International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 15, Issue 7, 2023, pp.-12502-12503.
Available online at https://bioinfopublication.org/pages/jouarchive.php?id=BPJ0000217

Research Article

EFFECT OF POTASSIUM AND SULPHUR FERTILIZATION ON THE SOIL FERTILITY OF SESAME (*Sesamum indicum* L.)

JAT R.*, NAGA S.R., CHOUDHARY R.S. AND JAT S.
Department of Agricultural Extension and Communication, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad, 211007, India
*Corresponding Author: Email - rschandiwal@gmail.com

Received: June 12, 2023; Revised: July 26, 2023; Accepted: July 28, 2023; Published: July 30, 2023

Abstract: A field experiment was carried out at the S.K.N. College of agriculture's agronomy farm in Jobner, Rajasthan on loamy sand soil in *kharif* 2014. The experiment included 16 treatment combinations with four levels of potassium and sulfate at each of the following levels: 0, 25, 50, and 75 kg ha^{-1} and 0, 20, 40, and 60 kg ha^{-1}, respectively. The findings demonstrated that gradual increases in potassium levels up to 50 kg K_2O ha^{-1} and sulfur levels of 40 kg S ha^{-1} considerably improved the soil fertility and sesame quality.

Keywords: *Potassium, Sulphur content, Soil fertility*

Citation: Jat R., *et al*., (2023) Effect of Potassium and Sulphur Fertilization on the Soil Fertility of Sesame (*Sesamum indicum* L.). International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 15, Issue 7, pp.- 12502-12503.

Introduction

Sesame is known as "the queen of oils" having extraordinary aesthetic and skin care properties. As a short-duration crop, it fits well into a variety of cropping sequences and systems and is cultivated throughout the entire year. With a yield of 2.94 million tonnes and a productivity of 448 kg ha^{-1}, sesame is produced on 6.57 million hectares worldwide. In India, it is cultivated on 17 lakh hectares, yielding 7.48 lakh tons at a productivity of 439 kg ha^{-1} [1]. The activation of enzymes, as well as resistance to the cold, illness, water stress, and other harmful situations, depend heavily on potassium. Because it has a substantial impact on the quality and growth of oil seeds and is well recognized for its involvement in the synthesis of proteins, oils, and vitamins, sulphur, a vital plant nutrient, may play a big role in increasing the output and productivity of oilseeds in the nation.

Prolonged use of chemical fertilizers alone in intensive cropping systems leads to unfavorable soil fertility, harmful effects on soil physico-chemical and biological properties and undermine sustainable crop production. Deficit of organic matter makes the situation worst for oil seed crops. The fact that crop deficiencies of sulphur have been reported with increase in frequency over the past several years greater attention has been focused on the importance of sulphur in plant nutrition [2]. In light of this, a study was conducted to determine the impact of potassium and sulphur fertilization on the soil fertility of sesame crops.

Materials and method

Sesame cv. RT-46 was used in a field experiment at the S.K.N. College of Agriculture's agronomy farm in Jobner, Rajasthan. The experiment was done using a randomized block design with four replications. The experimental soil had a loamy sand texture, a high infiltration rate (22.4 cm hr^{-1}), and a saturated hydraulic conductivity of 10.20 cm hr^{-1}. There were 16 treatments total, with four levels of K and four levels of S applied as gypsum and 0, 25, 50, and 75 kg of K_2O/ha, respectively. The soil had low levels of organic carbon (0.21%), low levels of available nitrogen (125.64 kg N ha^{-1}), medium levels of available phosphorus (18.43 kg P_2O_5 ha^{-1}), and low levels of both available potassium (178.05 kg K_2O ha^{-1}), while having insufficient levels of accessible sulphur (7.95 mg kg^{-1}). The soil's response was 8.2 and it was not salty. All of the treatments—levels of sulfur after correcting sulfur obtained from potassium sulphate administered through gypsum 21 days before sowing-were applied before to sowing and physically integrated in the top 15 cm of soil.

A broadcast application of urea and DAP, the required dosage of N and P, was made prior to planting. The crop was grown using a regular set of procedures.

Result and discussion

Nutrient content and uptake

The nutrients content and uptake in seed and stalk were significantly influenced by the application of potassium [Table-1]. Nutrient absorption and content in seed and stalk were considerably highest at 50 kg K_2O ha^{-1}. According to Vaghani *et al*. (2010) [3], increasing levels of sulphur and potassium considerably boosted the absorption of N, P, K, and S in seed and stalk. Sesame seed and stalk content increases in nitrogen, phosphate, potassium, and sulfur may also result from synergistic effects up to a certain degree and According to Jadav *et al*. (2010) [4], the application of potassium at 40 kg ha^{-1} and sulphur at 40 kg ha^{-1} considerably boosted the N, P, K, and S content and absorption by seed and stalk of the sesame crop.

