IMPACT OF LEVELS OF SULPHUR AND GENOTYPES OF LINSEED ON PHYSICO-CHEMICAL PROPERTIES AND FERTILITY STATUS OF SOIL

Kuchanwar O. D., Patil S. R., Jiotode D.J. and Salunke H. S.

College of Agriculture, Nagpur Dr. P.D.K.V. Akola (M.S) India

Email: ommalakuchanwar@yahoo.com

Abstract: The experiment was laid out in Factorial Randomized Block Design with 12 treatments combinations of four levels of sulphur i.e. 0, 10, 15 and 20 kg ha⁻¹ with common dose of three genotypes of linseed were NL-97, NL-260 and Padmini in the year 2011-12 in *rabi* season. The pH value of soil ranged from 7.72 to 7.55 at sulphur level @ 0 kg ha⁻¹ to 20 kg ha⁻¹ respectively indicating pH decreases significantly with increase in sulphur levels. The highest pH value (7.72) was observed at sulphur level @ 0 kg ha⁻¹ and the lowest pH value (7.55) observed in treatment sulphur level @ 20 kg ha⁻¹. The electrical conductivity values of soil ranged from 0.24 dSm⁻¹ to 0.19 dSm⁻¹ at sulphur level @ 0 kg ha⁻¹ to 20 kg ha⁻¹ respectively indicating EC decreases significantly with increase in sulphur levels. Organic carbon content in soil ranged from 0.51 to 0.56% after harvest of linseed under the influenced of various sulphur levels was significantly increased due to sulphur application. The highest (0.56%) organic carbon content in soil was recorded with sulphur @ 20 kg ha⁻¹, followed by sulphur @ 15 kg ha⁻¹ (0.55%), lowest organic carbon content was (0.51%) recorded in control plot. After harvest of linseed, due to application of sulphur increased the availability of nutrients content in soil i.e. available N, P, K and S (274.24 kg ha⁻¹ N, 15.27 kg ha⁻¹ P, 458.33 kg ha⁻¹ K and 12.84 mg kg⁻¹ S). The highest increased due to application of sulphur @ 20 kg ha⁻¹.

Keywords: Sulphur, Genotypes, Physico-chemical property, Fertility

Introduction:

The importance of sulphur in Indian agriculture has been realized only in recent years with the appearance of its deficiency in many parts of the country. Sulphur deficiency is known to affect nitrogen metabolism in plant. When sulphur is limiting, protein synthesis decreases where by nitrogen is not fully utilized resulting in accumulation of non-protein N in the plant. The critical N:S. ratio varies with the crop and variety and there is a strong relationship between total-N, total-S and protein N, protein S ratios (Dev *et al.*, 1981). In the plant, sulphate (SO₄⁻²) ions reduced and accumulated in to organic compounds. The available sulphate (SO₄⁻²) ion remains in soil solution, much like the nitrate ion (NO₃⁻), until it is taken up by the plant, in this form it is subject to leaching as well as microbial immobilization. In water logged soils, it may be reduced to elemental sulphur (S) or other unavailable form. Nitrogen is associated with S in soil organic matter in a ratio of about 8:1, although the extreme ratios may vary from 5:1 to 13:1.

Materials and methods:

The experiment was conducted on field of AICRP (All India Co-ordinated Research

Project) on linseed, College of Agriculture, Nagpur. (M.S.) during *rabi* season 2011-12 with three genotypes i.e. NL-97, NL-260 and Padmini and four sulphur levels i.e. 0, 10, 15 and 20 kg ha⁻¹ with 12 treatments combination with three replications. The experiment was laid out in Factorial Randomized Block Design (FRBD). To study the physico-chemical properties and fertility status of soil. The soil samples were collected treatment wise from each plot. The samples were air dried under shed and grinded in wooden mortar and pestle and passed through a 2 mm sieve. The processed soil samples (< 2 mm) were used for the analysis of macronutrient (available N, P, and K) and allied physico-chemical soil properties. The collected soil samples were processed and analysed for pH, EC and Organic carbon following standards method Wakley and Black, 1934). Free calcium carbonate described by Piper, (1966). Soil samples were analysed by using standard method as described for available N (Subbiah and Asija 1956), available phosphorus, potassium (Jackson 1967) and available sulphur by Chesnin and Yien, (1951).

Results and discussion:**Effect of different levels of sulphur and genotypes of linseed on physico-chemical properties of soil**

pH : Regarding pH of soil data presented in table 1. Result revealed that, pH of soil decreased with increasing levels of sulphur. From the data it was observed that, the highest pH was found at sulphur level 0 kg ha⁻¹ (7.72) as compared other sulphur level but result were statistically non-significant. As S level increased pH decreased which might be due to salt concentration decreased in soil but statistically results was not significant. In case of genotypes from data, it was observed that NL-97 and padmini gave lowest pH (7.62) as compared to NL-260 (7.65). There was non-significant effect about pH of soil. Interaction effect of different levels of sulphur with three genotypes for pH of soil was statistically non-significant.

Electrical Conductivity (dSm⁻¹): Regarding EC of soil data presented in table 1.

