E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating: 5.20
www.agronomyjournals.com
2025; SP-8(7): 94-97
Received: 02-04-2025
Accepted: 05-05-2025

Stuti Srivastava
M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Shikha Singh
Assistant Professor, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Murari Mohan
Ph.D. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Stuti Srivastava
M.Sc. Scholar, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Influence of foliar application of boron and zinc on growth and yield of greengram (*Vigna radiata* L.)

Stuti Srivastava, Shikha Singh and Murari Mohan

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i7Sb.3271

Abstract
Greengram (*Vigna radiata* L.), commonly called as mungbean is an important pulse crop grown mainly in *Zaid* and *Kharif* season in India. A field experiment was conducted during the *Zaid* season of 2024 in Greengram crop (Var. Samrat PDM-139) at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Allahabad (U.P.). The treatments consisted of 3 different levels of Boron *i.e.* (0.5, 0.75 and 1%) and Zinc i.e. (0.5,1and 1.5%). The experimental field soil was sandy loam in texture, moderately basic in reaction (pH 7.5), available medium organic carbon (0.598%), moderately available phosphorus (28.4kg / ha) and highly available potassium (243.3kg / ha) The result showed that significantly highest growth parameters *viz.*, plant height (41.50 cm), number of nodules/ plant (17.10), dry weight (13.30 g/plant) and yield attributes such as effective pod/plant (19.58), seed/pod (9.33), test weight (29.30 g), seed yield (1386.47 kg / ha) and stover yield (2579.33Kg / ha) were observed with application of foliar spray of Boron 1.0% followed by Zinc 1.5% (T9). Higher gross returns (Rs. 114592.99/ha), net return (Rs. 77298.99/ha) and Benefit Cost Ratio (2.07) was recorded superior with application Boron 1% along with Zinc 1.5% in Treatment 9. It concludes that with the application of Boron 1% along with Zinc 1.5%, performed better in growth and yield of Greengram has recorded highest test weight, grain yield, stover yield, net return and benefit cost ratio and as well as it is economically profitable in the treatment of T9 (Boron 1% + Zinc 1.5%).

Keywords: Boron, greengram, zinc yield and yields attributes

Introduction
Greengram (*Vigna radiata* L.) is one of the important legume plants of the pulse family (*Fabaceae*). It is commonly known as mungbean, mungo, Oregon pea, or simply mung and is also cultivated as a green manure crop. It is grown as a catch crop in between the *Zaid* and *kharif* seasons and is one of India's major *Zaid* pulse crops. Its seed is more palatable, nutritive, digestible, and non-flatulent than other pulses grown in the world. The seed of Greengram contain an average of 20-24% protein, 62.5% carbohydrates, 1.4% fat, 4.2% fiber, vitamins, and minerals. It provides enough fibers and iron hence becomes easily digestible. Because of its short growing time, which allows it to fit into intercropping systems with diverse crops, high tonnage capacity, and exceptional nutritional properties for food, feed, and forage, it has a wide range of adaptations. In underdeveloped nations like India, pulses are frequently referred to as "poor man's meat" since they are less expensive than meat. India is the major producer of green gram in the world, and it is grown in almost all the states. It is grown on about
40.38 lakh hectares with a total production of 31.5 lakh tonnes with a productivity of 783 kg/ha and contributes 11% to the total pulse production in the year 2023-24. Some of the state like Uttar Pradesh (0.30 lakh/ha) are the major producer of Greengram in India.
Micronutrients like boron is one of the mineral nutrients required for normal plant growth. The most important functions of boron in plants are thought to be its structural role in cell wall development, cell division, seed development and stimulation or inhibition of specific metabolic pathways for sugar transport and hormone development. Zinc (Zn) is an important micronutrient for plants since it is involved in many key cellular functions such as metabolic and physiological processes, enzyme activation, and ion homeostasis. It Involved in enzyme activity, hormone production, and overall plant metabolism. Boron deficiency causes decrease in pollen grain

count, pollen germination etc. It also influences growth parameters and filling up of seeds. Zinc is a very essential micronutrient for plant growth as it contains component of various enzyme systems for energy production, protein synthesis, and growth regulation. Zinc is also involved in auxin formation; activation of dehydrogenase enzymes; stabilization of ribosomal fractions. Zinc deficient plants also exhibit delayed maturity. Boron is very important in plant metabolism through acting activity of certain enzyme, cell division, carbohydrate transport, and calcium and potassium uptake and protein synthesis, ultimately it may enhance in pod and seed formation. It is an essential micronutrient required for crop growth and yield due to its major role in formation and maintenance of cell wall and cell membrane integrity and reproductive growth, especially flowering, fruit. it set to seed more sensitive to B deficiency than vegetative growth.

