The Pharma Innovation Journal 2021; 10(11): 1756-1758

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(11): 1756-1758

www.thepharmajournal.com
Received: 07-09-2021
Accepted: 29-10-2021

Mandadi Muniratnakumar Reddy
Department of Agronomy,
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj Allahabad, Uttar Pradesh, India

Shikha Singh
Department of Agronomy,
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj Allahabad, Uttar Pradesh, India

Corresponding Author:
Mandadi Muniratnakumar Reddy
Department of Agronomy,
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj Allahabad, Uttar Pradesh, India

Response of chickpea (*Cicer arietinum* L.) To various levels of boron and molybdenum

Mandadi Muniratnakumar Reddy and Shikha Singh

Abstract
During *rabi* season of 2020-21, a field experimental study was carried out to evaluate chickpea with respect to boron and molybdenum under Prayagraj climatic condition at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.).The Experiment was laid out in Randomized Block Design with 9 treatment combinations which were replicated thrice. The treatment combination were formed by combining three levels of boron (1, 1.5 and 2 kg/ha) and three levels of molybdenum (1, 2 and 3 kg/ha), treatment combination of 2 kg B/ha + 3 kg Mo/ha recorded significantly highest plant height (57.54 cm), number of nodules (13.27/plant), dry weight (22.76 g/plant) and seed yield (1789.75 kg/ha), respectively.

Keywords: Boron, chickpea, growth, molybdenum, seed yield

Introduction

Pulses are an important group of food crops that can play a vital role to address national food and nutritional security and also tackle environmental challenges. The share of pulses to total food grain basket is around 9-10 per cent and is a critical and inexpensive source of plant-based proteins, vitamins and minerals. Pulses are critical in food basket (dal-roti, dal-chawal), are a rich source of protein (at 20-25 per cent, it is double the protein content of wheat and thrice that of rice) and help address obesity, diabetes malnutrition etc. Chickpea constitutes nutrient composition of about 20% protein, respectively (Min. of Agri. & FW (DAC & FW), GOI). Micronutrients like cobalt, boron, molybdenum and zinc play an important role in increasing legume yield through their effect on the plant itself, nitrogen fixing symbiotic process and effective use of primary and secondary nutrients. Now a days nutrients depletion in soil particularly micronutrients in the soil is increasing. Micronutrient deficiency problems are also aggravated due to high demand of modern crop cultivars. Boron plays an important role for synthesis of amino acids and proteins. It also regulates carbohydrates metabolism, mechanism of root and necessary for translocation of sugar, phosphorus, etc. and helps in the absorption of nitrogen and formation of nodules (Singh *et al.*, 2015) [16]. Legume crops required more amount of boron compared to most field crops as boron plays vital role in proper development of reproductive organs. Its deficiency leads to sterility in plants by malformation of reproductive tissues affecting pollen germination, resulting in increased flower drop and reduced fruit set (Subasinghe *et al*., 2003) [17]. Molybdenum is known important to be a key element required by the microorganisms for nitrogen fixation. It is structural component of nitrogenase enzyme which is actively involved in nitrogen fixation by *Rhizobium* bacteria in the root nodules of leguminous crops and simultaneously essential for absorption and translocation of iron in plants as well as seed.
Keeping the above points in view, an experimental trial was conducted to find out appropriate ratio of boron and molybdenum supplement which can sustain in soil type and climatic condition of Uttar Pradesh.

Materials and Methods

A research trial was conducted at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) during *rabi* season of 2020-21 with three levels of boron and molybdenum each. The location is situated at 25.57^{o} N latitude, 87.19^{o} E longitude and at an altitude of 98 m above mean sea level. The soil was sandy loam in texture containing low organic carbon (0.435%), available nitrogen (205.8 kg/ha), medium available phosphorus (14.8 kg/ha) and potassium

(242.5 kg/ha). As per recommended N,P,K (20:40:20 NPK Kg/Ha), full doses of nitrogen, phosphorus and potassium were given at the time of sowing in the form of urea, diammonium phosphate and muriate of potash. Along with the above nutrients, various levels of Mo and B were supplied to the respective plots as per treatments. The seeds were sown on 10^{th} of November, 2020. Inter-row distance of 30 cm and intra-row distance of 10 cm were maintained in all plots and furrows were opened at a depth of 3-4 cm. Plants were thinned and gap filling was done at 15 DAS to obtain a desired plant population. In order to minimize weed competition, manually two hand weedings were carried out at 25 and 60 DAS. Only one irrigation was given at the time of preflowering to ensure better pod growth and weight. At every 20 days duration, observations such as plant height, number of nodules/plant, dry weight and observation of yield at harvest stage were noticed. Based on appropriate experimental design, data generated from the research field were subjected to statistical analysis of variance. Significant was tested by variance ratio (~F-value) at 5% level (Gomez and Gomez, 1984) [2].

Results and Discussion

The data pertaining to plant height, number of total nodules/plant, dry weight and seed yield of chickpea in accordance with treatment of boron and molybdenum levels were depicted in Table 1.