Table- 1. Effect of different levels of sulphur and genotypes of linseed on physico-chemical properties of soil

Treatments	pH	E.C. (dSm ⁻¹)	O.C. g kg ⁻¹	CaCO ₃ %
Sulphur levels				
S ₀ (0 kg ha ⁻¹)	7.72	0.24	5.1	5.15
S ₁ (10 kg ha ⁻¹)	7.64	0.23	5.3	5.14
S ₂ (15 kg ha ⁻¹)	7.60	0.19	5.5	5.09
S ₃ (20 kg ha ⁻¹)	7.55	0.19	5.6	5.09
F-test	N.S.	N.S.	Sig.	N.S.
S.E.m. ±	0.07	0.03	0.1	0.03
C.D. at 5%	-	-	0.3	-
Varieties				
V ₁ (NL-97)	7.62	0.22	5.4	5.14
V ₂ (NL-260)	7.65	0.22	5.7	5.14
V ₃ (Padmini)	7.62	0.19	5.3	5.09
F-test	N.S.	N.S.	N.S.	N.S.
S.E.m. ±	0.06	0.02	0.2	0.02
C.D. at 5%	-	-	-	-
Interaction				
F-test	N.S.	N.S.	N.S.	N.S.
S.E.m. ±	0.12	0.04	0.5	0.04
C.D. at 5%	-	-	-	-
CV	4.83	4.45	109.4	4.41

Result revealed that, EC of soil decreased with increasing levels of sulphur. From the result, it was found that highest EC after harvest of linseed was recorded by application of sulphur level @ 0 kg ha⁻¹ (0.24 dSm⁻¹) followed by level of sulphur @ 10 kg ha⁻¹ (0.23 dSm⁻¹) but results were

statistically non-significant. In case of genotypes from data, It was observed that NL-97 & NL-260 gave highest EC (0.22 dS m⁻¹) as compared to Padmini (0.19 dS m⁻¹). Interaction effect of different levels of sulphur and three genotypes for EC of linseed was found to be statistically non-significant.

Organic carbon (g kg⁻¹): Regarding organic carbon content of soil after harvest of linseed crop data presented in table 1. Organic carbon in soil regulates the nutrients availability to crops, hence, its availability in soil after harvest of linseed was observed. The data exhibited statistically significant difference for different sulphur levels. From the results, it was observed that highest organic carbon content was recorded in treatment @ 20 kg ha⁻¹ S (5.6%) which is at par with sulphur level @ 15 kg ha⁻¹ S (5.5%) and at par with sulphur level @ 10 kg ha⁻¹ S (5.3%). Hence from the data, it was revealed that, increase in levels of sulphur there was increased in organic carbon content in soil because of increase in biomass of plant as increased in ancillary characters of plant. In case of genotypes from data, it was observed that NL-260 gave highest organic carbon (5.7%) as compared to NL-97 (5.4%) and Padmini (5.3%), but statistically results were non-significant. Interaction effect of different levels of sulphur with three genotypes of linseed, for organic carbon content in soil after harvest of linseed was statistically non-significant.

Calcium Carbonate (%) : Regarding CaCO₃ of soil data presented in table 1. Result revealed that, CaCO₃ of soil was no effect due to application of sulphur. From the data it was observed that, The highest CaCO₃ content in soil after harvest of linseed was found at sulphur level @ 0 kg ha⁻¹ (5.15 %) but results were statistically non-significant. In case of genotypes from data, it was observed that NL-97(5.14%) and NL-260(5.14%) gave highest CaCO₃ content as compared to Padmini (5.09%) and lowest in S₂ and S₃ levels but statistically data was non-significant. Interaction effect of different levels of sulphur with three genotypes of linseed, for CaCO₃ content in

soil after harvest of linseed was statistically non-significant.

Effect of different levels of sulphur and genotypes of linseed on fertility status of soil: The data pertaining to available N, P, K and S after harvest of linseed as influenced by different levels of sulphur are presented in table 2.

Table 2: Effect of different levels of sulphur and genotypes of linseed on fertility status of soil.

Treatments	N kg ha ⁻¹	P kg ha ⁻¹	K kg ha ⁻¹	S mg kg ⁻¹
Sulphur levels				
S ₀ (0 kg ha ⁻¹)	258.16	13.93	433.64	10.06
S ₁ (10 kg ha ⁻¹)	266.20	14.82	446.95	11.35
S ₂ (15 kg ha ⁻¹)	274.96	15.30	457.02	12.81
S ₃ (20 kg ha ⁻¹)	274.24	15.27	458.33	12.84
F-test	Sig.	Sig.	Sig.	Sig.
S.E.m. ±	1.14	0.06	1.93	0.07
C.D. at 5%	3.36	0.19	5.66	0.19
Varieties				
V ₁ (NL-97)	270.97	15.09	451.63	12.62
V ₂ (NL-260)	270.68	15.07	451.08	12.60
V ₃ (Padmini)	271.01	15.09	451.75	12.62
F-test	N.S.	N.S.	N.S.	N.S.
S.E.m.±	0.99	0.06	1.67	0.06
C.D. at 5%	-	-	-	-
Interaction				
F-test	N.S.	N.S.	N.S.	N.S.
S.E.m.±	1.98	0.11	3.34	0.11
C.D. at 5%	-	-	-	-
CV	8.62	9.67	8.21	5.03