Materials and Methods

A field experiment was carried out in alluvial soil at the Crop Research Farm of the Department of Agronomy, SHUATS, Prayagraj, U.P., during the *Zaid* season of 2024. The soil used in the experiment had a sandy loam texture, a pH of 7.5, a medium organic carbon (0.598%), medium in available N (249.50 kg/ha), moderately available phosphorus (28.4 kg/ha), and highly available potassium (243.3 kg/ha). On 5th March 2024, Greengram seeds (Samrat PDM -139) were planted with a 30 cm x 10 cm spacing. There were ten treatment combinations compression of three different nutrients source such as three levels of Zinc (0.5, 1and 1.5%) and three levels of boron (0.5, 0.75 and 1%) foliar spray at 15 and 30 days replicated thrice and conducted in randomized block design. To apply organic manure as a spreading method, 4-5 cm deep furrows were dug along the seed rows using a hand hoeing. Ten days after sowing, the gaps were filled by transplanting once germination took place. Where necessary, seedlings were trimmed out to maintain 30 cm x10 cm spacing. In order to reduce crop density, weed competition, intercultural operations were carried out between 15 and 30-days intervals. On 13th May 2024, harvesting of the crop was done. At regular intervals from germination to harvest, plant growth parameters such as plant height (cm) and dry weight (g/plant) were assessed. At harvest, yield metrics such as pods/plant, seeds/pod, test weight (g), seed yield (kg/ha), stover yield (kg/ha), and harvest index (%) were measured at 15, 30, 45 and 60 DAS. Analysis of variance (ANOVA), as it relates to randomized block design, was used to statistically examine the observed data of nine treatments.

Results and Discussion

Growth parameter

The data of growth parameter are presented in Table 1. Significantly highest plant height (41.50 cm) was recorded with the application of Boron 1% + Zinc 1.5% in treatment 9. However, which was significantly superior over all the treatments except T5 (37.49 cm). These results agree with the findings of, who reported that the highest plant height was recorded with foliar spray of zinc at Greengram. Zinc actively takes part in auxin production which increases the cell size and number thus increases the plant height. At 60 DAS, maximum number of nodules was recorded in T9 (17.10) which was significantly superior over all the treatments except T5 (14.93), T6 (15.52), T7 (15.87) and T8 (16.48) whereas minimum number of nodules was recorded in treatment T10 (10.65). At 60 DAS, there was significant difference among the treatments. Highest dry weight was recorded in T9 (13.30 g/plant) which was significant over all the treatments except T8 (12.58 g/plant). The minimum dry weight was recorded in treatment T10 (7.07 g/plant). At 45-60 DAS interval there was significant difference among the treatments. Highest crop growth rate was recorded in T9 (0.2627 g/m^2/day) which was significantly superior over all the treatments except T3 (0.2177 g/m^2/day) and T8 (0.2256 g/m^2/day). The minimum crop growth rate was recorded in treatment T2 (0.1209 g/m^2/day).

Application of Boron as foliar spray significantly increased plant height. This might be due to quick availability of boron to the crop as it plays an important role in tissue differentiation and carbohydrate metabolism. It is also a constituent of cell membrane and essential for cell division, maintenance of conducting tissue with regulatory effect on other element. It is also necessary for sugar translocation in plant and development of new cell in meristematic tissue. Nodule number, weight and nitrogenase activity are positively correlated with the nitrogen fixation. Increase in nodule number, weight and nodule development of Greengram was also observed with spray of boron. Improvement in nodule development with foliar boron spray was due to its role in formation of nodule in leguminous plants concerned with precipitation of excess cation, buffer action and regulatory effect on other nutrient element. Help in vascular system in root to give out branches to supply nodule bacteria with carbohydrate food that bacteria may not become parasitic. Such beneficial effect of boron with better edaphic environment available to the crop, might have improved all the growth attributes. Similar finding have also been reported in Greengram.

Foliar application of boron (0.2% through borax) increased the vegetative growth in terms of plant height, Crop growth rate and also increased the no. of nodules per plant Foliar application 0.2% of boron increased the total dry matter production and nodules weight in Greengram. This might be due to quick availability of boron to crop during the entire growing season. Boron plays an important role in tissue differentiation and carbohydrate metabolism. It is also a constituent of cell membrane and essential for cell division, maintenance of conducting tissue with regulatory effect on other element. It is also necessary for sugar translocation in plant and development of new cell in meristematic tissue.

