Original Research Article

Influence of Sulphur and Zinc on Growth, Yield and quality of Summer Green gram

Abstract

A field experiment was conducted during *Zaid* season (2021-22) at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.). The soil of experimental plot was sandy loam in texture, nearly natural in soil reaction (pH 7.1), low in organic carbon (0.28 %), available N (225 ~~kg~~Kg/ha), available P (19.50 ~~kg~~Kg/ha) and available K (213.7 ~~kg~~Kg/ha). The Treatments consisted of 3 levels of Sulphur Levels S_1 (20 Kg/ha), S_2 (30 Kg/ha), S_3 (40 Kg/ha) and 3 levels of zinc (Zn_1-5 ~~kg~~Kg/ha), (Zn_2- 7.5 ~~kg~~Kg/ha) and (Zn_3-10 ~~kg~~Kg/ha). The results reported that the application of Treatment-9 (Sulphur 40 Kg/ha + Zn 10 Kg/ha) recorded maximum ~~(Treatment 9) P~~plant height (60 cm), ~~Number~~ number of ~~Nodules~~ nodules per plant (34.13), plant dry weight (12.78 g/plant), number of pods per plant (39.61), number of seeds per pod (12.66), test weight (32.3 g), seed yield (0.868 t/ha), straw yield (2.287 t/ha) and the harvest index was only found to be ~~non significant~~insignificant. Maximum Gross returns (75446.00 INR/ha), Net returns (51814.00 INR/ha) and B:C ratio (2.1) was recorded with the treatment-9 (T_9). ~~with the application of Sulphur 40 Kg/ha + Zinc 10 Kg/ha.~~

~~Key words~~**Ketwords**: - *Sulphur, Growth, Yield, Zinc, Zaid season*.

1. INTRODUCTION

Green gram scientifically known as *Vigna radiata* is a plant species in the legume family and commonly called as mung bean, moong in India. India is its primary origin and is mainly cultivated in East Asia, Southeast Asia and the Indian subcontinent. It is the third important pulse crop of India grown in nearly 16% ~~per cent~~ of the total pulse area of the country. It contains protein rich seed with 20-25-%, ~~protein~~ and sometimes plants are cut and ploughed into the soil to enrich soil nitrogen. Green gram is an excellent source of high-quality protein. It has the capacity to fix atmospheric nitrogen through symbiotic nitrogen fixation. It can fix 50-66 ~~kg~~ Kg N ha-1 through symbiotic relationship between the host mungbean roots nodules and soil bacteria [1] ~~(Reddy and Reddi, 2005)~~. In India, Green gram occupy area of 42.38

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lakh~~,~~ ha ~~area~~ with total production of 23.25 lakh tonnes with productivity of 729.1 ~~kg~~ Kg /ha and contributes 12% to total pulse production in year (2021-22). Sulphur is increasingly being recognized as the fourth major plant nutrient after nitrogen, phosphorus and potassium. Crops in general require as much sulphur as they need phosphorus. Sulphur is also a constituent of vitamins biotin and thiamine (B1) and also of iron sulphur proteins called ferredoxins. Sulphur plays an important role in growth and development of crops. It plays an important role in the formation of S-containing amino acids like cystine (27% S), Cysteine (26% S), methionine (21% S), which act as building blocks in the synthesis of proteins. It has role to play in increasing chlorophyll formation and aiding photosynthesis. Sulphur is known to promote nodulation in legumes thereby enhancing the N fixation & ~~it's~~it is also constituent of free amino acid such as methionine, cysteine, and plays a vital role in protein synthesis [2] ~~**(Dhanushkodi et al., 2009)**~~.

Micronutrients are also essential for plant growth. Zinc is involved in Auxin metabolism like, tryptophan synthesis, protein synthesis, formation of nucleic acid and helps in utilization of nitrogen as well as phosphorus by plants. It also promotes nodulation and nitrogen fixation in leguminous crops [3] ~~Patel et al., 2013~~. Zinc influences the formation of growth hormones and it plays a helpful role in reproduction of certain plants [4] ~~(**Patel *et al.*, 2006).**~~ Zinc also has the role in photosynthesis and nitrogen metabolism and it helps in regulating the auxin concentration in plant. It promotes flower setting and help in proper development of fruits. It also helps in carbohydrates transformation and sulphur metabolism. The grain and straw yield were also significantly increased by the application of zinc. The favourable influence of applied zinc on these growth parameters, yield attributes and yield may be ascribed to catalytic or stimulatory effect of zinc on most of the physiological and metabolic processes of the plant. It also helps in chlorophyll formation and plays an important role in nitrogen metabolism. Thus, the application of zinc in a soil deficient in its content, improved the overall growth and development of plant.

