , T7- Sulphur 60 kg/ha + Boron -0.5%,T8-Sulphur60kg/ha+Boron-1,T9-Sulphur60kg/ha+Boron-1.5%,T10-Control(60-45-45) NPK kg/ha. Experimental plots consisted of three levels of sulphur (20kg, 40 kghand60kg/ha)assoilapplicationandB(0.5%,1%and1.5%)asfoliarapplicationandcontroli.e., recommended N, P and K (60:45:45 kg/ha) alone as soil application. All the treatmentswereappliedbybalancingtotheinitialsoiltestvaluesandcroprequirementstojustifythecr opresponseto thesupplied nutrients in both years.

Results and Discussion:

Number of flowers per plant: Significantly higher number (3.00) was recorded in the application ofSulphur – 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.*, (2011).

Seeds per capitulum: Significantly higher number of seeds per capitulum (308.00) was recorded in the application ofSulphur – 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 ofSulphur – 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 ofSulphur – 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).
Sulphur application was also highlybeneficial 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 pollenproduction 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.

Stover yield (kg/ha): maximum number of stover yield (3126.90) was recorded in the application ofSulphur – 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).

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

Conclusion

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

Table1.EffectofsulphurandborononyieldattributesandyieldofSunflower

S No	Treatments	Number offlowersp er plant	Seeds/ca pitulum	Testw eight (g)	Seedyiel d (kg/ha)	Stovery ield (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): 60:45:45NPK kg/ha	1.22	291.00	43.85	1024.21	2835.4	26.54
	F – Test	S	S	S	S	S	NS
	SEm (±)	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

Table 2. Effect of sulphur and boron on growth attributes of Sunflower

S. No.	Treatment combinations	AT 60DAS			During 30 - 45 DAS	
		Plant Height (cm)	**Dry Weight (gm/plant)**	**Number of leaves per plant**	**Crop growth rate ($g/m^2/day$)**	**Relative growth rate (g/g/day)**
1.	Sulphur – 20 kg/ha + Boron – 0.5%	129.15	43.05	20.73	11.34	0.0377
2.	Sulphur – 20 kg/ha + Boron – 1%	130.10	45.00	21.40	11.59	0.0387
3.	Sulphur – 20 kg/ha + Boron – 1.5%	129.63	44.64	20.87	11.44	0.0377
4.	Sulphur – 40 kg/ha + Boron – 0.5%	130.18	45.50	21.73	11.65	0.0377
5.	Sulphur – 40 kg/ha + Boron – 1%	128.29	42.00	19.67	10.46	0.0350
6.	Sulphur – 40 kg/ha + Boron – 1.5%	131.63	47.45	24.87	11.63	0.0370
7.	Sulphur – 60 kg/ha + Boron – 0.5%	130.26	44.12	21.73	11.44	0.0381
8.	Sulphur – 60 kg/ha + Boron – 1%	128.86	42.68	20.20	11.04	0.0376
9.	Sulphur – 60 kg/ha + Boron – 1.5%	135.41	49.37	25.00	11.91	0.0356
10.	Control (RDF) : 60:45:45 NPK kg/ha	125.76	41.07	18.00	10.78	0.0398
	F- test	S	S	S	S	NS
	SEm(±)	1.36	0.67	0.35	0.26	0.0001
	CD (p=0.05)	4.03	1.99	1.05	0.77	-

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