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Effect Of Sulphur On Growth, Yield, Nutrient Uptake And Content And Oil Contentin Linseed

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ABSTRACT
A pot experiment was carried out to study the effect of sulphur nutrition on growth, yield, nutrient uptake and content and oil content of linseed crop on sandy loam soil at the C.S.A.U.A.&T., Kanpur, during Rabi season of 2013-14 and 2014-15. The results indicated that application of 40 ppm S pot-1 improved the growth parameters like plant height, number of branches plant-1 and yield components viz., number of capsules/plant, 1000-seed weight (test wt.), seed and stover yield as compared to other treatments. However, the yield values were statistically at par at 40 & 60 ppm S levels. The content of sulphur increased with its application upto 60 ppm S while, uptake of S increased upto 40 ppm and thereafter, decreased. The results also exhibited that oil content of seed increased with the application of sulphur upto their highest levels. The oil contents in seeds increased upto 60 ppm S. However, increase was higher magnitude at higher level of sulphur.
Key words : *Sulphur, linseed, nutrient uptake, yield, growth, oil content.*

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INTRODUCTION

Linseed (*LinumusitatissimumL.*) is an important oilseed crop of the world. In India, it is grown in winter season in the Deccan Rabi zone, and accounts 21.42 lakh hac. of total area, with an average production and productivity of 2.12 lakh tonnes and 403 kg/ha respectively during 2013-14 (Directorate of Economics and statistics, 2013-14). Seed of linseed contain about 35-47% oil. It contains 35-70% linolenic acid, (omega-3 fatty acid) the factor which reduces blood cholesterol concentration and cardiovascular benefits by affecting prostaglandins and leukotriens related to blood clotting and inflammatory disorder like rheumatoid arthritis (Srivastava, 2010). Linseed is a natural source of lignin which has anticarcinogenic properties and also provide protection against certain form of cancer due to estrogenic and antiestrogenic activities inside the body (Srivastava, 2010). Moreover, due to high content of unsaturated fatty acids and it is being used as an excellent drying oil for use in paints, varnishes, printing ink, coating oils, oil cloths, lanolin, and soap industries and similar other products.

Nutritionally, oilseed rape and Brassica species in general require sulphur during their growth (Zhao *et al.,* 1993), for the synthesis of both protein and naturally occurring glucosinolates. Glucosinolates are a group of secondary metabolites containing alpha–thioglucose, alpha- sulphonated oxime moiety and a side chain, their concentration is closely related to the sulphur supply, what is not surprising, since each glucosinolate molecule contains two or three sulphur atoms (Zhao *et al.* 1997). Both sulphur uptake and sulphur translocation in linseed crop (oilseed) vary as a function of growth stage and plant part. Application of sulphur significantly increased yield as well as quality (Kumar *et al,* 2009). So, keeping these aspects in view, a experiment was under taken to study the effect of sulphur nutrition on growth, yield, nutrient uptake and quality of linseed (*Linumusitatissimim* L.).

MATERIALS AND METHODS

The experiments to evaluate the effect of sulphur on growth, yield, uptake of nutrients and oil content of linseed were conducted under irrigated conditions during Rabi season 2013-14 and 2014-15 on sandy loam soil (Inceptisols) at department of Soil Science and Agricultural Chemistry, C.S. Azad University of Agriculture and Technology, Kanpur. The soil of experimental site contained 62.50% sand, 21.10% silt,15.40% clay, had pH 7.8, Ec 0.56 ds/m, organic carbon 0.41%, available N, P and K was 240, 10.10 and 108 Kg/ ha, respectively and available sulphur was 9.20 mg/ kg. The treatments comprising of four levels of sulfur (0, 20, 40 and 60 ppm through gypsum) and replicated four times in a randomized complete block design. All the sixteen treatments were given a uniform recommended doses of N, P and K (80kg N, 60kg P_2O_5 and 40kg K_2O). Nitrogen was applied in the form of urea, phosphorus in the form of diammonium phosphate and potash in the form of muriate of potash. Half dose of N as basal and half as top dressing. The amount of N present in DAP was adjusted while applying N through urea. Sulphur was applied as perSpectrophotometer (Conway and Earle, 1962). The oil content was expressed in percentage (Anon.,1975). The nitrogen content was estimated by modified Kjeldahl's method. The protein content was calculated by multiplying the nitrogen content (%) with a factor 6.25 (Tai and Young, 1974). Further, the uptake of N and S were analyzed by the standard procedure as described by Jackson (1973). The estimation of sulphur by turbidimetrically (Chesnia and yien,1951).

