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Influence of Zinc and Boron on Yield and Economics of Cowpea

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

"A field experiment was conducted at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, UP, during the autumn season of 2022 on sandy loam soil. The experiment was carried out in Randomized Block Design supplemented by Zinc (10, 15, 20 kg/ha) and Boron (1, 1.5, 2 kg/ha)". The variety Kashi Nidhi was used and sown in July 2022. The results revealed that the crop supplemented with 20 kg/ha Zinc + 2 kg/ha boron increased significantly in yield parameters viz., no. of pods per plant (19.7), no. of seeds per pod (15.6), seed yield (1.28 t/ha) and stover yield (2.43 t/ha). This treatment also showed a positive effect on economics viz., gross returns (84029.00 INR/ha), net returns (56369.00 INR/ha) and B: C (1:2.03).

Keywords: Boron; cowpea; economics; yield parameters; zinc.

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1. INTRODUCTION

Pulses are one of the necessary components of a daily diet for people in India, they are to be in the right proportion to provide the basic needs of protein, food and energy for good health and life sustenance. Pulses or grain legumes form a rich and cheap source of protein for humans, particularly for poor people, not only in India but throughout the world.

"Cowpea is one of the pulse crops in the U.P. grown mainly in autumn season under rainfed conditions. Its wide and droopy leaves keep soil and soil moisture conserved due to the shading effect. It has many local nomenclatures as the black-eyed pea or southern pea. It has high protein content varying from 21.2% to 30.6%, with an average of 24.6% and is also a rich source of calcium and iron. It has multiple uses like food, feed, forage, green manuring and vegetable" [1,2,3]. "In U.P. cowpea is of utmost importance because of their short duration, high yielding and quick growing capacity with high protein content. The crop gains a quick and thick canopy on the ground and help in soil conservation. It could be utilized as an alternative crop in dryland farming" [4].

"Zinc (Zn) is the only metal element in all six enzyme classes, oxidoreductases, transferases, hydrolases, lyases, isomerases and ligases" [5]. "Zinc plays a prime role in many physiological processes viz., chlorophyll formation, pollen formation, fertilization, protein synthesis, cell elongation and nodule formation. Hence, Zn nutrition favourably influences growth, yield, physiological parameters and nodule formation in pulses" [6]. "Since Zn is immobile in the plant, a constant supply of zinc is essential for optimum growth. Besides its prime role in chlorophyll formation, it is involved in several enzyme systems, growth hormones (auxins) and the synthesis of nucleic acid and plays a vital role in the intake and use of water by plants" [7].

"Boron (B) is an essential micronutrient indispensable for the natural growth and development of plants. It plays a vital role in the flowering and fertilization process, boosting the yield and quality of crop produce" [8]. B is essential for pollen tube germination, cell elongation, cell division, male flower sterility and fruit and seed formation in plants [9]. "It is essential for sugar transport, cell wall synthesis and structure, metabolism of carbohydrates, RNA, phenol and indole acetic acid, respiration and membrane integrity" [10].

2. MATERIALS AND METHODS

"The field trial was conducted during kharif season from July to September 2022 in Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, U.P. which locates at 25^0 24' 42" N latitude, 81^0 50' 56" E longitude and 98 m altitude above the mean sea level. This area is located on the right side of river Ganga which is 11 km away from Prayagraj city". The soil is slightly alkaline in nature with a (pH of 7.2). It had a sandy loam texture, high in Nitrogen (225 kg/ha), Potassium (187.3 kg/ha) and a medium in Phosphorous (11.5 kg/ha). The experiment was laid out in a Randomized Block Design with ten treatment combinations that were replicated thrice. The experimental field was ploughed thoroughly and brought to a fine tilth by removing stubbles. 30 plots of each 3.0 m x 3.0 m were made.

1. zinc 10 kg/ha + boron 1 kg/ha
2. zinc 15 kg/ha + boron 1 kg/ha
3. zinc 20 kg/ha + boron 1 kg/ha
4. zinc 10 kg/ha + boron 1.5 kg/ha
5. zinc 15 kg/ha + boron 1.5 kg/ha
6. zinc 20 kg/ha + boron 1.5 kg/ha
7. zinc 10 kg/ha + boron 2 kg/ha
8. zinc 15 kg/ha+ boron 2 kg/ha
9. zinc 20 kg/ha + boron 2 kg/ha
10. blanket application of 30-60-50 kg/ha of NPK (Control)

Major nutrients were applied in 30-60-50 kg/ha amount through urea, SSP, and Mop, to all treatments after opening the furrows and covered with soil while. Zinc is in formatting chelated zinc and boron is in formatting borax. Kashi Nidhi variety was used and sown by line sowing method in furrows with the spacing of 30 cm between rows and 10 cm between plants. The growth parameters viz., plant height (cm) and dry weight (g/plant), were recorded at 15 days-time intervals till physiological maturity and yield parameters viz., pods per plant (No.), seeds per pod (No), seed yield (t/ha) and stover yield (t/ha) were recorded at the time of harvesting on per hectare basis. Data were analysed statistically by using the ANOVA technique [11].