Sulphur spraying had a considerable impact on the nutritional content and absorption in seed and stalk [Table-1]. The application of sulfur @ 40 kg S ha^{-1} resulted in considerably higher nitrogen, phosphorus, potassium, and sulphur content and absorption in seed and stalk as compared to control. This rise in nitrogen content might be the result of sulphur levels being higher having a positive impact on nitrogen availability. Rotoin may have increased plant growth and development, which in turn led to a greater absorption of N, P, K, and S [5]. Due to their synergistic effects, sulphur fertilization aids in enhancing the plant's absorption of N, P, K, and S. It is also one of the nutrients that plants require to thrive, collecting 0.2 to 0.5% of their dry mass in plant tissue. It is also a crucial component in the production of chlorophyll and necessary for the synthesis of amino acids that contain sulfur, such as cystine, cysteine, and methionine (among others), which may have enhanced plant growth and development and, in turn, led to higher N, P, K, and S uptake. Application of sulphur @ 30 kg ha^{-1} have shown significant increase in nitrogen uptake due to its role in increase in nutrient uptake. The increased uptake of nitrogen was due to synergistic interaction effect of N and S and higher dry matter accumulation. These results were in conformity with the findings of Jeena *et al*. (2013) [6] and Singh *et al*. (2007) [7]. The build of available potassium was higher in the integration of inorganic fertilizer with organic manure. It may be due to the beneficial effects of organic manures affecting clay- organic interaction and direct K_2O additions widening available K pool of soil.

Table-1 Nutrient content and uptake of N, P, K and S in seed and stalk

Treatments	N content (%)		N uptake (kg ha^{-1})		P content (%)		P uptake (kg ha^{-1})		K content (%)		K uptake (kg ha^{-1})		S content (%)		S uptake (mg kg^{-1} ha^{-1})	
	Seed	Stalk	Seed	Stalk	Seed	Stalk	Seed	Stalk	Seed	Stalk	Seed	Stalk	Seed	Stalk	Seed	Stalk
Potassium levels																
K_0	2.868	0.986	18.55	9.65	0.796	0.137	5.13	1.34	0.751	0.168	4.84	7.87	1.010	1.12	6.51	10.92
K_{25}	3.407	1.102	25.71	12.30	0.874	0.159	6.57	1.79	0.821	0.192	6.17	9.81	1.110	1.21	8.35	13.46
K_{50}	3.712	1.167	30.68	14.08	0.939	0.170	7.74	2.05	0.876	0.208	7.22	11.27	1.195	1.28	9.84	15.50
K_{75}	3.783	1.187	31.92	14.55	0.951	0.176	8.00	2.16	0.905	0.218	7.61	11.57	1.222	1.32	10.28	16.23
SEm$\pm$	0.087	0.022	0.84	0.50	0.022	0.002	0.17	0.05	0.018	0.004	0.18	0.23	0.029	0.02	0.25	0.32
CD (P=0.05)	0.250	0.063	2.42	1.44	0.063	0.007	0.50	0.13	0.053	0.011	0.53	0.66	0.084	0.07	0.71	0.91
Sulphur levels																
S_0	2.920	0.990	18.47	9.63	0.801	0.135	5.05	1.32	0.755	0.168	4.76	7.83	1.022	1.11	6.44	10.79
S_{20}	3.410	1.100	26.09	12.30	0.875	0.161	6.67	1.80	0.820	0.192	6.25	9.81	1.112	1.21	8.48	13.52
S_{40}	3.670	1.170	30.45	14.09	0.937	0.171	7.75	2.06	0.873	0.208	7.22	11.25	1.193	1.29	9.87	15.53
S_{60}	3.770	1.182	31.85	14.57	0.948	0.175	7.98	2.16	0.905	0.218	7.62	11.64	1.210	1.32	10.19	16.26
SEm$\pm$	0.087	0.022	0.84	0.50	0.022	0.002	0.17	0.05	0.018	0.004	0.18	0.23	0.029	0.02	0.25	0.32
CD (P=0.05)	0.250	0.063	2.42	1.44	0.063	0.007	0.50	0.13	0.053	0.011	0.53	0.66	0.084	0.07	0.71	0.91

The results were in conformity with Laxminarayan and Patiram (2006) [8]. Application of S significantly increased the S uptake by sesame seed and stover. This increase in S uptake may be attributed to increase in S concentration in plant and dry matter yield. The results corroborated the findings of Sakal *et al.* (1993) [9] and Dwidevi *et al.* (2002) [10, 11].

