Original Research Article

Influence of sulphur and zinc on growth and yield of Black gram

*(Vignamungo*L.*)*

ABSTRACT

A field experiment was conducted during *Zaid*season 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 . there are 10 treatment each replicated thrice. The soil 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+zinc15kg/ha).

Keywords: *sulphur, zinc, growth parameters, yield attributes and economic analysis,*Black gram.

UNDER PEER REVIEW

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 Urad dal 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-sulphur protients 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 (21 S),which act as structure blocks in protein conflation. It hasa 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 agro ecological region.

UNDER PEER REVIEW

''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 view, 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 *zaid*season 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 ($g/m^2/day$), 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]**

UNDER PEER REVIEW

RESULT AND DISCUSSION

GROWTH PARAMETERS

Plant height –At harvest significantly higher 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).

The significantly higher plant height can be due to theapplication ofsulphur 30 kg/ha + zinc 15kg/hasulphur 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]

Nodules per plant --At harvest significantly highest 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 ofsulphur 30 kg/ha + zinc 15kg/ha.

The increment in nodulation with increasing levels of sulphur may be due to increase in amount of ferrodoxin. Ferrodoxins 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 ofSinghet al. (2015)[7]and Bharviet al. (2020).

Dry weight --At harvest significantly highest dry weight (6.43 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 ofsulphur 30 kg/ha + zinc 15kg/ha.

Increased dry matter production in response to increasing zinc applicationt may be caused by that impact on plant metabolism.(Surendra ram 2018 [8]

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 ofsulphur 30 kg/ha + zinc 10kg/ha.

YIELD ATTRIBUTES

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 ofsulphur 30 kg/ha + zinc 10kg/ha.

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 ofsulphur 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]

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 ofsulphur 30 kg/ha + zinc 10kg/ha.

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

Seed yield --At harvest significantly highest seed yeild(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 ofsulphur 30 kg/ha + zinc 10kg/ha.

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 cysteine, cysteine, and methionine. (kudi et al 2018)[11]

Stover yield --At harvest significantly highest stoveryeild (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).Thesignificantly highest number of Seed yeildplant can be due to the application ofsulphur 30 kg/ha + zinc 10kg/ha.

UNDER PEER REVIEW

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

Harvest index--At harvestthere was no significantdifference among the treatments.highest harvest index (40.91 cm) was observed in treatment-8(sulphur 30 kg/ha + zinc 10) whereas the minimum harvet index (35.76) was recorded with the treatment withtreatmentT_{10}-Control.

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 sulphur30kg/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.

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UNDER PEER REVIEW

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UNDER PEER REVIEW

Table1.Influenceofsulphurandzincongrowthattributesofblackgram

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	-

UNDER PEER REVIEW

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