Influence of Sulphur and Zinc levels on growth and yield of Cowpea

(*Vigna unguiculata* L.)

ABSTRACT: A field experiment entitled "Influence of Sulphur and Zinc levels on growth and yield of Cowpea (*Vigna unguiculata* L.)"**.** was carried out during *kharif* season of 2021 at experimental field of the Crop Research Farm, **Department of** Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, and Uttar Pradesh, India. The soil of experimental field is Sandy loam in texture, nearly neutral in soil reaction (pH 7.0). To determine the treatments which are T_1 20 kg/ha S + 10 kg/ha Zn, T_2. 20 kg/ha S + 15 kg/ha Zn, T_3. 20 kg/ha S + 20 kg/ ha Zn, T_4. 30 kg/ha S + 10 kg/ha Zn, T_5. 30 kg/ha S + 15 kg/ha Zn, T_6. 30 kg/ha S + 20 kg/ha Zn, T_7. 45 kg/ha S + 10 kg/ha Zn, T_8. 45 kg/ha S + 15 kg/ha Zn, T_9. 45 kg/ha S + 20 kg/ha Zn, T_{10}. Control was used. The Experiment was laid out in Randomized Block Design with Ten treatments which was replicated thrice.

Background: Cowpea is known as drought hardy nature, its wide and droopy leaves keeps soils and soil moisture conserved due to shading effect. It is also known as black-eyed pea or southern pea etc. and has multiple uses like food, feed, forage, fodder, green manuring and vegetable.

Objectives: To study the retaliation performances of Sulphur and zinc on growth, yield and yield attributes of cowpea (Vigna unguiculate L.)

Conclusion: It was determined that the application of Sulphur – 45 kg/ha + Zinc – 20 kg/ha resulted in a higher grain yield (13.67 q/ha), which was significantly superior to the other treatments.
***Key words*:** cowpea, growth, sulphur, yield and zinc.

INTRODUCTION

Cowpea (*Vigna unguiculate* L.) is one of the most important vegetable crops grown as pulse, vegetable and fodder. It is poor man's protein source and considered one of the most ancient human food sources and has probably been used as a crop plant since Neolithic times (Ng and Marechal 1985) (7). Cowpea is a vital multipurpose grain legume extensively cultivated in arid and semiarid tropics. It is an important source of nutrients and provides high quality, inexpensive protein diet based on cereal grains and starch foods. Cowpea is a good source of food, fodder, vegetables and certain snakes (Singh *et al*., 2012) (11). In India pulses are grown nearly in 25.43 m ha with an annual production of 17.28 m t and a median productivity of 679 kg/ha (Anonymous *et al.*, 2012) (2). In Rajasthan the realm under pulses is 47.54 lakh ha with an annual production of 32.54 lakh m t and an average productivity of 684 kg/ha and also the area under Cowpea is

1.02 lakh ha with the production of 0.64 lakh tonnes and productivity of 529 kg/ha. The per capita availability of pulses in India is 35.5 g/day as against the minimum requirement of 70 g/day/capita.

Sulphur is the fourth major nutrient next to N, P and K and an essential element for plant growth particularly for legumes crops which play an important role in plant metabolism system. Sulphur (S) is a constituent of some important amino acids namely cystine, cysteine and methionine. Sulphur is essential for the growth and development, plays a key role in plant metabolism. , S containing amino acids (cystine, cystieine and methionine) and promotes nodulation in legumes. It helps in chlorophyll formation and encourages vegetative plant growth.(Karche and co-workers 2012) (4).

Zinc, which is important for growth and reproduction in plants, animals and humans, is one of the seventh essential micronutrients. In plants, it plays a key role during physiological growth, DNA stabilization, gene expression, enzyme activity, protein synthesis and improved chlorophyll function (Prasad, 2003) (8). Zinc deficiency is a major limiting factor in several Asian countries. It is now being recorded as third most deficient nutrient in crop production after nitrogen and phosphorus. In India, zinc deficient soils occupy almost 50% of the agricultural area and are a critical constraint on yield.