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~~**MATERIALS AND METHODS:**~~

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2. METHODOLOGY

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The experiment was conducted during Zaid season of 2021-22. The experiment was conducted in Randomized Block Design consisting of nine 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 low level of organic carbon (0.28%), available N (225 Kg/ha), P (19.50 ~~kg~~Kg/ha) and higher level of K (92.00 ~~kg~~Kg/ha). The treatment combinations are T_1 – S 20 Kg/ha + Zn 5 ~~kg~~Kg/ha, T_2 – S 20 Kg/ ha + Zn 7.5 ~~kg~~Kg/ha, T_3 - S 20 Kg/ha+ Zn 10 ~~kg~~Kg/ha, T_4 - S 30 Kg/ha + Zn 5 ~~kg~~Kg/ha, T_5 - S 30 Kg/ha + Zn 7.5 ~~kg~~Kg/ha, T_6 - S 30 Kg/ha + Zn 10 ~~kg~~ Kg /ha, T_7 - S 40 Kg/ha + Zn 5 ~~kg~~Kg/ha, T_8 – 40 Kg/ha + Zn 7.5 ~~kg~~Kg/ha, T_9 – 40 Kg/ha + Zn 10 Kg/ha, Control (25-50-25 Kg/ha). The observations were recorded on different growth parameters at harvest viz. plant height (cm), plant dry weight (g), Number of nodules per plant, number of seeds per pod-, test weight, grain yield and stover yield.

3. RESULTS AND DISCUSSION

~~A.~~3.1. Growth Attributes:

At 45 DAS, the maximum plant height (60 cm) was recorded in treatment No.9 with application of S 40 Kg/ha + Zn 10 Kg/ha which was significantly superior over all other treatments and treatment with application of S 40 Kg/ha + Zn 5 ~~kg~~Kg/ha (58.80 cm) is statistically at par with treatment application of S 40 Kg/ha + Zn 10 Kg/ha. At 80 DAS, the highest Dry weight per plant was observed in the treatment with S 40 Kg/ha + Zn 15 ~~kg~~Kg/ha (12.78) which was significantly higher over the rest of the treatments and treatment with application of S 40 Kg/ha + Zn 7.5 ~~kg~~Kg/ha (12.12) which were statistically at par with application of with S 40 Kg/ha + Zn 10 Kg/ha. At 45 DAS, maximum Number of nodules (34.13) was recorded with application S 40 Kg/ha + Zn 10 Kg/ha which was significantly superior over all other treatments and treatment with application of S 30 Kg/ha + Zn 5 ~~kg~~Kg/ha. (14.30 g) is statistically at par with treatment (T_9) with the application of S 40 Kg/ha + Zn 15 ~~kg~~Kg/ha The probable reasons for higher Growth attributes at 45 DAS might be due to the fact that might be due to known role of sulphur in stimulation of cell division, photosynthetic process as well as formation of chlorophyll. It also promotes the root nodules in legumes, which cause the more sulphur available during vegetative growth period and development of plant occurs. These results are in accordance with those of Srivastava et al. [5] ~~(2006)~~.

3.2. Yield Attributes

Treatment with application of S 40 Kg/ha + Zn 15 Kg/ha was recorded maximum number of pods per plant (39.61) which was significantly superior over all other and treatment with application of S 40 Kg/ha + Zn 7.5 Kg/ha (37.81) which was statistically at par with the treatment with application of S 40 Kg/ha + Zn 15 Kg/ha. Treatment with application of S 40 Kg/ha + Zn 15 Kg/ha was recorded maximum number of seeds per pods

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(12.66) which was significantly superior over all other and treatment with application of S 40 Kg/ha + Zn 7.5 Kg/ha (12.61). Treatment with application of S 40 Kg/ha + Zn 15 Kg/ha was recorded maximum test weight (32.87 g) which was significantly superior over all other and treatment with application of S 30 Kg/ha + Zn 5 Kg/ha (31.83) which was statistically at par with the treatment with application of S 40 Kg/ha + Zn 15 Kg/ha. -Treatment with application of S 40 Kg/ha + Zn 15 Kg/ha was recorded maximum seed yield (0.868 t/ha) which was significantly superior over all other and treatment with application of S 30 Kg/ha + Zn 5 Kg/ha (0.822) and S 30 Kg/ha + Zn 5 Kg/ha (0.800) which was statistically at par with the treatment with application of S 40 Kg/ha + Zn 15 Kg/ha.Treatment with application of S 40 Kg/ha + Zn 15 Kg/ha was recorded maximum stover yield (2.098 t/ha) which was significantly superior over all other and treatment with application of S 30 Kg/ha + Zn 10 Kg/ha (2.078 t/ha) which was statistically at par with the treatment with application of S 40 Kg/ha + Zn 10 Kg/ha.