Soil fertility

The soil's availability of potassium was greatly improved by applying potassium at increasing rates, and the application of potassium @ 75 kg ha^{-1} significantly raised the soil's maximum availability of potassium [Table-1]. According to Gajghane *et al.* (2015) [11], the solubilization of native potassium could be the cause of the significant increase in the soil's available potassium nutrient status following potassium application. However, direct potassium addition to the soil's available potassium pool could also be the cause of the increase in available potassium status at crop harvest [12]. Higher seed yield and stover yield of sesame was obtained with RDF along with 25% N through FYM significantly improved soil physico-chemical characters via modifying the soil environment, for sustained nutrient supply, better aeration and microbial activity influencing nutrient uptake and improving growth and yield components and ultimately yield of sesame. The results are in line with Maheshbabu *et al.* (2008) [13].

The application of sulfur at an increasing rate has a considerable impact on the soil's accessible sulphur status [Table-1]. With an application of sulfur @ 60 kg ha^{-1}, the investigated soil's considerably highest accessible sulphur status was measured at crop harvest. With the application of sulfur, the available state of S dramatically increased. This rise may be the result of better soil physicochemical qualities and the ameliorating action of sulfur. The enhanced mineralization of organic sulphur and release of SO42- ions on its progressive oxidation are likely responsible for the increased quantity of accessible sulfur [14].

Conclusion

Based on the findings of the experiment, it was determined that applying potassium at a rate of 50 kg K_2O and sulphur at a rate of 40 kg S per hectare would improve soil fertility for the sesame crop.

Application of research: Farmers apply to sesame crop applying potassium at a rate of 50 kg K_2O and sulphur at a rate of 40 kg S per hectare would improve crop growth, yield and soil fertility for the sesame crop.

Research Category: Soil Science

Acknowledgement / Funding: Authors are thankful to Department of Soil Science, SKN College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, 303329, Rajasthan, India

****Research Guide or Chairperson of research: Dr Sita Ram Naga**
University: Sri Karan Narendra Agriculture University, Jobner, 303329, India
Research project name or number: MSc Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: SKN College of Agriculture, Jobner, 303329

Cultivar / Variety / Breed name: Sesame (*Sesamum indicum* L.)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Government of India (2013) *Department of Agriculture and Corporation, Ministry of Agriculture, Government of India, New Delhi*.
[2] Scherer H.W. (2001) *European Journal of Agronomy*, 14, 81- 111.
[3] Vaghani J.J., Polara K.B., Chovatia P.K., Thumar B.V. and Parmar K.B. (2010) *An Asian Journal of Soil Science*, 5, 356-358.
[4] Jadav D.P., Padamani D.R., Polara K.B., Parmar K.B. and Babaria N.B. (2010) *An Asian Journal of Soil Science*, 5, 144-147.
[5] Shah M.A., Manaf A., Hussain M., Farooq S. and Zafar-ul-Hya M. (2013) *International Journal of Agriculture & Biology*, 15, 1301-1306.
[6] Jeena M., Suman J. and Indira M. (2013) *Indian journal of Agricultural Research*, 47(3), 214- 219.
[7] Singh S. and Singh V. (2007) *Indian Journal of Agronomy*, 52(2), 158-159.
[8] Laxminarayan K. and Patiram (2006) *Journal of Indian Society of Soil Science*, 54(2), 213-220.
[9] Sakal R., Sinha R.B., Singh A.P. and Bhogal N.S. (1993) *Annals of Agricultural Research*, 14(3), 329-330.
[10] Dwivedi S. K., Singh R. S. and Dwivedi K. N. (2002) *Journal of Indian Society of Soil Science*, 50(1), 70-74.
[11] Gajghane P.G., Tonchers S. and Raut M.M. (2015) *Plant Achieves*, 15, 347-351.
[12] Tandon H.L.S. (1987) *Fertiliser Development & Consultation Organisation (FDCO), New Delhi.*
[13] Maheshbabu H. M., Hunje R., Biradar N. K. and Babalad H. B. (2008) *Karnataka Journal of Agricultural Sciences*, 21(2), 219-221.
[14] Pathan A.R.K. and Nag A.K. (2008) *Agriculture & Allied Science*, 3, 69-72.
[15] Jeena M., Suman J. and Indira M. (2013) *Journal of Indian Society of Soil Science*, 61(2), 122- 127.