

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 out in Randomized Block Design, consisting of three levels of zinc (10, 15, 20 kg/ha) and three levels of boron (1, 1.5, 2 kg/ha)”. The variety Kashi Nidhi was sown in July 2022. The results of the experiment revealed that the application of 20 kg/ha of zinc along with 2 kg/ha of boron significantly increased the yield parameters viz., no. of pods per plant (19.7), no. of seeds per pod (15.6), seed yield (1.28 t/ha), 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), B: C (1:2.03).

Keywords: Boron, Cowpea, Economics, Yield parameters, Zinc.

INTRODUCTION

Pulses along with cereals are the two necessary components of daily diet for people in India and they are to be in right proportion to provide the basic needs of protein, food and energy for good health and life sustenance. Pulses or grain legumes form the rich and cheap source of protein for both vegetarians and non-vegetarians 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 U.P. grown mainly in kharif season under rainfed conditions. Its wide and droopy leaves keep soil and soil moisture conserved due to shading effect. It is known as 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 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 importance because of its short duration, high yielding and quick growing capacity with high protein content. The crop is also known to provide quick and thick cover on the ground and help in soil conservation. It is grown as alternative crop in dryland farming (Sudhir kumar Rajpoot, 2016)^[4].

Zinc is an 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 role in many physiological processes viz., chlorophyll formation, pollen formation, fertilization, protein synthesis, cell elongation, 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, constant supply of zinc is essential for optimum growth. Besides its major role in chlorophyll formation, it is involved in several enzyme systems, growth

hormone (auxins) and the synthesis of nucleic acid and plays an important role in the intake and use of water by plants (Thamke, 2017)^[7].

Boron is an essential micronutrient indispensable for the normal growth and development of plants. It plays an important role in flowering and fertilization process, boosting 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 structure, metabolism of carbohydrate, RNA, phenol and indole acetic acid, respiration and membrane integrity (Parr and Loughman, 1983)^[10].

MATERIAL 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 is located 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 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 Randomized Block Design consisting of ten treatment combinations 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. 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 amount through urea, SSP, and Mop, to all treatments after opening the furrows and covered with soil while zinc was applied in the form of chelated zinc and boron was applied in the form of borax. Kashi Nidhi variety was 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), 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), stover yield (t/ha) were recorded at the time of harvesting on per hectare basis and data was statistically analysed by using ANOVA technique. (Gomez and Gomez, 1994)^[11].

RESULT AND DISCUSSION

The yield attributes *i.e.*, no. of pods per plant (19.7) was significantly highest with application of 20 kg/ha of zinc along with boron 2 kg/ha. No. of seeds per pod (15.6) were significantly highest with application of 20 kg/ha of zinc along with 2 kg/ha boron. However, application of 20 kg/ha zinc along with 1.5 kg/ha of boron and was found to be statistically at par with highest in seeds/pod (15.1). seed yield (1.28 t/ha) and stover yield (2.43 t/ha) were significantly highest with application of 20 kg/ha of zinc along with 2 kg/ha of boron. However, application of 20 kg/ha zinc along with 1.5 kg/ha of boron and was found to be statistically at par with 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 highest with the application of zinc at 20 kg/ha and 2 kg/ha of boron.

SUMMARY AND CONCLUSION

Under Irrigated conditions, cultivation of cowpea during kharif season with the application of zinc at 20 kg/ha and 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 fetched good net returns and B:C ratio.

REFERENCES

1. Kay, D.E. (1979). Food Legumes. Tropical Development and Research Institute, London.
2. Tindall, H.D. (1983). Vegetables in the Tropics. Macmillan Press, London.
3. Quass, C.F. (1995). Guidelines for the Production of Cowpeas. National Department of Agriculture, Pretoria.
4. Sudhir Kumar Rajpoot, DS Rana *Indian Farming* 66 (1), 05-09, 2016
5. Auld DS. Zinc coordination sphere in biochemical zinc sites. *Biometals*. 2001 Sep-Dec;14(3-4):271-313. doi: 10.1023/a:1012976615056. PMID: 11831461.
6. Neeta Kuniya, Neha Chaudhary, Sweta Patel. Effect of sulphur and zinc application on growth, yield attributes, yield and quality in light textured soil. *Int J Chem Stud* 2018;6(1):1529-1532.
7. Thamke, S. S. (2017). Studies on effect of graded levels of potassium and zinc on growth, yield, nutrient uptake and quality of pigeon pea. Ph.D. thesis, Vasantrya Naik Marathwada Krishi Vidyapeeth, Parbhani, 106p

8. Kanwar, J. S., and Randhawa, N. S.1974. Micronutrient research in soils and plants in India: A review. ICAR.Technical Bulletin (Agric). 50:1-60.
9. Ismail Cakmak, Hannes Kurz, Horst Marschner, *Physiologia Plantarum* 95 (1), 11-18, 1995
10. ANNE S POLLARD, ADRIAN J PARR, BRIAN C LOUGHMAN *Journal of Experimental Botany* 28 (4), 831-841, 1977
11. Gomez, K.A. and Gomez, A.A. (1984) *Statistical Procedures for Agricultural Research*. 2nd Edition, John Wiley and Sons, New York, 680 p.

UNDER PEER REVIEW

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

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