Effect of sulphur and zinc on growth and yield attributes of fenugreek (*Trigonella foenum-graecum* L)

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ABSTRACT

An experiment was conducted at Oilseeds Research Station, Jalgaon, Maharashtra to study the growth and grain yield attributes of fenugreek as influenced by different doses of micronutrients sulphur (S) and zinc (Zn). The treatments 20 MT per ha FYM + 100 per cent RDF + soil application of 30 kg per ha S at the time of sowing, 20 MT per ha FYM + 100 per cent RDF + soil application of 20 kg per ha S at the time of sowing, 20 MT per ha FYM + 100 per cent RDF + foliar application of 0.6 per cent $ZnSO_4$ 30 DAS and 20 MT per ha FYM + 100 per cent RDF + foliar application of 0.5 per cent $ZnSO_4$ 30 DAS took less number of days to 50 per cent flowering (45.33, 46.33, 46.50 and 46.67 respectively) as compared to control (49.67). All treatments proved superior in terms of number of pods per plant (27.40, 26.03, 25.00 and 24.90 in 20 MT/ha FYM + 100% RDF + soil application of 30 kg/ha S at the time of sowing, 20 MT/ha FYM + 100% RDF + foliar application of 0.6% $ZnSO_4$ 30 DAS, 20 MT/ha FYM + 100% RDF + foliar application of 0.5% $ZnSO_4$ 30 DAS and 20 MT/ha FYM + 100% RDF + soil application of 20 kg/ha S at the time of sowing, respectively) over control (19.00). Among all the treatments, 20 MT per ha FYM + 100 per cent RDF + soil application of 30 kg per ha S at the time of sowing resulted in highest increase in yield (51.55%) over control.

Keywords: Fenugreek; sulphur; zinc; growth; yield

INTRODUCTION

Fenugreek (*Trigonella foenum-graecum* L) is the third largest seed spice in India after coriander and cumin (Hosamath and Hedge 2018). It is commonly called as Methi in Hindi. Being a leguminous crop, plant's nodules enrich the soil with atmospheric nitrogen. It belongs to the family Fabaceae. It is a medicinal herb used to treat various diseases such as diabetes, inflammation, cancer, hypercholesteremia, reproductive dysfunction and neurodegenerative disorders. For centuries, fenugreek seeds have been used as carminative, demulcent, expectorant, laxative, and stomachic agents (Sun et al 2021).

In 2020-21, India produced 241.18 thousand MT fenugreek from an area of 156.16 thousand hectares with productivity of 15.4 MT per ha and in Rajasthan, it was grown over an area of 90.47 thousand hectares with production of 109.28 thousand MT and productivity of 1.21 MT per ha (Anon 2022). Thus Rajasthan is the lead producer of fenugreek. It is crop of commercial significance largely in Rajasthan, Madhya Pradesh, Gujarat and Uttarakhand.

Zinc is an indispensable micronutrient for crop growth, an important component of carbonic anhydrase and a stimulator of aldolase, which are involved in carbon metabolism (Tsonev and Lidon 2012). Zn plays a crucial role in activation of enzymes, auxin metabolism and in integrity of biological membranes (Broadley et al 2007).

Sulphur is essential for production of protein, fats and oils and also promotes enzyme activity and chlorophyll formation. It improves root growth and grain filling resulting in vigorous plant growth and resistance to cold tress. Several studies suggest that sulphur deficiency affects biomass, overall morphology, yield and nutritional value of the plants (Narayan et al 2023).

The present study was conducted to investigate the effect of sulphur and zinc on the growth parameters and grain yield attributes of fenugreek.

