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Influence of Potassium and Sulphur on Growth and Yield of Summer Sunflower (*Helianthus annuus*. L)

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Authors' contributions

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

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Original Research Article

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ABSTRACT

A research was conducted during summer season of 2022 at crop research farm (CRF), Department of Agronomy, SHAUTS, prayagraj (U.P), to evaluate the influence of potassium and sulphur on growth and yield of summer sunflower. The treatments consisted of 3 levels of Potassium (30,40,50 Kg/ha) and Sulphur as (10,20,30 Kg/ha) and a control. The experiment was laid out in randomized block design (RBD) with 10 treatments and replicated thrice. The results showed that Application of 50 kg potassium soil application with combination of 30 kg sulphur as soil application recorded highest plant height (125.4 cm), plant dry weight (15.0 g/plant), and the yield attributes namely seeds per capitulum (332.4) Test weight (33.7 g), seed yield (1463.44 kg/ha), stover yield (3211.6 kg/ha), harvest index (31.3 %) and highest benefit - cost ratio (1.94).

Keywords: Sunflower; capitulum; potassium; sulphur; growth; yield.

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1. INTRODUCTION

"Sunflower (*Helianthus annuus* L.) is an essential oilseed cash crop due to its excellent nutritional qualities with high concentration of linoleic acid, fine quality edible oil with adequate unsaturated fatty acids, anticholesterol properties, higher oil yield per unit area, early maturity, short duration , compliance to different climate and soil conditions, photothermo insensitiveness, less water requirement and responsiveness to better production management practices" [1,2]. "Sunflower is a potential oilseed crop with promise of increased area under its cultivation for enhancing oilseed production" [3]. "Sunflower has the potential to bridge up the gap between demand and supply of edible oil and it is well adapted to agro-ecological conditions of Pakistan" [4]. "Potassium plays a key role in increasing crop yield and improving the quality of product" [5]. "Potassium contributes to the osmotic pull that draws water into plant roots therefore, its deficiency in plants makes them susceptible to water shortage, mainly due to inability to use available water" [6,7]. "Sulphur deficiency in the soil increases with every next day due to the reason of severe consumption of low sulphur fertilizers, cultivation large number of crops in one season and also due to illogical use of plants for feed and fuel purpose. Erosion and leaching degraded the soil, which also donate their part in enhancing the areas have deficient in sulphur" [8]. "Sulphur plays a predominant role in improving the seed quality of sunflower crop and also the use efficiency of nitrogen and phosphorus. In oilseeds, sulphur plays a vital role in the development of seed and improving quality" [9]. In the view of these, the present investigation was carried out to study the influence of potassium and sulphur on growth and yield of summer sunflower.

2. MATERIALS AND METHODS

The experiment was carried out during *Zaid* season of 2022. The experiment was set up using a Randomized Block Design with three replications and ten treatment combinations, with the different treatments being distributed at random within each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.1) with low level of organic carbon (0.28%), available N (225 Kg/ha), P (19.50 kg/ha) and higher level of K (92.00 kg/ha). The treatment combinations are T_1 – 30 kg/ha Potassium + 10 kg/ha Sulphur, T_2 - 30 kg/ha Potassium + 20 kg/ha Sulphur, T_3 - 30 kg/ha Potassium + 30 kg/ha Sulphur, T_4 - 40 kg/ha Potassium + 10 kg/ha Sulphur, T_5 - 40 kg/ha Potassium + 20 kg/ha Sulphur, T_6 - 40 kg/ha Potassium + 30 kg/ha Sulphur, T_7 - 50 kg/ha Potassium + 10 kg/ha Sulphur, T_8 - 50 kg/ha Potassium + 20 kg/ha Sulphur, T_9 - 50 kg/ha Potassium + 30 kg/ha Sulphur,T_{10} – N:P:K – 80:60:40 kg/ha (Control). The observations were recorded on different growth parameters at harvest viz. plant height(cm), plant dry weight, Number of seeds per capitulum, test weight, seed yield, stover yield and harvest index [10].

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

At 75 DAS, treatment T_9-50Kg/ha Potassium + 30Kg/ha Sulphur recorded significantly superior plant height (125.4 cm) compared to all other treatments. Whereas, treatment T_8-50Kg/ha Potassium + 20Kg/ha Sulphur (125.0 cm) was found to be statistically at par with T_9-50Kg/ha Potassium + 30Kg/ha Sulphur, 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 [11]. At 75 DAS, maximum Dry weight (15.0 g/plant) was observed in the treatment T_9-50Kg/ha Potassium + 30Kg/ha Sulphur over the other treatments. However, treatments T_8- 50Kg/ha Potassium + 20Kg/ha Sulphur (14.8 g/plant) was found to be statistically at par with T_9-50Kg/ha Potassium + 30Kg/ha Sulphur as compared to other treatments [12].

