Ann. Pl. Soil Res 14(1):58-60 (2012)

EFFECT OF SULPHUR AND CALCIUM ON GROWTH AND YIELD OF SESAME UNDER RAINFED CONDITION OF NAGALAND

I.T. LONGKUMER AND T. GOHAIN
Department of Agronomy, School of Agricultural Sciences & Rural Development, Nagaland University: Medziphema-797106, Nagaland
Received: December, 2011

ABSTRACT

A field experiment was conducted during Kharif 2007 at Medziphema, Nagaland to study the effect of sulphur and calcium on sesame. Application of sulphur and calcium influenced the plant height, number of branches and leaf area index significantly over control. Highest plant height (116.30 cm) was recorded with the application of 20 kg S ha^{-1} in the form of gypsum. Maximum number of branches (4.77), number of capsules per plant (72.08), number of seeds per capsul (65.33), test weight (3.86), stover yield (6.16 q ha^{-1}) and seed yield (22.67q ha^{-1}) was recorded at 60 kg S ha^{-1}. Nitrogen, sulphur and calcium content in seed and stover of sesame increased with S and C,a however, the extent of increase due to Ca was less than that of S. The Ca content in seed and stover also increased with calcium and the extent of increase was similar to sulphur.

Keywords: Sulphur, calcium, yield, sesame. Nagaland

INTRODUCTION

Sesame (*Sesamum indicum* L.), the queen of oilseeds, is an important edible oilseed crops in India but its productivity is low. This lower productivity was ascribed to lack of high yielding varieties and gap adopting crop management technology and also due to the vagaries of monsoon during kharif. Apart from improved varieties irrigation and balanced fertilization was critical for realizing for higher yield. Sulphur is generally called the fourth major nutrient after N, P, and K, because, in general the S uptake by crops is just slightly less than uptake of P, but in case of oilseeds, S, uptake can exceed that of 'P'. This is because, in the plants, S is directly involved in the formation of all compounds. Addition of S to the oilseed crops increases the final oil yield in two ways, i.e., by improving the seed yield and also increasing the oil content of the seed. Gradual shift from S containing to S-free fertilizers and greater removal of this element through intensive cropping system with high yielding varieties of crops resulted in S-deficiency in a number of states in the country. Significant increase in seed yield due to application of sulphur was reported by Sarwagi *et al*. (1992) and Chaplot *et al*. (1992). However, there is no adequate information on the effect of S on sesame, more particularly in acid soils. Hence, the present study was undertaken to find out effect of sulphur and calcium on growth and yield of sesame.

MATERIALS AND METHODS

The field experiment was carried out during kharif 2007 at the Research cum Instructional Farm, School of Agricultural Sciences and Rural Development (SASRD), Nagaland University, Medziphema situated in the foot hill of Nagaland. The soil of the experimental field was well drained and sandy loam in texture having 5.4 pH, 18.6 g kg^{-1} organic carbon, 233, 25 and 194 kg ha^{-1} available N, P and K and 22kgha^{-1} sulphur. The treatments consisted of control (no SSP), control (with SSP), 20 kg S ha^{-1}, 40 kg S ha^{-1}, 60 kg S ha^{-1} 25 kg Ca ha^{-1}, 50 kg Ca ha^{-1}, 75 kg Ca ha^{-1}. The eight treatments replicated thrice in randomized block design. Sesame 'Pusa jai kisan' was sown in rows of 30cm apart at 2-3cm depth. Thinning was done 15 days after sowing to maintain plant to plant distance of 15cm. The recommended doses of NPK were applied as urea, diammonium phosphate and muriate of potash, respectively. Half of nitrogen along with full dose of P and K gypsum and lime as per treatments were applied as basal and mixed with the soil. The rest of N dose was top dressed at flowering stage. The crop was grown up to maturity by adopting standard package of practices. The crop was harvested in second week of November 2007. The grain and stover samples were analysed for N, S and Ca by adopting standard procedures (Jackson, 1973).

