

Original Research Article

Effect of Molybdenum and Sulphur on Growth and Yield of Summer Black gram (*Vigna mungo L.*)

Abstract

A field experiment was conducted during *Zaid* 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) to study treatments consisting of three levels of Molybdenum *viz.* Mo 1 kg, 1.5 kg and 2 kg/ha and three levels of Sulphur *viz.* 10, 20 and 30 kg/ha. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.28 %), available N (225 kg/ha), available P (19.50 kg/ha) and available K (92 kg/ha). Ten treatments were replicated thrice and laid out in Randomized Block Design. The results revealed that treatment nine (Molybdenum 2kg/ha+ Sulphur 30kg/ha) recorded significantly higher plant height(42.54 cm), number of branches/plants(6.93), number of leaves/plants(15.00), plant dry weight(5.27 g), number of nodules/plants(20.60), number of pods per plant(27.6), number of seeds per pod(9.53), seed yield(1.25 t/ha), stover yield(2.87), biological yield(4.12 t/ha), harvest index(30.3%), gross returns(87500.00), net returns (47281.52)and B:C ratio(1.18) as compared to other treatments.

Keywords: Molybdenum, Sulphur, Growth, Yield.

INTRODUCTION

Black gram (*Vigna mungo L.*) is one of the important pulse crops grown throughout India. Black gram productivity must be increased with proper fertilisation. It could meet its nitrogen requirements by symbiotic fixation of atmospheric nitrogen. It works well in many intensive crop rotations since it is a short-duration crop that can adapt to the off-season. It is eaten as "dal" (whole or split, husked and unhusked), or it can be parched. It is 'papad's' main ingredient. It is used as nutritive fodder, especially for mulch cattle, and as a green manuring crop. It enriches the soil by 42kg N ha⁻¹. It is a crop with a high protein content (26%) and makes up 10% of all the pulses produced in a nation (Gowda et al., 2013). The most promising feature of pulses is their ability to fix atmospheric nitrogen. It has been reported that black gram produces 22.10kg N ha⁻¹yr⁻¹ which supplements fifty-nine thousand tons of urea annually (Jatet al., 2017). A proportionate number of macro and micronutrients is essential for the necessary bacterial activity to accelerate nodulation and promote the growth virtue for improved production of black gram. Black gram contains about 24% protein, 60% carbohydrate, 10.9% moisture, 1.4% fat, 0.9% fibre, 3.2% minerals and vitamin viz. calcium 154 mg, phosphorous 385 mg, iron 9.1 mg and a small amount of vitamin B complex. It contains 78%-80% nitrogen in the form of albumin and globulin. Black gram has been distributed mainly in tropical to subtropical countries. In India black gram is grown on a 39.43 lakh ha area with a total production of 20.5 lakh tones and productivity of 532 kg/ha (agricoop.nic.in). Molybdenum is one of the most recognized nutrient elements considered essential for plant growth and planning an important role in the structural interring of cell walls and cell membranes and synthesis of protein as well as nitrogen fixation. Legume also contributes to the symbiotic fixation of nitrogen. Nitrogenase, an enzyme that fixes nitrogen, is a molybdenum compound. This element is necessary for nitrogen fixing to take place. Given that low levels of molybdenum result in poor seed output in pulse crops, it has come to be recognised as a crucial micronutrient. The enzymes nitrogenase and nitrate reductase have this structural component, which causes oxidation-reduction processes in plant cells (Yadav et al., 2017)

Sulphur is an important secondary essential plant nutrient. It is crucial for physiological activities like the synthesis of chlorophyll and sulphur-containing amino acids (cystine and methionine). Additionally, it produces coenzymes A, synthesises some vitamins (including biotin and thiamine), and regulates the metabolism of protein, fat, and carbs. In legumes, it also encourages nodulation. Sulphur can be quite beneficial in this regard for increasing the

yield of pulses like black gram. Restricted use of Sulphur is recognized as the fourth major plant nutrient after Nitrogen, phosphorous and potassium. It plays an important role in many plant processes like metabolism, which is dependent upon sulphur and its deficiency causes primary metabolic impairment. In plants, sulphur concentrations are found to be lower than nitrogen (Saito K *et al.*, 2004)

