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Growth and Yield of Cowpea (*Vigna unguiculata* L. Walp.) as Influenced by Sulfur, Boron and Zinc

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Abstract

A field experiment was conducted to assess the effect of sulfur, boron and zinc on growth and yield of cowpea. The results revealed that the growth and yield were significantly more when sulfur and zinc were applied along with recommended dose of NPK. Combined application of S at 15 kg/ha, Zn at 10 kg/ha, N at 25 kg/ha, 50 kg P_2O_5 ha and 25 kg K_2O/ha increased the growth and yield of cowpea significantly. There was also good response for sole application of sulfur and zinc along with along with recommended dose of NPK.

Key words : Sulfur, Boron, Zinc Cowpea, Yield.

In India, cowpea is an important pulse crop next to Bengal gram and red gram. Though pulses are always given secondary importance compared to cereals, their prime value rests with high nutritive value they impart to diet. Most limiting essential amino acids in the pulses are the S containing amino acids-cystine and methionine (1). A possible approach to remedying this deficiency is to increase the sulfur containing amino acids levels in seeds by sulfur fertilization of the soils in which legumes are grown. Boron is needed largely in the synthesis of carbohydrates and fats (2) and it is the nutrient that plays an important role in photosynthesis and translocation of metabolites influence on the test weight. Tomar et al. (3) reported that zinc deficiency is known to exist in larger areas and research carried out elsewhere has shown favorable response of crop to zinc application. Intensive agricultural practices along with use of sulfur, boron and zine free high analysis fertilizers leads to further increase of sulfur, boron and zinc deficiencies in soils. The research on effect of sulfur, boron and zinc on growth and yield of cowpea is necessary. Hence, the present investigation was planed to study the effect of individual and combined application of sulfur; boron and zinc along with recommended NPK fertilizers on growth and yield of cowpea.

Methods

A field experiment was conducted to study the effect of sulfur, boron and zinc on growth and yield of cowpea during *kharif* season at Regional Research Station, University of Agricultural Sciences, GKVK, Bangalore. The soil of the experimental site is red sandy clay loam texture having the soil pH was slightly acidic (5.80), organic carbon 0.48%, 18.68 kg P_2O_5/ha and 233.33 kg K_2O/ha and low in available sulfur (14.24 kg/ha), boron (1.10 kg/ha) and zinc (1.34 kg/ha).

The trial was laid out in randomized complete block design replicated thrice with 13 treatments : T_1 =NPK (recommended), T_2=NPK + S, T_3= NPK + B, T_4=NPK + Zn, T_5= NPK + S + B, T_6=NPK + S + Zn, T_7=NPK +B + Zn, T_8=NPK + S +B + Zn, T_9 = NPK + compost, T_{10}= NPK +S + compost, T_{11}=NPK + B + compost, T_{12} = NPK + Zn + compost, and T_{13} =compost. The variety KBC -2 was used with a spacing of 45 cm × 10 cm. The S (15 kg/ha). B (2.5 kg/ha) and Zn (10 kg/ha) were applied to the soil at the time of sowing along with recommended N, P_2O_5 and K_2O at 25 : 50 : 25 kg/ha and compost (7.5 t/ha). Observations viz. plant height (cm), number of green leaves/plant, leaf area (cm/plant), number of branches/plant, number of pods/plants, pod length (cm), number of seeds/pod, test weight (g), stalk yield (kg/ha), pod yield (kg/ha) and seed yield (kg/ha) were recorded on five plant samples and the data was subjected to statistical analysis.

Results and Discussion

Growth

The data revealed that the combined application

Table 1. Growth components of cowpea as influenced by sulfur, boron and zinc.

