

Original Research Article

Influence of sulphur and zinc on growth and yield of Black gram (*Vignamungo*L.)

ABSTRACT

A field experiment was conducted during Zaidseason of 2022 at the crop research farm, Department of agronomy, naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology And Science, Prayagraj (U.P) India. To study Response of Sulphur and zinc on growth and yield of Zaid black gram. The treatments consists of sulphur 20,25,30,kg/ha And zinc 5,10,15,kg/ha . thereare 10 treatment each replicated thrice. The soil texture of experiment plot was sandy loamy in texture, nearly neutral in oil reaction (pH 7.8), low in organic carbon (0.35%) available N(163.42kg/ha), available P(21.96 kg/ha) and available K (256.48 kg/ha). Results revealed that at higher plant height (39.80), number of branches/plant(5.00), number of Nodules/plant(41.50), plant dry weight (4.85g/plant), pods/plant (37.36), seeds/plant (7.00), Test weight (37.14g/plant), seed yield (13.63t/ha), stover yield (19.68t/ha), Harvest index (40.79%) Were significantly influenced with application of sulphur 30kg/ha +zinc 15kg/ha. Higher gross returns (INR 107670/ha), higher net returns (INR 74538.11/ha) and higher B:C (2.24) were also recorded in treatment 9(sulphur 30kg/ha+zinc 15kg/ha).

Keywords: sulphur, zinc, growth parameters, yield attributes and economic analysis

Comment [k1]: Black??

Comment [k2]: Zaidseason

Comment [k3]: Agronom

Comment [k4]: Naini

Comment [k5]: and

Comment [k6]: of Zaid

Comment [k7]: experimental treatments

Comment [k8]: sulphur concentrations

Comment [k9]: There

Comment [k10]: were

Comment [k11]: treatments

Comment [k12]: of each

Comment [k13]: delete

Comment [k14]: delete

Comment [k15]: slightly alkaline

Comment [k16]: cm

Comment [k17]: test

Comment [k18]: snd harvest

Comment [k19]:

Comment [k20]: were

INTRODUCTION

Black gram (*vignamungo*) is one of most important pulse crops grown in India, particularly Tamil Nadu. Pulses are commonly known as food legumes which are secondary to cereals in production and consumption in india. The United Nation, declared 2016 as “International Year of Pulses” (TYP) to heighten public awareness of the nutritional benefits of pulses are an integrated part of many diets across the globe and they have great potential to Improve human health, conserve our soil, protect the environment and contribute to global food security. Black gram is scientifically known as *Vignamungo* (L.) and commonly known as Uraddal in india. Black gram is tropical leguminous plant (Singh et al., 2009).[1]

Black gram (*vignamungo*L.) ranks fourth among the pulses for both in term of cultivation area coverage about 70,000 ha and production of 12.55% in total pulse production, black gram is one the highly prized pules bangladesh. Contribution of pulses to Indian agriculture and daily gram the third important pulse crop in india.

Sulphur is the second most important plant nutrient for pulses. Sulphur is known to help in chlorophyll formation, stimulating growth, seed formation and N fixation by enhancing nodule formation. Sulphur is increasingly honoured as the fourth major factory nutrient after nitrogen, phosphorous and potassium, Malik et al.[2] Sulphur is as essential as they bear phosphorus. Sulphur is also an element of the vitamins biotin and thiamine (B1) as well as iron-sulphurproteins called ferredoxins. Sulphur plays an important part in crop growth and development. It plays an important part in the conformation of amino acids containing S. similar as cystine (21S), which act as structure blocks in protein conflation. It has a part in adding the conformation of chlorophyll and abetting photosynthesis. Sulphur is known to encourage nodulation in legumes which adds nitrogen obsession. It is also component of free amino acids like methionine and cysteine and essential for fusion of protein Dhanushkodi et al.[3]

Sulphur as a fertilizer or a fertilizer or as a constituent of other fertilizers is generally not applied by farmers. As a result, large areas of S deficiency are reported from this agroecological region.

Comment [k21]: *Vignamungo*

Comment [k22]: ???commonly

Comment [k23]: India

Comment [k24]: were

Comment [k25]: had

Comment [k26]: improve

Comment [k27]: *Vignamungo*L

Comment [k28]: ??

Comment [k29]: delete

Comment [k30]: delete

Comment [k31]: ??

