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Research Article

Suitability of Sulphur and Molybdenum on Quality and Yield of Fenugreek on Sandy Loam Soil of Rajasthan

Mahendra Singh Manohar[1]*, A.C. Shivran[2] and Ashok Choudhary[3]

[1]S.K.N. College of Agriculture, S.K.N. Agriculture University, Jobner, Rajasthan-303329, India
[2]Department of Agronomy, S.K.N. College of Agriculture, S.K.N. Agriculture University, Jobner, Rajasthan-303329, India
[3]Department of Agronomy, SK Rajasthan Agricultural University, Bikaner (Rajasthan)

Abstract

A field experiment was conducted during *rabi* season of 2011-12 on sandy loam soil to study the suitability of sulphur and molybdenum on quality and yield of fenugreek. Results indicated that application of sulphur @ 60 kg/ha and molybdenum @ 1.5 kg/ha significantly increase the nitrogen, sulphur, molybdenum and their uptake, protein content, seed, straw and biological yield and it remained at par with the application of sulphur @ 40 kg/ha and molybdenum @ 1.0 kg/ha over rest of treatments. However, the molybdenum and sulphur content in straw unchanged under different levels of sulphur and molybdenum. Based on result of one year experimentation it is concluded that application of sulphur @ 40 kg/ha and molybdenum @ 1.0 kg/ha recorded significantly increase the N, S content and their uptake, protein content and seed yield (15.36 and 15.22 q/ha) of fenugreek.

Keywords: Fenugreek, Molybdenum, Nitrogen, Protein, Sulphur and Yield

***Correspondence**
Author: Mahendra Singh Manohar
Email: ashokagro777@gmail.com

Introduction

Fenugreek is considered as spice as well as legume crop. It is annual herbaceous and autogamous crop belonging to family fabaceae and sub family papillionaceae. Being a leguminous crop it fix atmospheric nitrogen through biological nitrogen fixation for the plant and also enriches the soil with nitrogen. Fenugreek (*Trigonella foenum-graecum* L.*)* popularly known by its vernacular name '*methi'* is an important vegetable and condiment crop grown in Northern India during *rabi* season for leaves, shoots and seeds. Its seeds are used as condiment and vegetable for human consumption and as a concentrate for cattle. The seed is bitter in taste due to presence of an alkaloid known as "trigonellin" (0.12 to 0.38%) which is considered as basic material for the synthesis of cellulose, hemicellulose, nutrient and amino acids and is thought to reduce glycosuria in diabetes. It prevents constipation, removes indigestion, stimulates spleen and liver and is appetizing and diuretic. Fenugreek also used in certain aurvedic medicines and in caliclactylence, dysentery, diarrhoea and dyspepsia with loss of appetite (especially ment for gastric troubles). Sulphur is the fourth major essential plant nutrient after N, P and K playing an important role in growth and development of plants and reported to be deficient in soils [1]. Crop removal is the major cause of sulphur depletion in soil. Due to continuous use of high analysis sulphur free fertilizers like Urea, DAP and intensive cropping, sulphur deficiency has been also reported as hidden hunger in many crops, especially oilseeds and pulses. It helps in chlorophyll formation and also a constituent of amino acids like cystine, cysteine and methionine. It is also responsible for synthesis of certain vitamins (biotine and thiamine), proteins, fats and metabolisms of carbohydrates. Gypsum has been found as an effective and cheapest source of sulphur in India as huge deposits of gypsum are available especially in Rajasthan. Molybdenum is the consitutent part of enzymes in plant *i.e.*, nitrate reductase, xanthine dehydrogenase, aldehyde oxidase and sulphite oxidase. Nitrate reductase catalyzes the first step in nitrate assimilation, a pathway that is of key importance for plant nutrition. Xanthine dehydrogenase is involved in purine catabolism aldehyde oxidases catalizes the final oxidation in the phytohormone biosynthesis of indole acetic acid and abscisic acid and sulphite oxidase in catalyzing the formation of sulphate. Molybdenum is also reported to have an essential role in iron absorption and translocation in plants [2]. Molybdenum is essential for the process of symbiotic

and non-symbiotic nitrogen fixation. An objective the present study on suitable dose of sulphur and molybdenum for obtaining higher yield of fenugreek.