	Treatments	Plant height (cm)	No. of green leaves/ plant	Leaf area (cm^2 plant)	No. of branches/ plant
1	NPK (recommended)	25.4	24.6	2115.6	7.6
2	NPK + S	32.8	29.1	2589.9	8.8
3	NPK + B	19.0	20.6	1874.6	5.9
4	NPK + Zn	32.1	28.8	2505.6	8.6
5	NPK + S + B	20.9	22.1	1922.7	7.1
6	NPK + S + Zn	41.7	34.1	3103.1	10.7
7	NPK + B + Zn	19.8	21.9	1883.4	6.9
8	NPK + S + B + Zn	21.6	22.5	1957.5	7.4
9	NPK + Compost	29.3	26.7	2403.0	8.2
10	NPK + S + Compost	39.7	31.9	2807.2	9.6
11	NPK + B + Compost	19.2	21.4	1879.2	6.1
12	NPK + Zn + Compost	36.8	31.2	2776.8	9.3
13	Compost	17.1	18.5	1665.0	4.2
	SE ±	2.98	1.96	137.5	0.80
	CD at 5%	8.71	5.73	401.40	2.35

of sulfur and zinc along with NPK T_6=NPK + S+ Zn gave significant increase in the growth components like plant height (41.7 cm), number of green leaves/ plant (34.1), leaf area (3103.1 cm^2/plant) and number of branches plant (10.7) when compared to other treatments (Table 1). The findings are in agreement with those reported by Chuabey et al. (4). According to Malewar et al. (5) the enhancement in root and shoot growth were closely related to sulfur and zinc status. But under adequate zinc supply auxin production, root initiation and shoot elongations of plant would increase causing stimulatory effect on the production and development of nodules. It was reiterated by Ghilidiyal et al. (6) that the maximum nodulation and dry weight would take place at 60 DAS with zinc application. Similar opinion was also given by Premkumar (7) and Naidu and Ram (8).

Yield

Application of NPK + S + Zn recorded significantly maximum number of pods/plant (17.0), pod length (17.5 cm), number of seeds/pod (14.7), test weight (10.8 g), stalk yield (3,350 kg/ha), pod yield (2470 kg/ha) and seed yield (2065 kg/ha) when compared to rest of the treatments. The positive response of cowpea to sulfur and zinc application was associated with low status of available sulfur and zinc in soil (14.34 and 1.34 kg/ha). The increase in seed yield may be due to significant increase in yield components like number of pods/plant, pod length , number of seeds/pod and test weight as compared to the other treatments. These results are in line with the findings of Singh and Yadav (9).

Thus it can be concluded that combined application of sulfur (15kg/ha) and zine (kg/ha) along with recommended dose of fertilizers for cowpea was found to be best to produce higher economic yield as com-

Table 2. Yield attributes and seed yield of cowpea as influenced by sulfur, boron and zinc.

	Treatments	No. of pods plant	Pod length (cm)	No. of seeds/ pod	Test weight (g)	Stalk yield (kg/ha)	Pod yield (kg/ha)	Seed yield (kg/ha)
1	NPK (recommended)	13.0	10.5	9.3	8.7	1560	1621	1200
2	NPK + S	14.9	14.3	11.3	9.9	2227	1765	1485
3	NPK +B	11.3	8.9	8.0	8.2	1248	1120	960
4	NPK + Zn	14.7	14.1	11.1	9.6	2208	1700	1472
5	NPK S + B	11.9	9.3	8.3	8.4	1458	1400	1042
6	NPK + S + Zn	17.0	17.5	14.7	10.8	3350	2470	2065
7	NPK + B + Zn	11.7	9.1	8.2	8.3	1442	1394	1030
8	NPK + S + B + Zn	12.1	9.7	8.4	8.4	1470	1420	1080
9	NPK + Compost	13.9	12.9	10.2	9.1	1716	1650	1320
10	NPK + S + Compost	16.1	16.0	13.0	10.8	2777	2180	1736
11	NPK + B + Compost	11.5	9.0	8.0	8.3	1386	1390	990
12	NPK + Zn + Compost	15.8	15.9	12.9	10.7	2618	2000	1720
13	Compost	9.5	7.2	7.2	8.1	945	901	735
	SE ±	0.83	1.16	1.16	0.64	164.65	149.93	112.10
	CD at 5%	2.43	3.41	3.38	1.88	480.62	437.66	327.21

pared to the other treatments.

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