Comment [k32]: L

Comment [k33]: Bangladesh

Comment [k34]: India

Comment [k35]: delete

Comment [k36]: delete

Comment [k37]:

Comment [k38]: ???

Comment [k39]: ??

Comment [k40]: had a

Comment [k41]: delete

Comment [k42]: delete

Comment [k43]: delete

Comment [k44]:

Comment [k45]: delete

Comment [k46]: delee

Comment [k47]: were

Comment [k48]: field

''Zinc also has a part in photosynthesis and nitrogen metabolism and helps regulate auxin attention in factory. It supports the establishment of flowers and helps in proper development of fruits. It also helps in carbohydrate conversion and sulphur metabolism. Grain and straw yield were also significantly increased by zinc. The salutary effect of applied zinc on these growth parameters, yield characteristics and yield can be attributed to the catalytic or stimulating effect of zinc on almost physiological and metabolic processes of the factory, Patil PA et al.[4] it also helps in the conformation of chlorophyll and plays an important part in nitrogen metabolism. thus, the operation of zinc in soil with a lack of its content battered the overall growth and development''

Keeping these points in vie.w, the present investigation entitled "effect of sulphur and zinc on growth and yield of black gram (*vignamungo L.*)" was conducted during Zaid-2022, at crop research farm, SHUATS, Prayagraj (U.P).

MATERIALS AND METHODS

A field experiment was conducted during zaidseason of 2021-22 at the crop research farm, department of agronomy, Naini Agriculture institute, Sam Higginbottom University of agriculture Technology and Sciences, Prayagraj (U.P) India. The soil of experiment plot was sandy loamy in texture, nearly neutral in soil reaction (ph 7.8), low in organic carbon (o.35%), The treatment consist of sulphur 20 kg/ha + zinc 5kg/ha, sulphur 20 kg/ha + zinc 10kg/ha, sulphur 20 kg/ha + zinc15kg/ha, sulphur 25 kg/ha + zinc 5kg/ha, sulphur 25 kg/ha + zinc 10kg/ha, sulphur 25 kg/ha + zinc 15kg/ha, sulphur 30 kg/ha + zinc 5kg/ha, sulphur 30 kg/ha + zinc 10kg/ha, sulphur 30 kg/ha + zinc 15kg/ha.

The experiment was laid out in Randomized block design, with 10 treatment replicated thrice. The observations were recorded for plant height, plant dry weight, branches per plant, nodules per plant, Crop growth rate (g/m²/day), Relative growth rate, Number of pods/plant, seeds/pod, test weight, seed yield, seed yield, stover yield, Harvest index. (the collected data was subjected to statistical analysis of variance method Gomez and Gomez, 1976[5])

Comment [k49]: crucial role

Comment [k50]: Reference?

Comment [k51]: delete

Comment [k52]: and yield

Comment [k53]: . Yield

Comment [k54]: delete

Comment [k55]: Thus

Comment [k56]: improve

Comment [k57]: development.

Comment [k58]: delete

Comment [k59]: aimed at.....

Comment [k60]: Crop Research.....

Comment [k61]: Institute

Comment [k62]: Soil texture

Comment [k63]: delete

Comment [k64]: slightly alkaline

Comment [k65]: and low

Comment [k66]: treatments

Comment [k67]: carried

Comment [k68]: r

Comment [k69]: parameters

Comment [k70]: c

Comment [k71]: r

Comment [k72]: n

Comment [k73]: h

Comment [k74]: The obtained

Comment [k75]: delete

RESULT AND DISCUSSION

GROWTH PARAMETERS

Plant height –At harvest significantly maximum plant height (43.26 cm) was observed in treatment-9(sulphur 30 kg/ha + zinc 15kg/ha). However, treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha) was statistically at par with treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha).

Comment [k76]: ??

The significantly higher plant height can be due to the application of sulphur 30 kg/ha + zinc 15kg/ha sulphur was involved in the protein synthesis and formation of chlorophyll thereby promoted vegetative growth; consequently, increased the plant height. Similar findings were also reported by Masih et al. (2020)[6]

Comment [k77]: delete

Comment [k78]: maximum

Comment [k79]: might

Comment [k80]: delete

Nodules per plant --At harvest significantly maximum number of nodule per plant (25.7 cm) was observed in treatment-9(sulphur 30 kg/ha + zinc 15kg/ha). However, treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha) was statistically at par with treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha).The significantly highest number of nodules per plant can be due to the application of sulphur 30 kg/ha + zinc 15kg/ha.