MATERIALS AND METHODS:

The experiment was conducted during the *Zaid* season of 2022. The experiment was conducted in a Randomized Block Design consisting of 10 treatment combinations with three replications and was laid out with the different treatments allocated randomly in each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.1) with a low level of organic carbon (0.28%), available N (225 Kg/ha), P (19.50 kg/ha) and a higher level of K (92.00 kg/ha). The treatment combinations are T₁ - Molybdenum 1kg/ha + Sulphur 10kg/ha, T₂ - Molybdenum 1kg/ha+ Sulphur 20kg/ha, T₃ - Molybdenum 1kg/ha+ Sulphur 30kg/ha, T₄ - Molybdenum 1.5kg/ha+ Sulphur 10kg/ha, T₅ - Molybdenum 1.5kg/ha+ Sulphur 20kg/ha, T₆ - Molybdenum 1.5kg/ha+ Sulphur 30kg/ha, T₇ - Molybdenum 2kg/ha+ Sulphur 10kg/ha, T₈ - Molybdenum 2kg/ha+ Sulphur 20kg/ha, T₉ - Molybdenum 2kg/ha+ Sulphur 30kg/ha, T₁₀ - Control 25:50:25(NPK kg/ha). The observations were recorded on different growth parameters at harvest viz. plant height(cm), number of branches/plants, number of leaves/plant, plant dry weight, number of nodules/plant, number of pods per plant, number of seeds per pod, seed yield, haulm yield

RESULTS AND DISCUSSION

A. Growth Attributes:

At 45 DAS, treatment with Molybdenum 2kg/ha+ Sulphur 30kg/ha recorded significantly the highest plant height (42.54 cm). However, treatments with Molybdenum 1kg/ha+ Sulphur 30kg/ha (41.34) and Molybdenum 1.5 kg/ha+ Sulphur 30kg/ha (41.94) were statistically at par with the treatment Molybdenum 2kg/ha+ Sulphur 30kg/ha. At 45 DAS, treatment with Molybdenum 2kg/ha+ Sulphur 30kg/ha recorded the significantly highest number of branches per plant (6.93). However, treatments with Molybdenum 1kg/ha+ Sulphur 30kg/ha (6.60) and Molybdenum 1.5kg/ha+ Sulphur 30kg/ha (6.87) were statistically at par with the treatment Molybdenum 2kg/ha+ Sulphur 30kg/ha. At 45 DAS, treatment with Molybdenum 2kg/ha+ Sulphur 30kg/ha recorded the significantly highest number of leaves per plant (15.00). However, treatment with Molybdenum 1.5kg/ha+ Sulphur 30kg/ha (14.80) was statistically at par with the treatment Molybdenum 2kg/ha+ Sulphur 30kg/ha. At 45 DAS, treatment with Molybdenum 2kg/ha+ Sulphur 30kg/ha recorded significantly highest

plant dry weight (5.27 g). However, treatment with Molybdenum1.5kg/ha+ Sulphur 30kg/ha (5.19) was statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha. At 45 DAS, treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded significantly the highest Number of nodules/plant (20.60). However, treatment Molybdenum1.5kg/ha+ Sulphur 30kg/ha (20.40) was statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha.