RESULTS AND DISCUSSION

Growth parameters : The data presented inTable-1shows that levels of sulphur had significantly treated through gypsum at the time of sowing. The seeds were sown during third week of November. At maturity plants are harvested manually. Harvested plants were tied in small bundles and kept up right with wall for sun drying for five days. After drying plants were thrashed manually. Seed yield was recorded on pot basis and then converted into hectare basis. Soil of experimental site was taken and analyzed as per standard method. The yield and growth characters i.e. plant height, number of branches/plant, number of capsules/plant and 1000-grains weight were recorded at maturity. The recorded data were subjected to statistical analysis appropriate to Randomized complete Block Design by using M. Stat. (Freed and Eisen Smith, 1986). Means were compared for significance at 5% probability level using LSD (Steel and Torrie, 1980). Plant samples were collected at harvesting stage and grain samples were analyzed for oil content. The oil content in seeds was estimated by Nuclear Magnetic Resonance (NMR)influence on growth parameters i.e. plant height, number of branches/plant, number of capsules/plant and test weight of 1000 seeds and seed and stover yields of linseed crop. The growth parameters and yield increased concordantly with increase in sulphur levels. Among the sulphur levels, application of 40 ppm S registered the highest plant height, number of branches/ plant, number of capsules/plant and test weight. It was significantly superior over 20 ppm S and control levels. The increase in yield attributes on addition of sulphur might be due to its deficiency in experimental soil. The crop receiving 40 ppm sulphur might have been helped in terms of vigorous root growth formation of chlorophyll, resulting in higher photosynthesis. The results of this investigation are in consonance with the findings of Reddappa Reddy (1981). Similar results were report by Singh and Sharma (1996), Tripathi*et al.,* (2010) and Charan*et al.,* (2013).

Yield : The yield determining components such as number of capsules/plant, 1000 -seed weight and seed and stover yields were significantly influence by the levels of sulphur (Table-1). On an average, the seed and stover yield increase upto 40 ppm levels of sulphur. However, the yield values were statistically at par at 40 and 60 ppm S levels. It has been observed that, on an average, the highest seed and stover yield of 14.33 g/pot and 20.75 g/pot at 40 ppm S were found 28.40% and 28.48% higher in comparison to lowest seed and stover yield of 11.16 g/pot and 16.15 g/pot at control, respectively. The results are in conformity with the findings of Jat and Mehra (2007), Singh and Pal (2011), and Kumar *et al.* (2014).

Content and Uptake of Sulphur : The data on nutrient content and uptake (Table-2) in both seed and stover indicates that application of sulphur increased the uptake of sulphur significantly. From the Table-2, it is obvious that content of sulphur in both seed and stover increased with an increase in sulphur level, being lowest at control and highest at 60 ppm S level. This shows synergistic effect of sulphur application with its absorption. The uptake is affected by yield parameters and therefore, the yield being highest at 40 ppm S level affected the uptake of sulphur. However, the sulphur uptake values in both seed and stover at 40 and 60 ppm levels were statistically at par. Therefore, the uptake of sulphur in both seed and stoverwere recorded higher at 40 ppm sulphure levels. The increase in sulphur content on its addition might be attributed to increase its availability on its addition, resulting in higher content of sulphur at its higher level i.e. 60 ppm sulphur. The increase in content and uptake of sulphur, these results are in conformity with the findings of Sharma *et al.* (1992), Singh *et al.* (2006) and Tomar (2012). The value of sulphur uptake at 2.5 and 5.0 ppm were found statistically *at par*.

Oil content : The data on the oil content (Table-2) showed that significant differences were manifested in the oil content of seeds due to sulphur application. The application of sulphur increased the oil content in seed in linear order, being lowest at control and highest at 60 ppm sulphur level is 40.85% was recorded. On an average, an increase of 4.53% in oil content was recorded at 60 ppm sulphur in comparison to control. This might be due to role of sulphur in synthesis of oil, sulphur is involved in the formation of glucosides and glucosinolates (mustard oil) and sulphydril-linkage and activation of enzymes, which aid in biochemical reaction within the plant. This confirms the findings of Mishra and Agarwal (1994) in soybean and Gangadhara*et al.* (1990) in sunflower. The increase in oil content on addition of sulphur might be associated with increase in Acetyl-CoA and carboxylase activity through the enhancement of Acetyl-CoA concentration (Ahmad *et al.,* 2000). The increase in oil content on addition of sulphur in oilseed crop has also reported by Varun *et al.* (2011) and Dash *el al.* (2012).

Table-1: Effect of sulphur on growth parameters and yield of linseed (mean of two years).