3.2 Yield Attributes

Significantly Maximum Number of Seeds/capitulum (332.4) was recorded with the application of treatment T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur over all the treatments. However, number of seeds (331.5) were obtained in T_8- 50Kg/ha Potassium + 20Kg/ha Sulphur were found to be statistically at par with T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur. Significantly Maximum Test weight (33.7 g) was recorded with the application of treatment T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur over all the treatments. However, the treatment T_8- 50Kg/ha Potassium + 20Kg/ha Sulphur (33.2) which were found to be statistically at par with T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur. Significantly Maximum Seed yield (1463.44 kg/ha)

Table 1. Influence of potassium and sulphur on growth attributes of sunflower

Treatments	Plant height(cm) At 60 DAS	Dry weight(g/plant) At 60 DAS
30 kg/ha Potassium + 10 kg/ha Sulphur	116.0	10.6
30 kg/ha Potassium + 20 kg/ha Sulphur	116.3	10.8
30 kg/ha Potassium + 30 kg/ha Sulphur	117.3	11.4
40 kg/ha Potassium + 10 kg/ha Sulphur	116.6	11.1
40 kg/ha Potassium + 20 kg/ha Sulphur	118.4	12.1
40 kg/ha Potassium + 30 kg/ha Sulphur	118.8	12.2
50 kg/ha Potassium + 10 kg/ha Sulphur	117.8	11.8
50 kg/ha Potassium + 20 kg/ha Sulphur	199.0	12.5
50 kg/ha Potassium + 30 kg/ha Sulphur	119.4	12.8
Control: N:P: K – 80:60:40 kg/ha	115.2	10.3
F-Test	S	S
SEm±	0.17	0.09
CD (P=0.05)	0.52	0.28

Table 2. Influence of potassium and sulphur on yield attributes and yield of sunflower

Treatments	Seeds/ capitulum	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
30Kg/ha Potassium + 10Kg/ha Sulphur	320.0	28.8	1155.10	3035.4	27.6
30Kg/ha Potassium + 20Kg/ha Sulphur	321.3	29.3	1235.81	3092.2	28.6
30Kg/ha Potassium + 30Kg/ha Sulphur	325.7	30.2	1290.80	3159.0	29.0
40Kg/ha Potassium + 10Kg/ha Sulphur	324.4	29.5	1247.81	3132.5	28.5
40Kg/ha Potassium + 20Kg/ha Sulphur	329.2	31.7	1399.42	3186.9	30.5
40Kg/ha Potassium + 30Kg/ha Sulphur	330.5	32.4	1417.10	3194.8	30.7
50Kg/ha Potassium + 10Kg/ha Sulphur	327.8	30.4	1349.70	3171.7	29.8
50Kg/ha Potassium + 20Kg/ha Sulphur	331.5	33.2	1426.03	3202.9	30.8
50Kg/ha Potassium + 30Kg/ha Sulphur	332.4	33.7	1463.44	3211.6	31.3
Control	318.8	28.3	1071.70	2996.3	26.3
F test	S	S	S	S	S
S. Em (±)	0.51	0.24	17.92	7.57	0.29
CD (P = 0.05)	1.54	0.73	53.25	22.50	0.88

was recorded with the treatment T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur. over all the treatments. However, the T_6- 40Kg/ha Potassium + 30Kg/ha Sulphur (1417.10 kg/ha) and T_8- 50Kg/ha Potassium + 20Kg/ha Sulphur (1426.03 kg/ha) which was found to be statistically at par with T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur. Significantly Maximum Stover yield (3211.6 kg/ha) was recorded with the treatment T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur over all the treatments. However, the T_6- 40Kg/ha Potassium + 30Kg/ha Sulphur (3194.8 kg/ha) and T_8- 50Kg/ha Potassium + 20Kg/ha Sulphur (3202.9 kg/ha) which was found to be statistically at par with T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur. Significantly Maximum Harvest index (31.3 %) was recorded with the treatment T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur over all the treatments. However, the treatments T_5- 40Kg/ha Potassium + 20Kg/ha Sulphur (30.5 %) T_6- 40Kg/ha Potassium + 30Kg/ha Sulphur (30.7 %) and T_8- 50Kg/ha Potassium + 20Kg/ha Sulphur (30.8%) which was found to be statistically at par with T_9- 50Kg/ha Potassium + 30Kg/ha Sulphur [13-19].