Comment [k81]: ??

The increment in nodulation with increasing levels of sulphur may be due to increase in amount of ferredoxin. Ferredoxins are copious in sulphur and contain Fe-S clusters that play a pivotal role in nitrogen fixation. Not only that, sulphur helped in fixing atmospheric nitrogen, which in turn helped to improve nodulation in mungbean plants. This was also supported by the findings of Singh et al. (2015)[7] and Bharvi et al. (2020).

Comment [k82]: increased

Dry weight --At harvest significantly highest dry weight (6.43 cm) was observed in 10kg/ha) was statistically at par with treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha).The significantly highest number of nodules per plant can be due to the application of sulphur 30 kg/ha + zinc 15kg/ha.Increased dry matter production in response to increasing zinc application may be caused by that impact on plant metabolism.(Surendra ram 2018 [8]

Comment [k83]: delete

Comment [k84]: []

Comment [k85]: A maximum

Comment [k86]: maximum

Comment [k87]: might

Comment [k88]: delete

Crop growth rate --At harvest significantly highest crop growth rate (6.30 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10kg/ha). However, treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha) was statistically at par with treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha).The significantly highest number of nodules per plant can be due to the application of sulphur 30 kg/ha + zinc 10kg/ha.

Comment [k89]: The

Comment [k90]: ??

Comment [k91]: delete

Comment [k92]: of sulphur

YIELD ATTRIBUTES

Comment [k93]: PARAMETERS

Test weight --At harvest significantly highest crop growth rate (6.30 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10kg/ha). However, treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha) was statistically at par with treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha).The significantly highest number of nodules per plant can be due to the application of sulphur 30 kg/ha + zinc 10kg/ha.

Comment [k94]: a maximum length of plant

Comment [k95]: ??

Comment [k96]: could

Number of pods per plant --At harvest significantly highest pods per plant (6.30 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10kg/ha). However, treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha) was statistically at par with treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha).The significantly highest number of nodules per plant can be due to the application of sulphur 30 kg/ha + zinc 10kg/ha.

Increment in the number of pods per plant, seeds per pod might be due to more availability of sulphur during the vegetative and reproductive stages of the crop. Sulphur is a part of amino acid (Cystine), which helped in chlorophyll formation, photosynthetic process and activation of enzymes (ArunRaj et al. (2018))[9]

Comment [k97]: component

Comment [k98]: delete

Number of seeds per pod --At harvest significantly highest Seeds per pod (6.30 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10kg/ha). However, treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha) was statistically at par with treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha).The significantly highest number of nodules per plant can be due to the application of sulphur 30 kg/ha + zinc 10kg/ha.

Comment [k99]: might

The higher number of seeds/pod and 1000 seed weight might be due to application of sulphur the metabolic activities promoting chlorophyll formation and photosynthesis and root development (rahulpatidar et al.(2022))[10]

Comment [k100]: about

Comment [k101]: delete

Comment [k102]: delete

Seed yield --At harvest significantly highest seed yield (6.30 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10kg/ha). However, treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha) was statistically at par with treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha).The significantly highest number of nodules per plant can be due to the application of sulphur 30 kg/ha + zinc 10kg/ha.

Comment [k103]: of sulphur

Sulfur plays a role in the creation of chlorophyll, enzyme activation, increased crop yield, and higher oil percentage. Sulfur encourages nodulation in legumes, helps to increase the percentage of protein in legumes and oil in oilseeds, and is involved in the production of chlorophyll, which enables photosynthesis. Sulfur also contains amino acids such as cysteine, methionine, and methionine. (kudi et al 2018)[11]

Comment [k104]: Sulphur

Comment [k105]: ?

Comment [k106]: delete

Stover yield --At harvest significantly highest stover yield (6.30 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10kg/ha). However, treatment-9 (sulphur 30 kg/ha + zinc 15kg/ha) was statistically at par with treatment-8 (sulphur 30 kg/ha + zinc 10kg/ha).The significantly highest number of Seed yield plant can be due to the application of sulphur 30 kg/ha + zinc 10kg/ha.