RESULTS AND DISCUSSION

Growth and Yield: Application of sulphur and calcium influenced sesame plant height, number of branches and leaf area index significantly over control. Highest plant height (116.30cm) was recorded with the application of 20 kg S ha^{-1} as gypsum (Table 1). Leaf area index and dry matter production also increased with increasing level of sulphur. Gypsum being the source of sulphur and calcium might have helped in proper growth and development of the crop resulting in higher seed and stover yield (Table 2). These findings are in conformity with those of Chaplot *et al*. (1992) and Sarwagi *et al*. (1992). Increased growth and yield due to application of gypsum in acid soil was also reported by Das and Das (1995) on rapeseed. The effect of various levels of calcium on growth and yield attributing characters (except test weight) of sesame was also found to be beneficial over control. Seed and stover yield increased significantly with the increasing levels of calcium; however there was no influence of Ca on seed oil content. Beneficial effect of lime as a source of Ca on oilseed crops like rapeseed and mustard in acid soil was also reported by Bora and Singh (1993). Hence, the additional benefit in terms of seed yield due to gypsum treatment over lime treatments may be attributed to the sulphur present in gypsum. The increase in seed yield either withsulphur or calcium may be attributed to the beneficial effect of these elements on various yield attributes growth characters like plant height, number of branches which resulted in increasing stover yield with the increase in levels of either of the elements.

Table1: Effect of sulphur and calcium on plant height, number of branches per plant, leaf area index and dry matter accumulation/m^2 at different days after sowing of sesame

Treatments	Plant height (cm)	Branches /plant	Lead area index		Dry matter accumulation (g m^{-2})	
			45 DAS	75 DAS	45 DAS	75 DAS
Control (no SSP)	103.83	4.10	1.62	2.67	48.87	156.67
Control (with SSP)	102.67	4.30	1.85	2.75	52.77	168.98
20 kg S ha^{-1}	108.83	4.57	1.92	3.25	55.45	181.67
40 kg S ha^{-1}	116.30	4.72	1.80	3.14	54.22	176.26
60 kg S ha^{-1}	114.67	4.77	1.74	3.11	51.43	171.67
15 kg Ca ha^{-1}	106.67	4.43	1.97	3.24	52.11	188.33
50 kg Ca ha^{-1}	110.43	4.60	1.77	3.05	54.23	184.33
75 kg Ca ha^{-1}	112.10	4.67	1.68	3.14	54.67	185.67
CD (P= 0.05)	3.78	0.15	0.25	0.47	NS	NS

Table2: Effect of sulphur and calcium on different yield attributes of sesame

Treatments	Capsule/plant	Seed/capsule	Test weight (g)	Stover yield (q ha^{-1})	Seed yield (q ha^{-1})
Control (no SSP)	46.43	59.23	3.80	5.00	18.73
Control (with SSP)	53.20	61.50	3.81	5.29	19.80
20 kg S ha^{-1}	62.29	63.73	3.83	5.83	20.80
40 kg S ha^{-1}	70.72	65.23	3.85	6.13	21.83
60 kg S ha^{-1}	72.08	65.33	3.86	6.16	22.67
15 kg Ca ha^{-1}	57.40	63.43	3.80	5.36	20.31
50 kg Ca ha^{-1}	58.39	63.75	3.81	5.54	20.73
75 kg Ca ha^{-1}	62.08	64.67	3.81	5.87	21.04
CD (P= 0.05)	0.32	0.53	0.06	2.60	3.80

Table3. Effect of sulphur and calcium on nitrogen, sulphur and calcium content (%) both in seed and stover of sesame

Treatments	Nitrogen		Sulphur		Calcium	
	Seed	Stover	Seed	Stover	Seed	Stover
Control (no SSP)	3.77	0.67	0.33	0.12	0.19	0.44
Control (with SSP)	4.02	0.68	0.36	0.14	0.21	0.46
20 kg S ha^{-1}	4.44	0.70	0.41	0.17	0.23	0.47
40 kg S ha^{-1}	4.50	0.72	0.43	0.18	0.26	0.48
60 kg S ha^{-1}	4.62	0.74	0.45	0.19	0.26	0.49
15 kg Ca ha^{-1}	4.28	0.70	0.38	0.16	0.23	0.47
50 kg Ca ha^{-1}	4.40	0.72	0.37	0.16	0.25	0.48
75 kg Ca ha^{-1}	4.41	0.72	0.38	0.17	0.25	0.50
CD (P= 0.05)	0.02	0.01	0.02	0.01	0.01	0.01