4. CONCLUSION

On the basis of one season experimentation, it is concluded that application of Potassium 50 kg/ha and Sulphur 30 kg/ha (Treatment 9) performed better in terms of growth and yield as compared to other treatments. Significantly enhanced plant height, plant dry weight, number of seeds per capitulum, test weight, seed yield, stover yield, economic yield. The conclusions reached are solely based on data from one season, necessitating further confirmation before being recommended.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kaya MD, Kolsarici O. Seed yield and oil content of some sunflower (*Helianthus annuus* L.) hybrids irrigated at different growth stages. Afr. J. Biotechnol. 2011;10:4591-4595.
2. Burton JW, Miller JF, Vick BA, Scarth R, Holbrook CC. Altering fatty acid composition in oilseed crops. Adv. Agron. 2008;84:273-306.
3. Cheema HSHS, Singh B. A user's manual to CPCS 1, Punjab Agric. Univ. Ludhiana, India; 2008.
4. Ali A, Ahmad A, Khaliq T, Akhtar J. Planting density and nitrogen rates optimization for growth and yield of sunflower (*Helianthus annuus* L.) hybrids. Journal of Animal and Plant Science. 2012;22(4):1070-1075.
5. Soleimanzadeh M, Hussain MR. Response of sunflower to drought stress under different potassium levels. World Appl Sci J. 2010;8(4):443-448.
6. Ahmad Z, Anjum S, Waraich EA, Ayub MA, Ahmad T, et al. Growth, physiology, and biochemical activities of plant responses with foliar potassium application under drought stress – a review. Journal of Plant Nutrition. 2018;41:1734-1743.
7. Gujar A, Buriro M, Kubar MS, Kubar KA, Kamran M, et al. Agronomic performance of sunflower (*Helianthus annus* L.) against different sources and levels of potassium fertilization. Journal of environmental and Agricultural Sciences. 2018;15:18-57.
8. Rani K, Sharma KL, Nagasri K, Srinivas K, Murthy VT, Maruthi GR, Korwai H, Grace J. Response of sunflower to sources and levels of sulfur under rainfed semi-arid tropical conditions. Communications in Soil Science and Plant Analysis. 2009;40: 2926–2944.
9. Naser A, Anjum Sarvajeet, Gill S, Shahid Umar, Igbal Ahmed, Armando C. Durate, Edurada Pereira. Improving growth and productivity of *Oliferous brassica* under changing environment. Significance of nitrogen and sulphur nutrient and underlying mechanisms. The Scientific World Journal, 2012:21.
10. Dipak Salve, Monika S. Bhavsar, Rajanikant B. Ghagare, Sugandh N. Shinde. Effect of potassium and sulphur on nutrient uptake, yield and quality of safflower in Vertisol. International Journal of Current Microbioly and Applied Sciences. 2018;7(01):1116-1123.
11. Kumar S, Singh SS. Effect of different levels of phosphorus and sulphur on the growth, yield and oil content of sunflower, (*Helianthus annuus* L). Journal of Oilseeds Research. 2011;22(2):408-409.
12. Rajiv D, Singh P, Prakash HG. Response of sesame (*Sesamum indicum L*.) varieties to sulphur and potassium application under rainfed condition. International Journal of Agricultural Sciences. 2012;8(2):476-478.
13. Farhad ISM, Islam MN, Hoque S, Bhuiyan MSI. Role of potassium and sulphur on the growth, yield and oil content of soybean (*Glycine max* L.). An Academic Journal of Plant Sciences. 2010;3(2):99-103.
14. Ahmad F. Influence of sulphur and potassium levels on yield and yield attribute of sesame (*Sesamum indicum* L.). International Journal of Research Studies in Agricultural Sciences (IJRSAS). 2018;4(5):8-10.
15. Ayub. Experiment conducted on effect of different sources and levels of potash on yield and oil content of spring sunflower. Pakistan Journal of Biological science. 2009;2(3):801-803.
16. Badrul H, Intikhab A. Effect of nitrogen, sulphur and farmyard manure on growth dynamics and yield of sunflower (*Helianthus annuus L*.) under temperate conditions. Scientific Research and Essays. 2013;8(43):2144-2147.
17. Brar MS, Sharma P, Singh A, Dhillon NS, Sandhu SS. Effect of potassium nutrition on the yield, quality and nutrient uptake by sunflower. Journal of the Indian Soc. of Soil Sciences. 2010;58(3):344-346.
18. Ebrahimian A, Soleymani A. Growth length and dry matter yield in different stages of safflower as affected by nitrogen, phosphorus and potassium fertilizers.

International Journal of Agronomy and Plant Production. 2013;4(5):963-969.

19. Pavani S, Rekha KB, Babu SN, Moguloju M. Effect of nitrogen and Sulphur on growth, yield and quality of sunflower (*Helianthus annuus* L.). Crop Research. 2013;45(1-3):152-154.

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