The values related to plant height showed significant difference among treatments. However, significantly highest plant height (57.54 cm) was recorded in 2 kg B/ha + 3 kg Mo/ha and at par values were noticed in the treatments of 1.5 kg B/ha + 3 kg Mo/ha and 2 kg B/ha + 2 kg Mo/ha (53.92 and 52.97 cm), respectively. Factors such as boron might have increased plant height by formation of new plant cells, elevated the level of IAA, development of meristematic tissues, cell elongation and tissue differentiation and sugar transportation. Whereas, Mo also resulted in increase in yield might be due to enhanced chlorophyll formation which enhances photosynthesis resulting an increase in plant height. By combined application of boron and molybdenum resulted a positive impact on growth. Similar results were reported by Karpagam *et al.* (2014) [15]; Ray *et al.* (2015) [14]; Kala *et al.* (2017) [14] and Sarmad Iqbal *et al.* (2021) [15].

However, number of nodules was significantly higher in 2 kg B/ha + 3 kg Mo/ha (13.27/plant).Application of 1.5 kg B/ha + 3 kg Mo/ha, 2 kg B/ha + 1 kg Mo/ha and 2 kg B/ha + 2 kg Mo/ha (12.27, 11.67 and 10.67/plant) were found to be at par with 2 kg B/ha + 3 kg Mo/ha. Application of B and Mo in combination had increased root nodulation significantly. The maximum nodule number per plant (13.2) was recorded with integrated use of B and Mo which may plays synergistic effect on nodulation of chickpea. Molybdenum is an essential trace element and is vital for synthesis and activity of molybdoenzymes such as nitrogen assimilation enzyme-nitrate reductase and the nitrogen fixing enzyme-nitrogenase, the key regulatory component for initiation of nodulation and maintenance of nitrogen fixation in legumes. Similar observations were recorded by Singh *et al*., 2015 [16]; Jamal Nasar and Zahir Shah (2017) [3]; Ranjit Chatterjee and Subhendu Bandyopadhyay (2017) [13] and Quddus *et al*. (2018) [12].

The results of dry weight (22.76 g/plant) was recorded significantly higher in 2 kg B/ha + 3 kg Mo/ha and at par values were found in the treatments of 2 kg B/ha + 2 kg Mo/ha, 1.5 kg B/ha + 3 kg Mo/ha and 1.5 kg B/ha + 2 kg Mo/ha (22.26, 21.40 and 21.29 g/plant) respectively. A significant effect of micronutrients on growth and yield of chickpea was very visible by soil application of boron and molybdenum. Such enhancement effect of soil application might be attributed to the favourable influence of these nutrients on metabolism and biological activity of plant and its stimulating effect on photosynthetic pigments and enzymes activity which in turn encourage vegetative growth of plants. These findings are in harmony with those obtained by **Divya** Sahare *et al*. (2019) [1]; Verma *et al.* (2017) [18] and Karraja Kathyayani *et al*. (2021) [6].

Seed yield recorded a significant difference among treatment combinations. However, Seed yield (1789.75 kg/ha) recorded significantly highest in 2 kg B/ha + 3 kg Mo/ha. Whereas, 2 kg B/ha + 2 kg Mo/ha and 1.5 kg B/ha + 3 kg Mo/ha noticed at par values (1549.03 and 1523.22 kg/ha), respectively. Grain yield of chickpea was significantly influenced with increasing levels of micronutrients. This was perhaps due to the combined application of micronutrients (B and Mo) enhanced the survival and multiplication of microorganisms, more nitrogen fixation, transport of sugars and better uptake and assimilation of available nutrients by the plants during the entire growth period. Similar results have been reported by the findings of Nawaz Khan *et al.* (2014) [9]; Preeti Choudhary *et al*. (2017) [10]; Menaka *et al*. (2018) [8]; Mekkei (2020) [7] and Sarmad Iqbal *et al*. (2021) [15].

Table 1: Effect of boron and molybdenum levels on growth and yield of chickpea

Treatments	Plant height (cm)	Number of nodules/plant	Dry weight (g/plant)	Grain yield (kg/ha)
1 kg B/ha + 1 kg Mo/ha	45.73	6.93	17.40	1026.58
1 kg B/ha + 2 kg Mo/ha	48.45	7.07	18.18	1092.65
1 kg B/ha + 3 kg Mo/ha	48.96	8.33	18.23	1078.08
1.5 kg B/ha + 1 kg Mo/ha	49.28	9.93	18.75	1197.94
1.5 kg B/ha + 2 kg Mo/ha	50.36	10.13	21.29	1344.31
1.5 kg B/ha + 3 kg Mo/ha	53.92	12.27	21.40	1523.22
2 kg B/ha + 1 kg Mo/ha	50.53	11.67	18.87	1270.18
2 kg B/ha + 2 kg Mo/ha	52.97	10.67	22.26	1549.03
2 kg B/ha + 3 kg Mo/ha	57.54	13.27	22.76	1789.75
S.Em(±)	1.90	0.87	0.94	145.41
CD (P=0.05)	5.70	2.62	2.82	435.94

Conclusion

From the above study, it can be concluded that the chickpea was found to be more responsive regarding growth and yield by application of 2 kg Boron and 3 kg Molybdenum per hectare which might be recommended for this region.

