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) on the topic "Effect of Molybdenum and Sulphur on growth and Yield of Summer Black gram (*Vigna mungo* L.)", 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 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). There were 10 treatments each being replicated thrice and laid out in Randomized Block Design. The results revealed that treatment 9 (Molybdenum2kg/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, Economics.

INTRODUCTION

Black gram *(Vigna mungo L.)* is one of the important pulse crops grown throughout India. Proper fertilization is essential to improve the productivity of black gram. It can meet its nitrogen requirements by symbiotic fixation of atmospheric nitrogen. It is a short duration crap and adaptability to off season; it fits well in many intensive crop rotations. It is consumed in the form of 'dal' (whole or split, husked and unhusked) or parched. It is chief constituent of 'papad'. It is used as nutritive fodder specially for mulch cattle and also used as green manuring crop. It adds 42kg N ha-1 in soil. It is a protein rich (26%) crop and contributes 10 percent of total pulse production in a country **(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 59 thousand tons of urea annually **(Jat *et al.*, 2017)**. Inorder to advance the growth virtue for better productivity of black gram, a proportionate amount of macro and micronutrients are decisive for sufficing bacterial activity to intensify nodulation. 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 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 39.43 lakh ha area with total production of 20.5 lakh tones and productivity of 532 kg/ha **(agricoop.nic.in)**. In Uttar Pradesh it occupies an area of 2.65 lakh ha with total production of 1.76 lakh tones and the productivity of 489 kg/ha. **(Anonymous 2015).** Molybdenum is one of the most recognized nutrient elements considered to be essential for the growth of plant also planning important role in structural interring of cell wall and cell membrane and synthesis of protein a well as nitrogen fixation. Legume it plays and additional role symbiotic nitrogen fixation. The nitrogen fixing enzyme, nitrogenase is compound of molybdenum. Without adequate quantities of this element, nitrogen fixation can't occur. Molybdenum has been perceived as an important micronutrient as it paucity lead to poor seed yield in pulses. It is a structural component of nitrogenase and nitrate reductase enzymes which brings about oxidation- reduction reaction in plant cells **(Yadav *et al.*, 2017)**

Sulphur is an important secondary essential plant nutrient. It plays an important role in physiological processes like synthesis of sulphur containing amino acids (cystine and methionine) and chlorophyll. It is also responsible for synthesis of certain vitamins (biotine and thiamine), co-enzymes-A, metabolism of carbohydrates, fat and protein. It also promotes

nodulation in legumes. In this way sulphur can be very helpful in enhancing the productivity of pulses including black gram. Restricted use of Sulphur is recognized as fourth major plant nutrient after Nitrogen, phosphorous and potassium and it plays important role in many plant process 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 T_1 – Molybdenum 1kg/ha + Sulphur 10kg/ha, T_2 – Molybdenum 1kg/ha+ Sulphur 20kg/ha, sT_3- Molybdenum 1kg/ha+ Sulphur 30kg/ha, T_4 – Molybdenum 1.5kg/ha+ Sulphur 10kg/ha, T_5 – Molybdenum 1.5kg/ha+ Sulphur 20kg/ha, T_6 – Molybdenum 1.5kg/ha+ Sulphur 30kg/ha, T_7 - Molybdenum2kg/ha+ Sulphur 10kg/ha, T_8- Molybdenum2kg/ha+ Sulphur 20kg/ha, T_9 - Molybdenum2kg/ha+ Sulphur 30kg/ha, T_{10}- 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 Molybdenum2kg/ha+ Sulphur 30kg/ha recorded significantly 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 Molybdenum2kg/ha+ Sulphur 30kg/ha. At 45 DAS, treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded significantly highest number of branches per plant (6.93). However, treatments with Molybdenum1kg/ha+ Sulphur 30kg/ha(6.60) and Molybdenum1.5kg/ha+ Sulphur 30kg/ha(6.87) were statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha.. At 45 DAS, treatment with Molybdenum2kg/ha+ Sulphur 30kg/ha recorded significantly highest number of leaves per plant (15.00). However, treatment with Molybdenum1.5kg/ha+ Sulphur 30kg/ha(14.80) was statistically at par with the treatment Molybdenum2kg/ha+ Sulphur 30kg/ha. AT 45 DAS

treatment with Molybdenum2kg/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 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 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 highest Number of seeds per pods (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 application of Molybdenum 2kg/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 Molybdenum2kg/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 M D. (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.

Karraja Kathyayani, 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

Kumar, J. and Sharma, M. (2005). Effect of phosphorus and molybdenum on yield and nutrient uptake by chickea (*Cicer arietinum* L). *Advances in Plant Science* 18: 869-873

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.

Togay Y, Togay N, Dogan Y. (2008) Research on the effect of phosphorus and molybdenum applications on the yield and yield parameters in lentil (*Lens culinaris* Medic.), *African Journal of Biotechnology*. ***7***(9).

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 nutrirtion.* **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
Molybdenum 1kg/ha+ Sulphur 10kg/ha	38.60	5.60	12.40	3.10	17.60
Molybdenum 1kg/ha+ Sulphur 20kg/ha	39.10	6.00	13.40	4.10	18.60
Molybdenum 1kg/ha+ Sulphur 30kg/ha	41.34	6.60	14.20	4.90	20.00
Molybdenum 1.5kg/ha+ Sulphur 10kg/ha	38.90	5.80	13.00	3.70	18.20
Molybdenum 1.5kg/ha+ Sulphur 20kg/ha	39.20	6.20	13.80	4.50	19.00
Molybdenum 1.5kg/ha+ Sulphur 30kg/ha	41.94	6.87	14.80	5.19	20.40
Molybdenum 2kg/ha+ Sulphur 10kg/ha	39.00	5.80	13.20	3.90	18.40
Molybdenum 2kg/ha+ Sulphur 10kg/ha	39.80	6.40	14.00	4.70	19.20
Molybdenum 2kg/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 Black gram.

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