B. Yield Attributes

Treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded significantly the highest Number of pods per plant (27.6). However, treatment Molybdenum1.5kg/ha+ Sulphur 30kg/ha (27.00) was statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha. Treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded significantly the highest Number of seeds per pod (9.53). However, treatment Molybdenum1.5kg/ha+ Sulphur 30kg/ha (9.27) was statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha. The highest test weight (31.20) was recorded in Treatment 7 with an application of Molybdenum2kg/ha+ Sulphur 10kg/ha, though there was no significant difference among the treatments. Treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded the highest seed yield (1.25 t/ha). However, treatment with Molybdenum1kg/ha+ Sulphur 30kg/ha (1.12), Molybdenum1.5kg/ha+ Sulphur 30kg/ha (1.22) and Molybdenum2kg/ha+ Sulphur 20kg/ha (1.06) were statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha. Treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded the highest stover yield (2.87 t/ha). However, treatment with Molybdenum1kg/ha+ Sulphur 30kg/ha (2.69), Molybdenum1.5kg/ha+ Sulphur 30kg/ha (2.77) and Molybdenum2kg/ha+ Sulphur 20kg/ha (2.63) were statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha. Treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded the highest biological yield (4.12 t/ha). However, treatment with Molybdenum1kg/ha+ Sulphur 30kg/ha (3.18), Molybdenum1.5kg/ha+ Sulphur 30kg/ha (3.99) and Molybdenum2kg/ha+ Sulphur 20kg/ha (3.69) were statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha. Treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded the highest harvest index (30.3%). However, treatment with Molybdenum1kg/ha+ Sulphur 20kg/ha (27.83%), Molybdenum1kg/ha+ Sulphur 30kg/ha (28.49%), Molybdenum1.5kg/ha+ Sulphur 20kg/ha (28.19%), Molybdenum1.5kg/ha+ Sulphur 30kg/ha (30.34%) and Molybdenum2kg/ha+ Sulphur 20kg/ha (28.22%) were

statistically at par with the treatment Molybdenum 2kg/ha+ Sulphur 30kg/ha.

CONCLUSION

From the results, it can be concluded that black gram with the application of Molybdenum 2 kg/ha and Sulphur 30kg/ha (treatment 9) recorded the highest plant height, seed yield and Benefit-cost ratio

Reference.

- Arunraj M, Vasanthi D, Manisingh MD. (2018) Effect of sulphur on growth and yield of Green gram. *International journal of science, environment, and technology*. **7**(5):1861-1867.
- Awomi TA, Singh A, Kumar M, Bordoloi L. (2012) Effect of phosphorus, molybdenum and cobalt nutrition on yield and quality of mungbean (*Vigna radiata* L.) in acidic soil of Northeast India. *Indian J Hill Farm*. **25**(2):22-26.
- Biswas P, Bhowmick M, Bhattacharya A. (2009) Effect of molybdenum and seed inoculation on nodulation, growth and yield in urdbean [*Vigna mungo* (L.) Hepper]. *Journal of Crop and Weed*. **5**(1):141-144.
- Devi, K. V., Singh, M. S., Singh, S.B and Singh, K. K. (2012). Influence of Sulphur and Boron Fertilization on Yield, Quality, Nutrient Uptake and Economics of Soybean (*Glycine max*) under Upland Conditions. *Journal of Agricultural Science*. **4**(4): 1-10.
- Karrajakathyayani, Rajesh Singh, and Punnam Chhetri, (2021). Effect of levels of boron and molybdenum on growth and yield of black gram (*Vigna mungo* L.). *International journal of current microbiology and applied sciences* .**10**(02):339-345.
- Khan, K., and V. Prakash. 2014. Effect of rhizobial inoculation on growth, yield, nutrient and economics of summer urdbean (*Vigna mungo* L.) in relation to zinc and

molybdenum. *International Journal of Advanced Research in Chemistry and Chemical Engineering* **1** (1):1-10

- Mahilane, C and Singh, V. (2018). Effect of Zinc and Molybdenum on Growth, Yield Attributes, Yield and Protein in Grain on Summer Blackgram (*Vigna mungo* L.) *International Journal of Current Microbiology and Applied Sciences*. **7**(1):1156- 1162.
- Mir, A. H., Lal, S. B., Salmani, M., Abid, M. and Khan, I. 2013. Growth, yield and nutrient content of blackgram (*Vigna mungo*) as influenced by levels of phosphorus, sulphur and phosphorus solubilizing bacteria, *SAARC Journal of Agriculture*, **11**(1): 1-6.
- Niraj, V. P. S., & Ved Prakash (2014). Effect of phosphorus and sulphur on growth, Yield and quality of black gram (*Phaseolus mungo*.), *Asian Journal of Soil Science*, **9**(1), 117-120.
- Patel, A.K., Nath, T., Prajapati, A., Singh, V.K., Pandey, S.K. (2018) Effect of doses and sources of sulphur on growth and yield of black gram (*Vignamungo* L. Hepper) under rainfed condition of Vindhyan Soil. *Journal of Pharmacognosy and Phytochemistry* 91-94
- Sritharan, N., Rajavel, M and Senthilkumar, R. (2015). Physiological approaches Yield improvement in blackgram. *Legume Research*. **38**(1): 91-95.
- Wasaya, A., Shabir, M. S., Hussain, M., Ansar, M., Aziz, A., Hassan, W and Ahmad, I. (2017). Foliar application of Zinc and Boron improved the productivity and net returns of maize grown under rainfed conditions of Pothwar plateau. *Journal of soil science and plant nutrition*. **17**(1):1-10.
- Yadav, M., Yadav, S.S., Kumar, S., Yadav, T. and Yadav, H.K. (2017). Effect of phosphorus and bio-fertilizers on growth and yield of urdbean [*Vigna mungo* (L.) Hepper]. *Int. J. of Plant and Soil Sci.*, **18** (5):1-7.