Uptake of Nutrients: Nitrogen, sulphur and calcium uptake in seed and stover of sesame increased significantly with increasing levels sulphur (Table 3). As a source of S and Ca application of gypsum resulted in increased availability of these nutrients in the soil leading to their higher uptake. Higher N content in both seed and stover with the increase in the level of gypsum might be due to synergistic effect of S and N. Higher yield and higher concentrations of

Table 4: Effect of sulphur and calcium on uptake of nitrogen, sulphur and calcium (kg ha^{-1}) in seed and stover of sesame

Treatments	Nitrogen			Sulphur			Calcium		
	Seed	Stover	Total	Seed	Stover	Total	Seed	Stover	Total
Control (no SSP)	19.1	12.4	31.5	1.6	2.2	3.9	0.9	8.2	9.1
Control (with SSP)	21.3	13.5	34.8	1.9	2.7	4.6	1.1	9.1	10.2
20 kg S ha^{-1}	25.8	14.5	40.4	2.3	3.5	5.9	1.3	9.7	11.0
40 kg S ha^{-1}	27.5	15.6	43.2	2.6	3.9	6.5	1.5	10.5	12.1
60 kg S ha^{-1}	28.4	16.7	45.1	2.7	4.3	7.1	1.6	11.1	12.7
15 kg Ca ha^{-1}	22.9	14.2	37.1	2.0	3.2	5.2	1.2	9.6	10.8
50 kg Ca ha^{-1}	24.3	14.9	39.3	2.0	3.3	5.4	1.4	9.9	11.3
75 kg Ca ha^{-1}	25.9	15.1	41.0	2.2	3.5	5.8	1.4	10.4	11.9
CD (P= 0.05)	0.16	0.30	0.32	0.11	0.13	0.21	0.06	0.18	0.18

N, S and Ca in both seed and stover due to application of gypsum resulted in higher uptake of these nutrients by seed and stover and ultimately the total uptake. Similar results were also recorded by Singh (1998) in rapeseed. Nitrogen uptake and its uptake by seed and stover and total uptake increased with the increase in the levels of calcium. Higher levels of Ca might have influenced the chemistry of the soil favourably which might have resulted in uptake of proportionately higher amount of N. Sulphur concentration in seed increased slightly, while increase in stover for all the levels of lime was statistically significant; however the extent of increase was less than that of gypsum. As such the S uptake by seed and stover and also total uptake increased with increasing levels of lime which was the resultant of increase in both seed and stover yield and increased concentration of the nutrient (Table 4). Calcium content both in seed and stover also increased along with the increase in the level of Ca and the extent of increase was similar to that for the levels of gypsum. More yield of seed and stover and higher concentration of Ca with increasing levels of lime resulted in higher uptake of this nutrient either by seed or stover and ultimately the total uptake.

REFERENCES

Bora, P. C. and Singh, L. S.(1993) Effect of gypsum and calcium carbonate on rapeseed (*Brassica campestris* L. var. Toria) and mustard (*Brassica juncea* L. var. Rai). *Journal of the Agricultural Science of North-east India Society*, **6**:69-71.

Chaplot, P. C.; Jain, G. L. and Bansal, K. N. (1992) Effect of sulphur and phosphorus on sesame (*Sesamum indicum*) and its residual effect on wheat (*Triticum asestivum*). I*ndian Journal of Agronomy*. **37**(2):340-341.

Das, K. N. and Das, K. (1995) Effect of Sulphur and nitrogen fertilization on growth and yield of toria (*Brassica campestris* sub. Sp. Oleifera var. toria). *Indian Journal of Agronomy*. **40**(2):329-331.

Jackson, M.L. (1973) Soil Chemical Analysis. Prentice Hall of India Limited, New Delhi.

Sahu, S. K.; Sandha, B. and Dash, P. K.(1991) Effect of sulphur and molybdenum on yield of groundnut with and without lime in acid soil of Orissa. *Farmer and Parliament.* **26**(1):18.

Sarawgi, S. K.; Lal, N.; Tripathi, R. S. and Purohit, K. K.(1992) Effect of nitrogen, potassium, sulphur on growth and yield of sesame (*Sesamum indicum* L.) In summer season. *Annals of Agricultural Research* **16**(1):101-103.