MATERIAL and METHODS

The field experiment was conducted in randomized block design at Oilseeds Research Station, Jalgaon, Maharashtra during 2022-2023. A uniform dose of 20 MT per ha FYM + recommended dose of fertilizers (RDF) (20:60:30 NPK kg/ha) was uniformly given to all the treatments. The treatments used were T_1 (20 MT/ha FYM + 100% RDF), T_2 [20 MT/ha FYM + 100% RDF + foliar application of 0.5% zinc sulphate ($ZnSO_4$) 30 DAS], T_3 (20 MT/ha FYM + 100% RDF + foliar application of 0.6% $ZnSO_4$ 30 DAS), T_4 (20 MT/ha FYM + 100% RDF + soil application of 20 kg/ha S at the time of sowing) and T_5 (20 MT/ha FYM + 100% RDF + soil application of 30 kg/ha S at the time of sowing) replicated thrice.

The spacing was kept 30 cm × 30 cm to 15 cm × 15 cm and all the cultural practices were uniformly applied in all the experimental plots. Forty plants in each treatment and replication were selected for observations viz plant height, number of branches per plant, days to 50 per cent flowering, chlorophyll content, number of pods per plant and grain yield at harvest of the crop.

RESULTS and DISCUSSION

Data on the effect of Zn and S on the growth and yield attributes of fenugreek are given in Table 1.

Plant height

After 30 DAS, higher plant height was recorded maximum in T_5 (20 MT/ha FYM + 100% RDF + soil application of 30 kg/ha S at the time of sowing) (8.10 cm) and T_4 (20 MT/ha FYM + 100% RDF + soil application of 20 kg/ha S at the time of sowing) (7.92 cm), both at par, in comparison to T_2 (20 MT/ha FYM + 100% RDF + foliar application of 0.5% $ZnSO_4$ 30 DAS) (7.75 cm) and T_3 (20 MT/ha FYM + 100% RDF + foliar application of 0.6% $ZnSO_4$ 30 DAS) (7.72 cm), which were at par and also at par with T_4 (7.92 cm). But all the treatments proved superior over control treatment T_1 (20 MT/ha FYM + 100% RDF) (7.17 cm). However, at 60 DAS, T_5 (25.23 cm), T_3 (24.17 cm), T_4 (23.87 cm) and T_2 (23.30 cm) were at par for plant height in comparison to 21.77 cm in T_1, but T_2 (23.30 cm) was at par with T_1 (21.77 cm). At 90 DAS, all the treatments were at par for plant height with 42.90, 42.17, 42.00 and 41.87 cm in T_5, T_3, T_2 and T_4 respectively, but T_4 (41.87 cm) was at par with T_1 (40.50 cm).

Number of branches per plant

The number of branches per plant is an important attribute contributing to seed yield. At 30 DAS, number of branches was higher in T_5 (7.07) and T_4 (6.92), the treatments being at par, in comparison to T_3 (6.68) and T_2 (6.67), which, on the other hand, were at par with T_1 (6.62) and also with T_4 (6.92). At 45 DAS, all the treatments resulted in higher number of branches of 7.97 (T_5), 7.77 (T_3), 7.60 (T_4) and 7.53 (T_2) in contrast to 7.03 (T_1), but T_2 (7.53) was at par with T_1 (7.03).

Days to 50 per cent flowering

The treatments T_5, T_4, T_3 and T_2 took less number of days to 50 per cent flowering (45.33, 46.33, 46.50 and 46.67 respectively) and were at par. Maximum number of days to 50 per cent flowering was recorded in T_1 (49.67).

Chlorophyll content

The treatments T_5, T_3, T_4 and T_2 recorded higher chlorophyll content (56.77, 55.73, 54.87 and 54.47 mg/g respectively) and were at par. Lowest chlorophyll content (50.80 mg/g) was observed in T_1 which was also at par with T_2 (54.47 mg/g).

Number of pods per plant

Number of pods per plant is an important seed yield contributing character and might be higher due to better growth performance of the crop. All treatments proved superior (27.40, 26.03, 25.00 and 24.90 in T_5, T_3, T_2 and T_4 respectively) over control for number of pods per plant and were at par among themselves. Minimum number of pods per plant was recorded in T_1 (19.00).