Available nitrogen in soil : From the results, it was observed that available nitrogen content in soil after harvest of linseed significantly increased with increase in levels of sulphur upto @ 15 kg ha⁻¹. The highest available N in soil was observed at sulphur level @ 15 kg ha⁻¹ (274.96 kg ha⁻¹), which was found to be at par with sulphur level @ 20 kg ha⁻¹ (274.24 kg ha⁻¹). Similar finding were observed by Raut *et al.* (2000). In case of genotypes from data, it was observed that Padmini gave highest N content in soil (271.01 kg ha⁻¹) as compared to NL-97 (270.97 kg ha⁻¹) and NL-260 (270.68 kg ha⁻¹) but statistically data was non-significant. Interaction effect of different levels of sulphur and three genotypes for available N in soil statistically was non-significant.

Available phosphorus in soil : From the results, it was observed that available phosphorus content in soil after harvest of linseed significantly increased with increase in levels of sulphur upto @ 15 kg ha⁻¹. The highest P content in soil (15.30 kg ha⁻¹), @

15 kg ha⁻¹ S, which was found to be at par with sulphur level @ 20 kg ha⁻¹ (15.27 kg ha⁻¹). Hence result revealed that, P content in soil increases due to the application of sulphur. Increase in available P in soil might be due to increase in biomass due to different levels of S. In case of genotypes from data, it was observed that NL-97 (15.09 kg ha⁻¹) and Padmini (15.09 kg ha⁻¹) gave highest P content in soil as compared to NL-260 (15.07 kg ha⁻¹) and results were statistically non-significant. Interaction effect of different levels of sulphur and three genotypes for available P content in soil was statistically non-significant.

Available potassium in soil : Result revealed that, K content in soil after harvest of linseed increased with increase in levels of sulphur. From results in was found that, highest K content in soil (458.33 kg ha⁻¹) at sulphur level @ 20 kg ha⁻¹, which was found to be at par with sulphur level @ 15 kg ha⁻¹ (457.02 kg ha⁻¹). Hence, it was revealed that K content in soil increases due to the application of sulphur, and also results were statistically significant. Similar results were reported by Ramdevputra *et al.* (2010). Increase in available K in soil might be due to increase in biomass due to different levels of S. In case of genotypes from data, it was observed that Padmini gave highest K content in soil (451.75 kg ha⁻¹) as compared to NL-97 (451.63 kg ha⁻¹) and NL-260 (451.08 kg ha⁻¹) but results were statistically non-significant. Interaction effect of different levels of sulphur with three genotypes for available potassium in soil was statistically non-significant.

Available sulphur in soil: Result revealed that, available S in soil after harvest of linseed significantly increased with increase in sulphur levels. From data, it was observed that, the highest S content in soil (12.84 mg kg⁻¹) at sulphur level @ 20 kg ha⁻¹, which was found to be at par with sulphur level @ 15 kg ha⁻¹ (12.81 mg kg⁻¹). Hence, from result, it was observed that, available sulphur in soil after harvest of linseed increases due to the application of sulphur. Similar findings were reported by Ramdevputra *et al.* (2010). Increase in available S in soil might be due to increase in biomass due to different levels of S. In

case of genotypes from data, it was observed that NL-97(12.62 mg kg⁻¹) and Padmini (12.62 mg kg⁻¹) gave highest S content in soil as compared to NL-260(12.60 mg kg⁻¹) and results were statistically non-significant. Interaction effect of different levels of sulphur with three genotypes for available sulphur after harvest of linseed was statistically non-significant.

References:

- Chesnin, L. and C. H. Yein, 1951.** Turbidimetric determination of available Sulphur. Proc. Soil Sci. Soc. Am.15:149-151.
- Jackson, M. L., 1967.** Soil chemical analysis prentice Hall, Inc, New York, U.S.A.
- Piper, C. S.; 1966.** Soil and plant analysis IV Edition University of acelcide, adeitada, Australia: 135-200.
- Ramdevputra, M. V.; K. N. Akbari ; G. S. Sutaria ; V. D. Vora and D. R. Padmini, 2010.** Effect of sulphur application on yield of groundnut and soil fertility under rainfed conditions. Legume Res. 33(2): 143-145.
- Raut, R. F.; Abdul Hamid ; S. S. Hadole and G. S. Jeughale, 2000.** Effect of irrigation and sulphur on concentration uptake and availability of sulphur nitrogen and phosphorus in mustard (*Brassica juncea*) J. Soils and Crops 19(1): 145-148.
- Subbaiah, B. V. and G. L. Asija, 1956.** A rapid procedure for the estimation of available nitrogen in soil. Current Sci. 25: 256-260.
- Walkey, N. M. and A.I. Black. 1934.** Estimation of organic carbon by chromic acid titration method Soil Sci. 25: 259-263.