Table.1 Effect of Molybdenum and Sulphur on growth attributes of Black gram.

Treatment	Plant height (cm) AT 45 DAS	Number of branches/ plant AT 45 DAS	Number of leaves/plant AT 45 DAS	Plant dry weight (g/ plant) AT 45 DAS	Number of nodules/plant AT 45 DAS
Molybdenum1kg/ha+ Sulphur 10kg/ha	38.60	5.60	12.40	3.10	17.60
Molybdenum1kg/ha+ Sulphur 20kg/ha	39.10	6.00	13.40	4.10	18.60
Molybdenum1kg/ha+ Sulphur 30kg/ha	41.34	6.60	14.20	4.90	20.00
Molybdenum1.5kg/ha+ Sulphur 10kg/ha	38.90	5.80	13.00	3.70	18.20
Molybdenum1.5kg/ha+ Sulphur 20kg/ha	39.20	6.20	13.80	4.50	19.00
Molybdenum1.5kg/ha+ Sulphur 30kg/ha	41.94	6.87	14.80	5.19	20.40
Molybdenum2kg/ha+ Sulphur 10kg/ha	39.00	5.80	13.20	3.90	18.40
Molybdenum2kg/ha+ Sulphur 10kg/ha	39.80	6.40	14.00	4.70	19.20
Molybdenum2kg/ha+ Sulphur 30kg/ha	42.54	6.93	15.00	5.27	20.60
Control 25:50:25(NPK kg/ha)	37.76	5.40	11.93	2.70	17.27
SEm(±)	0.57	0.16	0.15	0.04	0.15
CD at 5%	1.68	0.47	0.45	0.11	0.43

Table 2 Effect of Molybdenum and Sulphur on yield attributes of Blackgram.

Treatments	No. of pods/ Plant	No. of Seeds/ Pod	Test Weight (g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
Molybdenum1kg/ha+ Sulphur 10kg/ha	20.40	7.20	28.00	0.83	2.40	25.50
Molybdenum1kg/ha+ Sulphur 20kg/ha	21.40	8.00	27.40	0.99	2.56	27.83
Molybdenum1kg/ha+ Sulphur 30kg/ha	25.60	9.00	26.60	1.12	2.69	28.49
Molybdenum1.5kg/ha+ Sulphur 10kg/ha	21.00	7.40	29.80	0.87	2.44	26.24
Molybdenum1.5kg/ha+ Sulphur 20kg/ha	22.20	8.20	29.20	1.03	2.60	28.19
Molybdenum1.5kg/ha+ Sulphur 30kg/ha	27.00	9.27	29.80	1.22	2.77	30.34
Molybdenum2kg/ha+ Sulphur 10kg/ha	21.20	7.80	31.20	0.93	2.50	26.98
Molybdenum2kg/ha+ Sulphur 20kg/ha	24.20	8.60	30.60	1.06	2.63	28.22
Molybdenum2kg/ha+ Sulphur 30kg/ha	27.60	9.53	29.00	1.25	2.87	30.14
Control 25:50:25(NPK kg/ha)	20.00	7.00	28.87	0.79	2.36	24.57
SEm (±)	0.28	0.11	0.95	0.07	0.08	1.02
CD at 5%	0.84	0.33	--	0.22	0.25	3.03