Yield

All the treatments improved seed yield in fenugreek over control. T_5, T_3, T_4 and T_2 lead to seed yield of 926, 907, 870 and 843 kg per ha and were at par. Lower seed yield of 611 kg per ha was recorded in control (T_1). In overall, T_5 resulted in highest increase in yield (51.55%) over control followed by T_2 (48.45%), T_4 (42.39%) and T_2 (37.97%).

Khan et al (2024) reported that fenugreek's growth and physiology were improved by foliar spray

Table 1. Effect of sulphur and zinc on plant growth and grain yield attributes of fenugreek

Treatment	Plant height (cm) at			Number of Branches/ plant at		Days to 50% flowering	Chloropyll content (mg/g)	Number of pods/plant	Yield (kg/ha)	Increase in yield over control (%)
	30 DAS	60 DAS	90 DAS	30 DAS	45 DAS					
T_1	7.17	21.77	40.50	6.62	7.03	49.67	50.80	19.00	611	-
T_2	7.75	23.30	42.00	6.67	7.53	46.67	54.47	25.00	843	37.97
T_3	7.72	24.17	42.17	6.68	7.77	46.50	55.73	26.03	907	48.45
T_4	7.92	23.87	41.87	6.92	7.60	46.33	54.87	24.90	870	42.39
T_5	8.10	25.23	42.90	7.07	7.97	45.33	56.77	27.40	926	51.55
SE	0.09	0.62	0.43	0.08	0.17	0.54	1.15	1.60	55.48	-
$CD_{0.05}$	0.28	2.01	1.40	0.27	0.55	1.76	3.75	5.22	180.92	-

T_1: 20 MT/ha FYM + 100% RDF, T_2: 20 MT/ha FYM + 100% RDF + foliar application of 0.5% $ZnSO_4$ 30 DAS, T_3: 20 MT/ha FYM + 100% RDF + foliar application of 0.6% $ZnSO_4$ 30 DAS, T_4: 20 MT/ha FYM + 100% RDF + soil application of 20 kg/ha S at the time of sowing, T_5: 20 MT/ha FYM + 100% RDF + soil application of 30 kg/ha S at the time of sowing

of zinc and boron, which increased the length of the shoot (6%), root length (2%), fresh root weight (18%), dry root weight (8%), chlorophyll a (1%), chlorophyll b (25%), total soluble protein content (3%), shoot calcium (9%) and potassium (5%) contents. Kumawat et al (2022) revealed that application of 40 kg P_2O_5 per ha and 5 kg Zn per ha + zinc solubilizer resulted in significant increase in plant height, dry matter accumulation, effective root nodules, leaf area index, different yield attributes and yield of fenugreek. Zinc fertilization @ 5 kg Zn per ha + zinc solubilizer increased seed yield of fenugreek by 24 per cent during 2015-16 while the increase was 27 per cent during 2016-17 over the control.

Baldaneeya et al (2022) found that application of 40 kg S per ha resulted in significantly higher growth parameters, yield attributes and yield. Suthar and Kukreja (2021) reported that S showed a synergistic effect on yields of fenugreek. Protein content increased significantly with increase of S. S up to 50 kg per ha fundamentally expanded the yield-ascribing characters, the seed and natural yield and the net returns of fenugreek.

CONCLUSION

It was concluded from the study that all the treatments proved superior over control for days to 50 per cent flowering, number of pods per plant and grain yield thus exhibiting that Zn and S had a significant role in enhancing the grain yield parameters in fenugreek. The treatment 20 MT per ha FYM + 100 per cent RDF + soil application of 30 kg per ha S at the time of sowing resulted in highest increase in yield (51.55%) over control followed by 20 MT per ha FYM + 100 per cent RDF + foliar application of 0.6 per cent $ZnSO_4$ 30 DAS (48.45%), 20 MT per ha FYM + 100 per cent RDF + soil application of 20 kg per ha S at the time of sowing (42.39%) and 20 MT per ha FYM + 100 per cent RDF + foliar application of 0.5 per cent $ZnSO_4$ 30 DAS (37.97%).

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