MATERIALS AND METHODS

The experiment was carried out during *kharif* season of 2021 at the Crop Research Farm, Department of Agronomy, Naini Agricultural

Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh which is located at 25º24‘41.27” N latitude, 81°50‘56” E longitude (2021) and 98 m altitude above the mean sea level. This area is situated on the right side of the river *Yamuna* and south east side of Prayagraj city. Having nearly neutral in soil reaction (pH 7.0), organic carbon (0.375 %), available nitrogen (168.75 kg/ha), available phosphorus (17.4 kg/ha) and available potassium (231.7 kg/ha). The climate of the region is semi-arid subtropical. In this experiment a total of ten treatments has been developed and were tested. Treatment composed of T_1- Sulphur – 20 kg/ha + Zinc – 10 kg/ha, T_2- Sulphur – 20 kg/ha + Zinc – 15 kg/ha, T_3- Sulphur – 20 kg/ha + Zinc – 20 kg/ha, T_4- Sulphur – 30 kg/ha + Zinc – 10 kg/ha, T_5- Sulphur – 30 kg/ha + Zinc – 15 kg/ha, T_6- Sulphur – 30 kg/ha + Zinc – 20 kg/ha, T_7- Sulphur – 45 kg/ha + Zinc – 10 kg/ha, T_8- Sulphur – 45 kg/ha + Zinc – 15 kg/ha, T_9- Sulphur – 45 kg/ha + Zinc – 20 kg/ha, T_{10}- Control (20:50:20 NPK) kg/ha. Ten treatments were replicated thrice in Randomized Complete Block Design. The recommended dose of fertilizer (N: P: K) is 20:50:20 kg/ha. The statistics were calculated and analyzed by using the Ali, *et al* (2013) (1). Statistical approach.

RESULT AND DISCUSSION

Plant height (cm)

Observations recorded in respective to the plant height of cowpea were represented in Table (1) there was an increase in crop age and plant

height was progressively noticed with the advancement during the experimentation period. The analysis on plant height was significantly higher in all the different growth intervals with the effect of different levels Sulphur and zinc. At harvest maximum plant height was recorded (75.64 cm) with the application of Sulphur – 45 kg/ha + Zinc – 20 kg/ha which was significantly superior over all other treatments except with the application of Sulphur - 45 kg/ha + Zinc - 15 kg/ha (73.27 cm). The probable reason for increasing plant height might due to presence of sulphur in the application plays important role in several physiological and biochemical processes which are of vital importance for growth and development of plant. Similar results were earlier reported by Raiger *et al.,* (2017) (9). Application of zinc increase in plant height might be due to its role in biosynthesis of indole acetic acid (IAA) and especially due to its role in initiation of primordial for promoting of photosynthesis which resulted in better plant growth and yield Ali *et al*. (2013) (1).

Number. of Branches per plant

The optimum result observations were recorded in no. of branches per plant was depicted in Table (1) and was increased with advancement of the crop during the crop growth period. At harvest maximum no of branches per plant (9.66) recorded with the application of Sulphur – 45 kg/ha + Zinc – 20 kg/ha which was significantly superior over all other treatments except with the application of Sulphur - 45 kg/ha + Zinc - 15 kg/ha (8.89). Maximum no. of branches was observed with application of sulphur 40 kg/ha zinc 20 kg/ha availability

of zinc might have stimulated the metabolic and enzymic activity and there by increases the plant growth attributes which increases the number of branches/plant similar results have also reported by Kasturi *et al* (2000) (5).

Plant dry weight (g/plant)

Observations to be recorded in the dry weight of cowpea were represented in Table 1 the maximum dry weight had given at harvest. At harvest the maximum dry weight (67.90 g/plant) was found in the treatment with application of Sulphur – 45 kg/ha + Zinc – 20 kg/ha which was significantly superior over all other treatments except with the application of Sulphur - 45 kg/ha + Zinc - 15 kg/ha were it was recorded (64.98 g/plant). Zn and S application created a balanced nutritional environment which enhanced metabolic activities and photosynthetic rate, resulting in improvement in plant height and ultimately increases plant dry weight. Similar results were reported by Meena *et al.* (2006) (6) and Ramawtar *et al.* (2013) (10).