Treatments	Plant height (cm)	No. of branches / plant	No. of capsules plant	1000-seed wt. (g)	Yield (g/pot)	
					seed	stover
S-levels (ppm)						
S_0	62.41	4.92	46.02	7.19	11.16	16.15
S_{20}	65.04	5.92	52.67	8.05	13.26	19.20
S_{40}	66.13	6.35	55.80	8.60	14.33	20.75
S_{60}	65.97	6.25	54.50	8.50	13.84	20.70
CD (P = 0.05)	1.668	0.387	1.876	0.317	0.730	1.001

Table-2: Effect of Sulphur on its content and uptake and oil per cent in seed (mean of two years).

Treatments	S-contents (%)		S-uptake (mg/pot)		Oil yield (%)
	Seed	**Stover**	**Seed**	**Stover**	
S levels (ppm)					
S_0	0.29	0.12	32.42	20.17	39.08
S_{20}	0.37	0.15	49.42	29.23	40.32
S_{40}	0.41	0.17	58.71	36.35	40.80
S_{60}	0.42	0.17	58.47	35.26	40.85
CD (P = 0.05)	0.036	0.011	2.149	1.330	0.198

REFERENCES

1. Ahmad, A.; Khan, I. and Abdin, M.Z., 2000, Effect of sulphur fertilization on oil accumulation, Acetyl-CoA concentration, and Acetyl-CoA carboxylase activity in the developing seeds of rapeseed (*B. compestris* L.). *Australian Journal of Agriculture Research, 51:* 1023-1029.
2. Anonymous, Compendium; 2010-11. Directorate of Oil Seed Research, Rajendra Nagar, Hydrabad.
3. Anonymous, 1975. Official Methods of Analysis(12th Ed.), William Storwertzled, A.O.A.C. Publications, Washington, D.C., pp. 506-508.
4. Charan, Keshav, Kumar Vijay; Pal Mahender, 2013. Effect of Sulphur levels under various sowing method on growth and yield of Indian mustard (*Brassica Juncea* L.). *Progressive Research 8 :*575-579 (Special issue).
5. Chesnin, L. and yien, C.H., 1951. Tarbidimetric determination of available Sulphate. *Soil Science Society of American Proceedings, 15 :*149-151.
6. Conway, T.F. and Earle, F.R., 1962. *Journal American Oil Chemistry Society, 40 :*265-268.
7. Dash, N.R.; Ghosh; G.k.; Taylor and Francis. 2012. Efficacy of gypsum and magnesium sulphate as Sources of sulphur to rapseed in lateritic soils. *J. Pl. Nutr., 35(14) :*2156-2166.
8. Freed and S.P. Eisen Smith, 1986. Mstat Micro Computer Statistically Programme. Michigan State University Agriculture, Michigan, Lansing, USA.
9. Gangadhara, G.A., Manjunathiah, H.M. and Satyanarayana, T.,1990. Effect of S on yield, oil content of sunflower and uptake of micronutrients by plants. *J. Ind. Soc. Soil Sci., 38 :*692-694.
10. Jackson, M.L., 1973. Soil Chemical Analysis, Prentice Hall of India Private Limited, New Delhi, p. 187.
11. Jat, J.R. and Mehra, R.k. 2007. Effect of sulphur and zinc on yield, macronutrient content and uptake by mustard on Haplusteps. *J. Indian Soc. Soil Sci., 55(2) :* 190-195.
12. Kumar, A.; Singh, P.; Kumar, A. and Maurya, C.L. (2009). Effect of applied S and Zn on seed yield, quality and oil content of linseed (*LinumUsitatisimmum*). *J. Oilseeds Res., 26 :*287-289.

13. Mishra, A.k. and Agarwal,H.P., 1994, Effect of sulphur on growth, yield, protein and oil content of soybean. *J. Oilseeds Res., 11 :*99-102.
14. Reddappa Reddy, M., 1981. Effect of calcium, sulphur & boron on the yield and composition of sunflower (*Helianthus annuus* L.). *M.Sc. (Agri.) Thesis, Uni. Agric. Sci.,* Bangalore (India).
15. Sharma, N.K.; Khaddar, V.K.; Sharma, R.A. and Singh, D. 1992. Effect of different sources and levels of sulphur on nutrients uptake by mustard. *Crop. Res., Hissar, 5:* 50-53.
16. Singh, S.P. and Pal, M.S. 2011. Effect of integrated nutrient management on productivity, quality, nutrient uptake and economics of mustard. *Indian J. Agron., 56(4) :*381–387.
17. Singh, V.K. and Sharma, H.C. 1996. Response of Indian mustard (*Brassica juncea* L.) to levels and time to Sulphur application. *Crucifirae News Letter, 18 :* 138–139.

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