Maximum stover yield obtained in green gram with the application of zinc may be due to increase in metabolic process in plants due to sulphur application similar results were reported by (teja et al 2020)[12]

Comment [k107]: was obtained

Comment [k108]: delete

Harvest index-- At harvest there was no significant difference among the treatments. highest harvest index (40.91 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10) whereas the minimum harvest index (35.76) was recorded with the treatment with treatment T₁₀-Control.

Comment [k109]: A maximum

CONCLUSION

It was concluded that with the application of sulphur 30 kg/ha along with the zinc 15 kg/ha (Treatment-9), has performs positively and improves growth and yield parameters. Maximum plant height, number of branches, no of nodules, plant dry weight, crop growth rate, number of pod/plant, test weight, seed yield and stover yield were also recorded with application sulphur 30 kg/ha along with the zinc 15 kg/ha (Treatment-9). These findings are based on one season therefore; further trials may be required for further confirmation.

Comment [k110]: had

Comment [k111]: delete

Comment [k112]: were

REFERENCES

1. Singh, H., Elamathi, S., and Anandhi, P. 2009. Effect of row spacing and dates of sowing on growth and yield of lentil (*Lens culinaris*) under northern eastern region of U.P. *Legume Research* **32**(4):307-308.
2. Malik A, Fayyaz-UI-Hassan A, Abdul Wahieed A, Qadir G, Asghar R. 2006. In reactive effects of irrigation and phosphorus on green gram *Vigna radiata* L, *Pakistan J Bot* **2006**;38(4):1119-1126
3. Dhanushkodi V, Kannathasan M, Jamespitchai G, Indirani R. 2009. Influence of sulphur on growth and quality attributes of irrigated blackgram (*Vigna mungo*) in Alfisols of Thoothukudi district in Tamilnadu, *Madras Agric J*. **2009**;96:116-120
4. Patil PA effect of zinc application on yield characters and dry matter of stover. *Madras Agric. J*. 2006;57(6):473-475
5. Kudi, S., Swaroop, N., David, A.A., Thomas, T., Hasan, A. and Rao, S. 2018. Effect of different levels of sulphur and zinc on soil health and yield of green gram (*Vigna radiata* L.) Var. Patidar-111. *Journal of Pharmacognosy and Phytochemistry* **9**(3): 50-55.
6. Prajapati, J. P., Kumar, S., Singh, R. P., Kushwaha, I. K. and Yadav, P. K. 2013. Effect of Phosphorus and Sulphur on growth and yield attributes and yield of green gram (*Vigna radiata* L.). *Environment and Ecology* **31**(4);1977-1979.

Comment [k113]: italic

Comment [k114]: delete

Comment [k115]: capital

Comment [k116]: delete

Comment [k117]: character

Comment [k118]: ???

Comment [k119]: of Phosphorus

7. Arun Raj M, Vasanthi D, David Isreal M,2018. Effect of sulphur on growth and yield of greengram, International journal of science Environment and Technology. 2018;7(5)

Comment [k120]:

8. Surendra Ram. 2018.Response of sulphur and zinc nutrition on yield attributes, yield of mungbean (*vignaradiata L.*) under partially reclaimed saline sodic soils in eastern U.P *plant archives*,special issue (ICAAAS-2018).2018;18:177-181.

Comment [k121]: delete

9. Singh, K., Manohar, R.S.,Chaudhry, k., yadav. A.K and Singh, M. 2015.Growth and yield of mungbean (*vigna radiata L.*)inreponse to the application of sulphur and boron under rainfed condition. Growth 10(4):1665-1669.

Comment [k122]: 2019

10. Italiya JH, jadav NJ, Rathod SV, Viradiya. (2019)Effect of sulphur and zinc on yield and chemical compotion of yield Greengram, International journal of chemical studies 2019;7(3):364-368.