3. RESULTS AND DISCUSSION

The yield attributes were significantly recorded highest with the application of 20 kg/ha of zinc along with boron 2 kg/ha. No. of pods per plant (19.7), No. of seeds per pod (15.6) were

Table 1. Influence of zinc and boron on yield parameters of cowpea

Sl.no	Treatments	Pods per plant(no.)	Seeds per pod(no.)	Seed yield(t/ha)	Stover yield(t/ha)
1.	Zinc 10 kg/ha and Boron 1 kg/ha	15.1	15.1	0.90	1.12
2.	Zinc 15 kg/ha and Boron 1 kg/ha	15.8	14.9	0.95	1.36
3.	Zinc 20 kg/ha and Boron 1 kg/ha	16.9	12.4	1.01	1.40
4.	Zinc 10 kg/ha and Boron 1.5 kg/ha	18.0	13.4	1.08	1.63
5.	Zinc 15 kg/ha and Boron 1.5 kg/ha	17.6	13.6	1.10	1.75
6.	Zinc 20 kg/ha and Boron 1.5 kg/ha	18.5	15.1	1.16	2.07
7.	Zinc 10 kg/ha and Boron 2 kg/ha	18.1	13.4	1.19	1.76
8.	Zinc 15 kg/ha and Boron 2 kg/ha	19.1	13.8	1.20	2.09
9.	Zinc 20 kg/ha and Boron 2 kg/ha	19.7	15.6	1.28	2.43
10.	30-60-50 kg/ha NPK (Control)	15.8	12.5	0.79	2.18
	S.Em (±)	0.16	0.63	0.06	0.04
	CD (5%)	0.47	1.81	0.17	0.13

Table 2. Influence of zinc and boron on economics of cowpea

Sl. no.	Treatments	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
1.	Zinc 10 kg/ha and Boron 1 kg/ha	58828.00	32673.00	1.22
2.	Zinc 15 kg/ha and Boron 1 kg/ha	61700.00	34912.00	1.30
3.	Zinc 20 kg/ha and Boron 1 kg/ha	65528.00	38123.00	1.39
4.	Zinc 10 kg/ha and Boron 1.5 kg/ha	70269.00	43986.00	1.67
5.	Zinc 15 kg/ha and Boron 1.5 kg/ha	75953.00	44797.00	1.66
6.	Zinc 20 kg/ha and Boron 1.5 kg/ha	77372.00	48450.00	1.76
7.	Zinc 10 kg/ha and Boron 2 kg/ha	78495.00	50962.00	1.92
8.	Zinc 15 kg/ha and Boron 2 kg/ha	84029.00	51460.00	1.98
9.	Zinc 20 kg/ha and Boron 2 kg/ha	52882.00	56369.00	2.03
10.	30-60-50 kg/ha NPK (Control)	24650.00	28321.00	1.14

highest with applying 20 kg/ha zinc added with 2 kg/ha boron. However, the application of 20 kg/ha zinc with 1.5 kg/ha boron and was found statistically at par with the highest in seeds/pod (15.1). Seed yield (1.28 t/ha) and stover yield (2.43 t/ha) were significantly the highest with the application of 20 kg/ha of zinc added with 2 kg/ha boron. However, the application of 20 kg/ha zinc along with 1.5 kg/ha of boron was found statistically at par with highest seed yield (1.28t/ha).

The Economics of cowpea presented in Table 2. Gross returns (84029.00 INR/ha), net returns (56369.00 INR/ha) and B:C (2.03) ratio were the highest values by applying 20 kg/ha zinc and 2 kg/ha boron.

4. SUMMARY AND CONCLUSION

Cultivation of cowpea under the application of 20 kg/ha zinc and 2 kg/ha boron was found more desirable in terms of growth and yield when compared to other treatments as well as fetched good net returns and B:C ratio.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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