Research Article

Effect of Sulphur and Molybdenum on Yield Attributes, Yield and Economics of Fenugreek

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 effect of sulphur and molybdenum on yield attributes, yield and economics of fenugreek. Results indicated that application of sulphur @ 60 kg/ha and molybdenum @ 1.5 kg/ha significantly increase the pods per plant, seeds per pod, seed yield, straw yield, biological yield and net returns 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 test weight and harvest index unchanged under different levels of sulphur and molybdenum. Based on result it is concluded that application of sulphur @ 40 kg/ha and molybdenum @ 1.0 kg/ha recorded significantly higher seed yield (15.36 and 15.22 q/ha) and net returns (₹ 39244 and 38504/ha) of fenugreek.

Keywords: Fenugreek, Molybdenum, Net Returns, 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. The major objective of the present study is to find out the 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 yield attributes such as pods per plant and seeds per pod and remained at par with the application of sulphur @ 40 kg/ha over the rest of treatments (**Table 1**). This resulted in more pods per plant and pods containing greater number of seeds and bold seeds. Hence, it is obvious fact that application of sulphur improved overall nutritional environment of the rhizosphere as well as in the plant system which in turn enhanced plant metabolism and photosynthetic activity resulting in to better growth and development of plants and ultimately the yield attributes [3-5]. Seed yield, straw yield, biological yield and net returns significantly increase with the application of sulphur @ 60 kg/ha and it was remained at par with the application of sulphur over the rest of treatments (Table 1 and **Table 2**). The seed and straw yields primarily being a function of cumulative response of growth and yield attributing characters increased remarkably with increase in sulphur level. This was due to increase in yield of fenugreek with application of sulphur and relative low cost of input in relation to output.Similar results were also reported by [5-7]. However, the test weight and harvest index unchanged under different levels of sulphur.

Table 1 Effect of sulphur and molybdenum levels on yield attributes and yields of fenugreek

Treatments	Pods/plant	Seeds/pod	Test weight (g)	Seed yield (q/ha)	Straw yield (q/ha)
Sulphur (kg/ha)					
0	27.91	10.77	12.46	11.25	28.36
20	32.10	12.57	12.70	14.12	34.57
40	33.97	13.55	12.84	15.36	37.42
60	35.02	13.99	12.94	15.86	38.58
SEm ±	0.59	0.28	0.15	0.32	0.79
CD (P= 0.05)	1.72	0.80	NS	0.93	2.29
Molybdenum (kg/ha)					
0	29.03	10.92	12.48	11.72	29.15
0.5	32.00	12.54	12.69	14.13	34.75
1.0	33.80	13.56	12.85	15.22	37.17
1.5	34.20	13.86	12.92	15.52	37.85
SEm ±	0.59	0.28	0.15	0.32	0.79
CD (P= 0.05)	1.72	0.80	NS	0.93	2.29

Table 2 Effect of fertility sulphur and molybdenum levels on biological yield, harvest index and net returns

Treatments	Biological yield (q/ha)	Harvest index (%)	Net returns (₹/ha)
Sulphur (kg/ha)			
0	39.61	28.41	23847
20	48.69	29.01	34734
40	52.78	29.11	39244
60	54.44	29.16	40826
SEm ±	0.92	0.51	1176
CD (P= 0.05)	2.66	NS	3396
Molybdenum (kg/ha)			
0	40.87	28.69	26251
0.5	48.88	28.88	35005
1.0	52.39	29.05	38504
1.5	53.37	29.05	38890
SEm ±	0.92	0.51	1176
CD (P= 0.05)	2.66	NS	3396

Effect of molybdenum levels

Results further indicated that application of molybdenum @ 1.5 kg/ha significantly increases the pods per plant, seeds per pod, seed yield, straw yield, biological yield and net returns 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 might be due to its unique role in enhancing nitrogen fixation thereby increasing its availability to the plants for efficient growth and development of plants in terms of photosynthetic area which enhanced the photosynthesis and synthesis of other metabolites for plant use. The increase in yield and yield characters could be attributed to increased size of source and consequently enhanced traslocation of photosynthates towards newly formed sink i.e. pods and seeds. The results on seed and straw yields thus confirmed the trend observed in growth and yield attributing characters with application of molybdenum [8-10]. Similar result was found in net returns at this level as compared to lower levels are attributed to more yields as compared to cost involved in treatment application. However, the test weight and harvest index 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 higher seed yield (15.36 and 15.22 q/ha) and net returns (₹ 39244 and 38504/ha) of fenugreek.

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