Treatment with application of S 20 Kg/ha + Zn 7.5 Kg/ha was recorded maximum harvest index (37 %) and minimum with application of S 30 Kg/ha + Zn 10 ~~kg~~Kg/ha (21.7 %). There is no significant differences between treatments. Similar, result found by the increase in yield attributing characters might be due to application of zinc increased the enzymatic and physiological activities and performance of many catalytic function in plant system, beside transformation of carbohydrates, chlorophyll and protein synthesis. The increase in yield was mainly due to enhanced rate of photosynthesis and carbohydrate metabolism as influenced by sulphur application. The results obtained are in accordance with findings reported by Surendra [6] ~~Ram (2018)~~.

4. CONCLUSION

On the basis of one season experimentation it can be concluded that with the application of S 40 Kg/ha + Zn 10 kg/ha was found more productive (0.868 t/ha) and economically viable (2.1).

The conclusions drawn are based on one season data only which requires further confirmation for recommendation.

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~~Reference~~**REFERENCES**

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Table.1 Influence of Sulphur and zinc levels on growth attributes of summer Green gram

Treatments	Plant height (cm)	Dry weight (g/plant)	Nodules/ plant (no)
1.Sulphur 20Kg/ha + Zinc 5kg/ha	55.81±SE	9.55±SE	28.6±SE
2.Sulphur 20Kg/ha + Zinc 7.5kg/ha	57.40±SE	9.68±SE	30.97±SE
3.Sulphur 20Kg/ha+ Zinc 10kg/ha	58.54±SE	10.56±SE	31.67±SE
4.Sulphur 30Kg/ha + Zinc 5Kg/ha	56.40±SE	10.07±SE	33.17±SE
5.Sulphur 30 Kg/ha + Zinc 7.5kg/ha	57.73±SE	10.13±SE	25.67±SE
6.Sulphur 30Kg/ha + Zinc 10Kg/ha	56.07±SE	10.24±SE	30.63±SE
7.Sulphur 40Kg/ha + Zinc 5Kg/ha	58.80±SE	11.31±SE	29.73±SE
8.Sulphur 40Kg/ha + Zinc 7.5Kg/ha	57.13±SE	12.12±SE	31.23±SE
9.Sulphur 40Kg/ha+ Zinc 10Kg/ha	60.00±SE	12.78±SE	34.13±SE
10. N-P-K 25-50-25 Kg/ha (Control)	52.02±SE	8.85±SE	27.67±SE
~~F test~~F-value	~~S~~xx.xxx	xx.xxx~~S~~	xx.xxx~~S~~
~~S Ed (±)~~	~~1.04~~	~~0.35~~	~~0.87~~
~~CD (P=0.05)~~	~~0.5~~	~~0.73~~	~~1.82~~

± SE must be written for each mean, because there are three replicates for each treatment, followed by the significant letters to differentiate between treatments, in addition to F-value, which must be written too with its significance.

This action should be applied for Table 2.

Table.2 Effect of plant growth regulators and zinc levels on yield attributes and yield of Toria.

Treatments	Pods/Plant (no)	seeds/pod	Test Weight (g)	Seed Yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
1.Sulphur 20Kg/ha + Zinc 5kg/ha	29.39±SE	8.44±SE	26.54±SE	0.550±SE	1.039±SE	34.0±SE
2.Sulphur 20Kg/ha + Zinc 7.5kg/ha	33.33	8.88	30.27	0.560	0.921	37.0
3.Sulphur 20Kg/ha+ Zinc 10kg/ha	32.65	9.21	29.63	0.629	1.800	25.8
4.Sulphur 30Kg/ha + Zinc 5Kg/ha	34.97	10.64	31.83	0.800	1.702	31.0
5.Sulphur 30 Kg/ha + Zinc 7.5kg/ha	32.64	10.94	27.21	0.822	1.706	32.0
6.Sulphur 30Kg/ha + Zinc 10Kg/ha	36.94	11.87	30.24	0.577	2.078	21.7
7.Sulphur 40Kg/ha + Zinc 5Kg/ha	35.87	11.64	28.98	0.598	1.718	34.0
8.Sulphur 40Kg/ha + Zinc 7.5Kg/ha	37.81	12.61	31.04	0.657	1.702	27.8
9.Sulphur 40Kg/ha+ Zinc 10Kg/ha	39.61	12.66	32.87	0.868	2.098	29.2
10. N-P-K 25-50-25 Kg/ha (Control)	25.02	8.1	25.03	0.510	0.910	35.0
F-testvalue	Sxx.xxx	Sxx.xxx	Sxx.xxx	Sxx.xxx	Sxx.xxx	NSxx.xxx
S Ed (±)	0.88	1.04	0.73	0.06	0.11	--
CD (P=0.05)	1.8	0.5	1.5	0.13	0.24	--

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