Acknowledgement

I express gratitude to my advisor Dr. (Mrs) Shikha Singh and all the faculty members of Department of Agronomy for constant support and guidance to carry out the whole research work.

References

1. Divya Sahare, Shrivastava GK, Sanjay K, Dwivedi. Growth and yield maximization of chickpea (*Cicer arietinum*) through basal and foliar application of major and micro nutrients. International Journal of Chemical Studies 2019;7(6):2543-2546.
2. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research, edn 2, Johns and sons, New York. 1984, 591.
3. Jamal Nasar, Zahir Shah. Effect of iron and molybdenum on yield and nodulation of lentil. *ARPN* Journal of Agricultural and Biological Science 2017;12(11):332-339.
4. Kala DC, Dixit RN, Vivek Trivedi, Gangadhar Nanda, Shiv Singh Meena, Manikant Prabhakar. Effect of graded doses of sulphur and boron on growth and yield attributes, yield and nutrient content in chickpea under central plains of Uttar Pradesh. Environment & Ecology 2017;35(4):2703-2707.
5. Karpagam J, Girish Chander. Molybdenum application for enhancing growth, yield and soil health on green gram (*Vigna radiata* L.). International Journal of Scientific Research 2014;3(12):2277-8179.
6. Karraja Kathyayani, Rajesh Singh, Punnam Chhetri. Effect of levels of boron and molybdenum on growth and yield of blackgram (*Vigna mungo* L.). International Journal of Current Microbiology and Applied Sciences 2021;10(2):339-345.
7. Mekkei MER. Effect of micronutrients (Zn, B and Mo) foliar application at various growth stages of chickpea (*Cicer arietinum* L.) on yield and yield components. Journal of Plant Production 2020;11(1):1-6.
8. Menaka P, Ashoka Rani Y, Narasimha Rao KL, Hareesh Babu P, Lal Ahamed M. Response of chickpea (*Cicer arietinum* L.) to foliar application of ethrel, kinetin and boron. International Journal of Current Microbiology and Applied Sciences 2018;7(11):1653-1660.
9. Nawaz Khan, Muhammad Tariq, Khitab Ullah, Dost Muhammad, Imran Khan, Kamran Rahatullah *et al*. The effect of molybdenum and iron on nodulation, nitrogen fixation and yield of chickpea genotypes (*Cicer Arietinum* L.). IOSR Journal of Agriculture and Veterinary Science 2014;7(1):63-79.
10. Preeti Choudhary, Gautam Ghosh, Neha, Shobha Kumari. Effect on yield and benefit: cost ratio of green gram at different phosphorus levels and frequency of boron levels. International Journal of Current Microbiology and Applied Sciences 2017;6(6):1095-1103.
11. Pulses Revolution - From Food to Nutritional Security. Crops Division, Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Krishi Bhavan, New Delhi, Government of India – 110 001.
12. Quddus MA, Hossain MA, Naser HM, Naher N, Khatun F. Response of chickpea varieties to boron application in calcareous and terrace soils of Bangladesh. Bangladesh Journal of Agricultural Research 2018;43(4):543-556.
13. Ranjit Chatterjee, Subhendu Bandyopadhyay. Effect of boron, molybdenum and biofertilizers on growth and yield of cowpea (*Vigna unguiculata* L. Walp.) in acid soil of eastern Himalayan region. Journal of the Saudi Society of Agricultural Sciences 2017;16:332-336.
14. Ray S, Biman De, Hazari S. Growth and productivity as influenced by nutrient management practices on pigeon pea [*cajanus cajan* (L.) millsp.] in upland alfisols of Tripura. SAARC Journal of Agriculture 2015;13(1):123-134.
15. Sarmad Iqbal, Kabir Khan, Asim Muhammad. Response of chickpea (*Cicer arietinum* L.) to different molbydenum and boron levels. *Bioscience Research* 2021;18(1):566-573.
16. Singh DK, Singh AK, Sanjay Kumar Singh, Mandhata Singh, Srivastava OP. Effect of balanced nutrition on yield and nutrient uptake of pea (*Pisum sativum* L.) under Indo-gangetic plains of India. The Bioscan 2015;10(3):1245-1249.
17. Subasinghe S, Dayatilake GA, Senaratne R. Effect of B, Co and Mo on nodulation, growth and yield of cowpea (*Vigna unguiculata*). Trop. Agric. Res. Ext. 2003;6:108-112.
18. Verma CB, Mohd. Aslam, Ram Pyare, Jitendra Singh. Influence of micro nutrients on yield, metabolic and quality attributes of chickpea (*Cicer arietinum* L.) varieties under rainfed condition. Agriways 2017;4(1):55-60.