Yield, Straw yield and Harvest Index of Cowpea

Observation regarding yield are given in Table (2). Grain yield is an important and considerable trait at all the time. Maximum seed yield (13.67 q/ha) and Straw yield (15.26 q/ha) were recorded with application Sulphur – 45 kg/ha + Zinc – 20 kg/ha which was significantly over all the treatments except with the application of Sulphur - 45 kg/ha + Zinc - 15 kg/ha in grain yield (12.03 q/ha) and straw yield (14.27 q/ha) which was statistically at par with the

applications of Sulphur – 45 kg/ha + Zinc – 20 kg/ha. The grain yield being the function of cumulative effect of yield attributes, increased significantly due to addition of Sulphur. Sulphur of chloroplast protein resulted in greater photosynthetic efficiency which in turn translated in terms of increase in yield Karche *et al*. (2012) (4). Similar results were also reported by Singh *et al*. (2006) (12) and Singh and Mann (2007) (13). Zinc play an important role in biosynthesis of indole acetic acid which is responsible for initiation of primordial for reproductive parts and partitioning of photosynthesis towards them which resulted in better yield. While maximum Harvest index was recorded in the application of Sulphur - 45 kg/ha + Zinc - 10 kg/ha (47.93 %) and found non significant. Similar finding is found due to the increase in grain yield and straw yield the harvest index increases Baviskar *et al*. (2010) (3).

CONCLUSION

It is concluded that application of Sulphur – 45 kg/ha + Zinc – 20 kg/ha was found more productive in grain yield (13.67 q/ha) which was significantly superior over rest of the treatments.

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Table 1: Influence of Sulphur and Zinc growth attributes of Cowpea

	Treatments	Plant height (cm)	No. of Branches per plant	Dry weight (g/plant)
		At harvest	At harvest	At harvest
T1	Sulphur - 20 kg/ha + Zinc - 10 kg/ha	65.85	8.40	58.20
T2	Sulphur - 20 kg/ha + Zinc - 15 kg/ha	66.84	8.43	58.63
T3	Sulphur - 20 kg/ha + Zinc - 20 kg/ha	67.94	8.46	59.01
T4	Sulphur - 30 kg/ha + Zinc - 10 kg/ha	68.38	8.53	61.2
T5	Sulphur - 30 kg/ha + Zinc - 15 kg/ha	69.97	8.60	61.42
T6	Sulphur - 30 kg/ha + Zinc - 20 kg/ha	71.33	8.70	63.70
T7	Sulphur - 45 kg/ha + Zinc - 10 kg/ha	70.46	8.63	63.02
T8	Sulphur - 45 kg/ha + Zinc - 15 kg/ha	73.27	8.93	64.78
T9	Sulphur - 45 kg/ha + Zinc - 20 kg/ha	75.64	9.66	67.90

T10	Control (NPK 20: 50: 20) kg/ha	63.33	7.86	56.58
	SEm (±)	0.845	0.264	1.124
	CD (0.05%)	2.51	0.784	3.342

Table 2: Influence of Sulphur and Zinc on Yield and Economics of Cowpea

	Treatments	**Yield**		
		Grain yield (q/ha)	**Stover yield (q/ha)**	**Harvest index (%)**
T1	Sulphur - 20 kg/ha + Zinc - 10 kg/ha	7.98	9.44	45.8
T2	Sulphur - 20 kg/ha + Zinc - 15 kg/ha	8.91	10.30	46.37

T3	Sulphur - 20 kg/ha + Zinc - 20 kg/ha	9.00	10.46	46.23
T4	Sulphur - 30 kg/ha + Zinc - 10 kg/ha	9.62	11.08	46.52
T5	Sulphur - 30 kg/ha + Zinc - 15 kg/ha	10.83	12.45	46.51
T6	Sulphur - 30 kg/ha + Zinc - 20 kg/ha	11.53	13.17	46.66
T7	Sulphur - 45 kg/ha + Zinc - 10 kg/ha	11.27	12.29	47.93
T8	Sulphur - 45 kg/ha + Zinc - 15 kg/ha	12.03	14.27	45.78
T9	Sulphur - 45 kg/ha + Zinc - 20 kg/ha	13.67	15.26	47.30

T10	Control (NPK 20: 50: 20)	7.90	8.70	47.45
	S.Em(±)	0.345	0.340	1.018
	CD (p=0.05)	1.02	1.010	-