Comment [k123]: delete

11. Singh, M., Sirothia, P., Bhat, M.A., Tiwari, P. and Namdeo, A.(2015). Growth and yield of mungbean (*VignaradiataL.*) in response to the application of sulphurand boronrainfed conditions. Growth10(4): 1665-1669

Comment [k124]: 2015

Comment [k125]: *Vignaradiata*

12. Maddila T., Rabindra Kumar, AbrarYasis Baba., (2020)Performance of sulphur on growth and yield of green gram (*vignamungo L.*)International Journal of Multidisciplinary Research and Development.ISSN:2349-5979

Comment [k126]: 2020

13. Patidar R.,Sirothia P., Singh P.,(2022) effect of sulphur on yield of blackgram (*vignamungo L.*)under rainfedcondition of Chitrakootarea.International Journal of Chemical Studies 2022;10(3):35-37

Comment [k127]: 2022

Comment [k128]: rained

Comment [k129]:

14. Gomez, K.A., Gomez, A. A.,(1976) Three or more factor experiment. (In:) *Statistical Procedure for Agricultural Research 2nd ed.*, 1976, pp.139 -141

Comment [k130]: 1976

Comment [k131]: deetel

Table,1.Influence of sulphur and zinc on growth attributes of blackgram

S. No.	Treatments	At 45DAS				
		Plant Height (cm)	Nodules per plant	Dry weight (g/plant)	CGR (g/m ² /day) 45-60 DAS	RGR (g/g/day) 45-60 DAS
1.	Sulphur 20Kg/ha + Zinc5Kg/ha	33.43	35.67	4.38	4.51	0.014
2.	Sulphur 20Kg/ha + Zinc10Kg/ha	33.90	36.00	4.46	4.51	0.013
3.	Sulphur 20Kg/ha + Zinc15Kg/ha	34.61	36.30	4.49	4.92	0.015
4.	Sulphur 25Kg/ha + Zinc5Kg/ha	36.06	37.80	4.55	5.58	0.019
5.	Sulphur 25Kg/ha + Zinc10Kg/ha	36.37	37.90	4.62	5.50	0.018
6.	Sulphur 25Kg/ha + Zinc15Kg/ha	37.07	39.33	4.68	5.51	0.018
7.	Sulphur 30Kg/ha + Zinc5Kg/ha	38.39	40.90	4.75	5.66	0.018
8.	Sulphur 30Kg/ha + Zinc10Kg/ha	38.99	41.17	4.78	6.30	0.019
9.	Sulphur 30Kg/ha + Zinc15Kg/ha	39.80	41.77	4.84	5.68	0.018
10.	RDF (25:50:25 NPKkg/ha)	28.29	30.33	4.22	4.71	0.015
	F-Test	S	S	S	S	NS
	SEm±	0.67	1.29	0.04	0.23	-
	CD (P=0.05)	2.00	3.84	0.13	0.69	- 8

Table 2. Influence of sulphur and zinc on yield attributes of blackgram

S.No.	Treatments	TestWeigh(g)	No. of Seedsper pod	No. of Pods perplant	Seed Yield (t/ha)	Stoveryield (t/ha)	Harvest index(%)
1.	Sulphur 20Kg/ha + Zinc5Kg/ha	29.98	4.82	33.00	9.04	15.03	37.61
2.	Sulphur 20Kg/ha + Zinc10Kg/ha	31.40	5.32	33.18	9.39	15.75	37.47
3.	Sulphur 20Kg/ha + Zinc15Kg/ha	31.91	5.49	33.88	9.56	16.03	37.34
4.	Sulphur 25Kg/ha + Zinc5Kg/ha	32.34	5.90	34.86	10.08	16.49	37.92
5.	Sulphur 25Kg/ha + Zinc10Kg/ha	33.02	6.40	35.36	10.41	16.71	38.50
6.	Sulphur 25Kg/ha + Zinc15Kg/ha	33.46	6.59	36.02	11.12	17.07	39.45
7.	Sulphur 30Kg/ha + Zinc5Kg/ha	35.68	6.62	36.56	12.28	17.60	41.08
8.	Sulphur 30Kg/ha + Zinc10Kg/ha	35.68	6.94	37.32	12.98	18.75	40.91
9.	Sulphur 30Kg/ha + Zinc15Kg/ha	37.14	7.00	37.36	13.63	19.68	40.79
10.	RDF (25:50:25 NPK kg/ha)	29.13	4.80	30.14	8.00	14.38	35.76
	F-Test	S	S	S	S	S	NS
	SEm±	0.36	0.06	0.13	0.40	0.58	0.10
	CD (P=0.05)	1.07	0.17	0.38	1.20	1.72	-

UNDER PEER REVIEW

