

Original Research Article

Influence of zinc and boron on yield and economics of Cowpea

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 ~~kharif~~ season of 2022 on sandy loam soil. The experiment was ~~laid~~ ~~carried out~~ in Randomized Block Design ~~supplemented by, consisting of three levels of zinc~~ Zinc (10, 15, 20 kg/ha) and ~~three levels of~~ boron (1, 1.5, 2 kg/ha)”. The variety Kashi Nidhi was ~~used and~~ sown in July 2022. The results ~~of the experiment~~ revealed that the ~~crop~~ ~~supplemented with, application of~~ 20 kg/ha ~~of Zinc~~ zinc ~~along with,~~ 2 kg/ha ~~of~~ boron ~~increased~~ significantly ~~increased in~~ the 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.

Comment [e1]: What do you mean about “kharif”? Which one did you mean of four seasons are spring, autumn, summer, fall? Kindly choose the proper word and change it into all.

INTRODUCTION

Pulses ~~along with cereals~~ are ~~the two~~ one of the necessary components of a daily diet for people in India. ~~and they~~ 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 ~~the~~ a rich and cheap source of protein for ~~both vegetarians and non vegetarians~~ humans, and particularly for ~~the~~ poor people, not only in India but ~~also~~ throughout the world.

Cowpea is one of the ~~poor man's~~ pulse crops ~~of in the~~ U.P. grown mainly in kharif 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 is known as the~~ black-eyed pea or southern pea ~~etc.~~ ~~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 (Kay, 1979)^[1]; (Tindall, 1983)^[2]; (Quass, 1995)^[3]. In U.P., cowpea is of ~~great utmost~~ importance because of ~~its~~ their short duration, high yielding, and quick growing capacity with high protein content. The crop ~~is also known to provide~~ gains a quick and thick ~~cover~~ canopy on the ground and helps in soil conservation. It ~~is grown as could utilize~~ an alternative crop in dryland farming (Sudhir kumar Rajpoot and Rana, 2016)^[4].

Zinc (Zn) is ~~an the only~~ important ~~constituent of enzymes and proteins.~~ ~~It is the only~~ metal element ~~present~~ in all ~~the~~ six enzyme classes, oxidoreductases, transferases, hydrolases, lyases, isomerases, and ligases (Auld, 2001)^[5]. Zinc plays a ~~major~~ primer role in many physiological processes viz., chlorophyll formation, pollen formation, fertilization, protein synthesis, cell elongation, and nodule formation ~~etc.~~ Hence, Zn nutrition favourably influences ~~the~~ growth, yield, physiological parameters, and nodule formation in pulses (Kuniya et al. 2018)^[6]. Since Zn is immobile in the plant, a constant supply of zinc is

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essential for optimum growth. Besides its ~~major-prime~~ role in chlorophyll formation, it is involved in several enzyme systems, growth ~~hormone~~ hormones (auxins), and the synthesis of nucleic acid and plays ~~an importanta vital~~ role in the intake and use of water by plants (Thamke, 2017) ^[7].

Boron (B) is an essential micronutrient indispensable for the ~~normal-natural~~ growth and development of plants. It plays ~~an importanta vital~~ role in ~~the~~ flowering and fertilization process, boosting ~~the~~ yield and quality of crop produce (Kanwar and Randhawa, 1974) ^[8]. B is ~~found-to-be~~ essential for pollen tube germination, cell elongation, cell division, male flower sterility, and fruit and seed formation in plants (Marschner, 1995) ^[9]. It is ~~considered-to-be~~ essential for sugar transport, ~~synthesis-of-cell-wall~~, cell wall ~~synthesis and~~ structure, metabolism of carbohydrates, RNA, phenol and indole acetic acid, respiration, and membrane integrity (Parr and Loughman, 1983) ^[10].

~~The current study was aimed to~~

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Write your aims for this study.

MATERIAL AND METHODS

“The field trial was conducted during ~~khari~~ season from July to September 2022 in Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, U.P., which ~~is-located~~ ~~locates~~ at 25° 24' 42" N latitude, 81° 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 ~~of-the-experimental-field~~ is slightly alkaline in nature, with a ~~(PH~~ ~~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 (11.5kg/ha). The experiment was laid out in ~~a~~ Randomized Block Design ~~consisting-of~~ 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.

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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. sulphur 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 amounts through urea, SSP, and Mop, to all treatments after opening the furrows and covered with soil. ~~while zinc is in formatting was applied in the form of~~ chelated zinc, and boron ~~was applied in the form of~~ 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., viz~~ plant height (cm), ~~and~~ dry weight (g/plant), were recorded at 15 days-time intervals till physiological maturity, ~~and yield~~ 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, ~~and data~~ Data were ~~was statistically~~ analysed ~~statistically~~ by using the ANOVA technique (Gomez and Gomez, 1994)^[11].

RESULT AND DISCUSSION

The yield attributes ~~were significantly the highest value with the application of 20 kg/ha zinc added with 2 kg/ha boron, whereas i.e.,~~ no. of pods per plant ~~scored (19.7) was significantly highest value of 19.7 with application of 20 kg/ha of zinc along with boron 2~~

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Comment [e6]: You pointed to the results only. Where is discussion section? Kindly discuss your results.

Comment [e7]: No any referring to Table (1).

~~kg/ha.~~The No. of seeds per pod (~~15.6~~) were significantly the highest value (15.6) with applying application of 20 kg/ha of zinc along added with 2 kg/ha boron. However, the application of 20 kg/ha zinc along added with 1.5 kg/ha ~~of~~ boron and was found ~~to be~~ statistically at par with the highest in seeds/pod (15.1). ~~seed~~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 along added~~ with 2 kg/ha ~~of~~ boron. However, the application of 20 kg/ha zinc along with 1.5 kg/ha of boron ~~and~~ was found ~~to be~~ statistically at par with the highest in seed yield (1.38 t/ha).

The Economics of cowpea ~~were~~ presented in table ~~no~~-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 with the application of 20 kg/ha zinc at 20 kg/ha and 2 kg/ha of boron.

SUMMARY AND CONCLUSION

~~Under Irrigated conditions, cultivation~~ Cultivation of cowpea ~~during kharif season with under~~ the application of 20 kg/ha zinc at 20 kg/ha and 2 kg/ha boron at 2 kg/ha was found ~~to be~~ more desirable in terms of growth, yield attributing characters and yield when compared to other treatments. ~~It also as well as~~ fetched good net returns and a B:C ratio.

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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(\pm)	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

UNDER PEER REVIEW