Materials and Methods

A field experiment was conducted during *kharif* season of 2011-12 at Department of Agronomy, College of Agriculture, Jobner, in a factorial randomized block design with three replications. The soil was loamy sand in texture, alkaline in reaction (pH 8.1), low in organic carbon (0.16 %), low available nitrogen (130.0 kg/ha), medium available phosphorus (18.57 kg P_2O_5/ ha), medium in potassium (152.0 kg K_2O/ha), low in sulphur (8.40 ppm) and molybdenum (0.04 ppm). The experiment consisted four sulphur levels (0, 20, 40 and 60 kg/ha) and four levels of molybdenum (0, 0.5, 1.0 and 1.5 kg/ha), thereby, making sixteen treatment combinations. Fertilizers were applied as per treatment through DAP, MOP, urea, gypsum and sodium molybdate at the time of sowing as basal dose. The fenugreek cv. 'RMt-1 was sown on 17 December, 2011 using seed rate of 25 kg/ha with a row spacing of 30 cm. The crop was harvested on 24 March, 2015. Five irrigations were applied during growing season. Intercultural operations *viz.*, thinning, hoeing and weeding were followed after 20 days of sowing to maintain recommended spacing and weed control. For weed management pendimethalin 1.0 kg a.i. /ha was applied as pre-emergence to control the weeds in early stages of the crop. Fully mature and develop pods from randomly selected five plants from each plot were plucked and number of seeds were counted. The average number of pods and seeds per plants was worked out. After threshing and winnowing the weight of seeds for each net plot area was recorded in kg per plot and then converted to kg/ha.

Results and Discussion

Effect of sulphur levels

Results revealed that application of sulphur @ 60 kg/ha significantly increases the nitrogen, sulphur, molybdenum, protein content, seed, straw and biological yield of fenugreek and remained at par with the application of sulphur @ 40 kg/ha over the rest of treatments (**Table 1** and **2**). Thus, increased availability of nutrients in the root zone coupled with increased metabolic activity at the cellular level probably might have increased the uptake of nutrient and their accumulation in vegetative plant parts. Increased accumulation of nutrients specially N, S and Mo in vegetative plant parts concomitant with improved metabolism led to greater transloc ation of these nutrients to reproductive structures of the crop. These results corroborate with the finding of [3-5]. However, the molybdenum content in straw unchanged under different levels of sulphur.

Table 1 Effect of sulphur and molybdenum levels on nitrogen and sulphur content and their uptake

Treatments	Nitrogen content (%)		Nitrogen uptake(kg/ha)		Total uptake (kg/ha)	Sulphur content (%)		Sulphur uptake (kg/ha)		Total uptake (kg/ha)
	Seed	Straw	Seed	Straw		Seed	Straw	Seed	Straw	
Sulphur (kg/ha)										
0	3.14	0.73	35.56	20.90	56.39	0.222	0.168	2.52	4.77	7.29
20	3.45	0.84	49.01	29.31	78.25	0.255	0.184	3.63	6.37	10.00
40	3.70	0.93	57.20	35.13	92.25	0.279	0.192	4.31	7.17	11.49
60	3.76	0.97	60.27	37.82	98.01	0.290	0.197	4.65	7.61	12.26
SEm ±	0.07	0.02	1.97	1.09	2.69	0.004	0.004	0.12	0.18	0.28
CD (P= 0.05)	0.21	0.06	5.69	3.14	7.77	0.012	0.012	0.34	0.52	0.80
Molybdenum (kg/ha)										
0	3.19	0.75	37.71	21.99	59.70	0.235	0.180	2.79	5.27	8.07
0.5	3.46	0.85	49.32	29.82	79.14	0.258	0.185	3.69	6.47	10.16
1.0	3.69	0.92	56.68	34.60	90.98	0.273	0.187	4.21	6.99	11.19
1.5	3.72	0.96	58.33	36.75	95.08	0.281	0.189	4.41	7.20	11.61
SEm ±	0.07	0.02	1.97	1.09	2.69	0.004	0.004	0.12	0.18	0.28
CD (P= 0.05)	0.21	0.06	5.69	3.14	7.77	0.012	NS	0.34	0.52	0.80

Table 2 Effect of fertility sulphur and molybdenum levels on content and their uptake, protein content and yield

Treatments	Molybdenum Content (ppm)		Molybdenum uptake (g/ha)		Total uptake (g/ha)	Protein content (%)	Yield (kg/ha)		
	Seed	Straw	Seed	Straw			Seed	Straw	Biological
Sulphur (kg/ha)									
0	4.33	1.22	4.90	3.47	8.36	19.63	11.25	28.36	39.61
20	4.53	1.25	6.43	4.33	10.75	21.56	14.12	34.57	48.69
40	4.67	1.27	7.21	4.77	11.97	23.13	15.36	37.42	52.78
60	4.76	1.29	7.62	4.98	12.59	23.50	15.86	38.58	54.44
SEm ±	0.07	0.03	0.22	0.14	0.33	0.45	0.32	0.79	0.92
CD (P= 0.05)	0.19	NS	0.63	0.41	0.96	1.30	0.93	2.29	2.66
Molybdenum (kg/ha)									
0	4.22	1.21	4.97	3.54	8.51	19.94	11.72	29.15	40.87
0.5	4.52	1.26	6.42	4.38	10.80	21.59	14.13	34.75	48.88
1.0	4.73	1.28	7.23	4.76	11.96	23.06	15.22	37.17	52.39
1.5	4.82	1.29	7.53	4.87	12.40	23.22	15.52	37.85	53.37
SEm ±	0.07	0.03	0.22	0.14	0.33	0.45	0.32	0.79	0.92
CD (P= 0.05)	0.19	NS	0.63	0.41	0.96	1.30	0.93	2.29	2.66

Effect of molybdenum levels

Results further indicated that application of molybdenum @ 1.5 kg/ha significantly increases the nitrogen, sulphur, molybdenum, protein content, seed, straw and biological yield of fenugreek but remained at par with the application of molybdenum @ 1.0 kg/ha over the rest of treatments (Table 1 and 2). This may be attributed to increased symbiotic nitrogen fixation, better root development, availability of nutrients and metabolic activity in fenugreek under the influence of applied molybdenum which enhanced N, S and Mo availability to the crop. Further, molybdenum also acts as a promoter in improving the uptake of nutrients from soil. The results are in close conformity with the findings of [6-7]. However, the sulphur and molybdenum content in straw unchanged under different levels of molybdenum.

Conclusion

Based on result of one year experimentation it is concluded that application of sulphur @ 40 kg/ha and molybdenum @ 1.0 kg/ha recorded significantly increase the N, S content and their uptake, protein content and seed yield (15.36 and 15.22 q/ha) of fenugreek.

References

[1] Tandon, H.L.S. Sulphur research and agricultural production in India, 1991, pp. 47-75.
[2] Das, D.K. Introductory Soil Science (Ist ed.) Kalyani Publishers, Ludhiana, 1996, pp. 335-340.
[3] Kumawat, M.L. 2001. Effect of compaction and sulphur on performance of fenugreek (Trigonellafoenum-graecumL.) growth under typic-ustipsamments. M.Sc. (Ag.) Thesis, Rajasthan Agricultural University, Bikaner.
[4] Yadav, S.S. and Sepat, S. Phosphorus and sulphur management in mothbean [Vigna aconitifolia (Jacq.) Marechal] under rainfed condition. Annals of Agricultural Research, 2008, 29(1, 2, 3 & 4): 38-42.
[5] Mathur, M.L., Purohit, A.K., Meena, H.S. and Solanki, R.H. Effect of phosphorus and sulphur on yield, quality and nutrient uptake by chickpea (Cicer arietinum L.). Environment and Ecology, 2013, 31(1A): 325-327.
[6] Dadhich, L.K. Effect of phosphorus, molybdenum and phosphate solubilizing bacteria on growth, yield and quality of clusterbean (Cyamopsis tetragonoloba L. Taub). M.Sc. (Ag.) Thesis, Rajasthan Agricultural University, Bikaner, 1997.
[7] Kumar, J. and Sharma, M. Effect of phosphorus and molybdenum on yield and nutrient uptake by chickpea (Cicer arietinum L.). Advances in Plant Sciences, 2005, 18(11): 869-873.

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