Yield attributes

The data of yield attributes are presented in Table 2. The maximum number of pods per plant was observed in treatment receiving application of T9 (19.58) which was significantly superior over all the treatments except T8 (18.80). The minimum number of pods were observed, in T10 (15.33). found significant increase in number of pods/plant and number of seeds/pod of Greengram due to application of increasing concentration of Zinc (*i.e.,* 1.5 and 3.0 kg Zn/ha). Our results are in corroboration with the findings of where boron increased pod weight in peanut. Pod dry matter in Greengram was increased by application of borax, ammonium molybdate & Ni. The maximum number of seeds per pod was observed in treatment receiving application of (9.33) which was significant all the treatments except T7 (8.67) and T8 (8.67). The minimum number of seeds per pod were observed in T10 (7.00). Whereas, significantly higher test weight (29.30 g) with application of (Boron 1% + Zinc 1.5%) were statistically at par with all treatment. Foliar application of seaweed saps had significantly influenced on the growth and yield of Greengram such as number of pods per plant, number of seeds per pod, test weight. Results reveals that maximum plant growth and yield attributes

were obtained in treatment 9.

The boron application enhanced the flower count which makes stigma receptive and sticky, thereby causing pollen seed fertile and enhanced pollination leads to increased seeds/pod by Kaisher *et al* (2010) [6]. The zinc application (3.0 kg/ha) recorded the highest plant height, number of branches/plant, number of pods/ plant and number of seeds/ pod in Greengram. This enhancement might be due to the crucial role of zinc in the synthesis of proteins and carbohydrate metabolism. concluded that enhanced pod setting and reduced the sterility of flower, thereby increase in test weight of green gram. The results are in harmony with those reported by Devi in soy bean, Singh and Srivastava *et al.* (2017) [2] in Greengram.

Grain yield

The data in Table 2 showed that the seed yield was observed highest in treatment receiving application of T9 (1386.47 kg/ha) which was significantly superior over all the treatments except T7 (1271.30 kg/ha). Lowest seed yield was observed in T10 (785.15 kg/ha). Ved *et al.* (2002) stated that, foliar applied zinc enhances photosynthesis, early growth of plants, improves nitrogen fixation, grain protein and yield in Greengram. Significant positive effect of zinc treatment was found on dry matter, seed and straw yield of Mungbean as well as crude protein% in the seeds (Krishna, 1995). That boron improves growth parameter which ultimately enhanced photosynthesis activity, protein and carbohydrate metabolism, higher uptake of nutrients and translocation of these compounds from source to sink. Also, boron improves pollen germination, pollen tube growth; make stigma receptive helps in better yield parameters so increase in seed yield was reported by Srivastava Alam and Islam and Maqbool *et al* (2015) [1] in Greengram.

Stover yield

The data in Table 2 showed that the highest stover yield was observed in T9 (2579.33 kg/ha) which was significantly superior over all the treatments except T7 (2386.00 kg/ha) and T8 (2417.33 kg/ha). The lowest stover yield was observed in T10 (1369.33 kg/ha). In the present study, increasing zinc concentration caused increase stover yield in Greengram. stated that, foliar applied zinc enhances photosynthesis, early growth of plants, improves nitrogen fixation, grain protein and yield in Greengram. Application of boron could enhance the yield attributes such as increasing pods on lateral branches, seed number, and overall seed yield of Greengram

Harvest index

Data presented in table 2 showed that the highest harvest index (37.51%) was recorded with the application of Boron 0.75% + Zinc 1.5% which was statistically at par to all treatments and lowest harvest index was observed in treatment 6 (33.02) with application of Boron 0.75% + Zinc 1%. Zinc foliar application tended to increase total biological yield of Greengram and maximum biological yield was obtained by praying 1% Zinc concentration. also noted the positive effect of zinc on growth of Mungbean plants, and he stated that the enhancement effect of spraying Mungbean plants with zinc might be attributed to the favourable influence of this nutrient on metabolism and biological activity and its stimulating effect on photosynthetic pigments and enzyme activity which in turn encourage vegetative and reproductive growth of plants.

Economics

The data on the economics of different treatments presented in Table 3 showed that the maximum gross return (₹ 114592.99/ha), net return (₹ 77298.99/ha) and benefit-cost ratio (2.07) was recorded with application of Boron 1% + Zinc 1.5% in treatment 9 and the minimum gross return (₹ 64665.03/ha) and net return (₹ 33971.03/ha) was observed and lowest benefit-cost ratio (1.11) was recorded in treatment 10 (Control: -20:40:20 kg NPK/ha). these results might be due to an increase in grain and stover yields in the same treatment because of enhanced availability of nutrients by the Boron and better utilization of micronutrients by Zinc, the result was in significantly higher according to in Greengram.

Table 1: Effect of foliar spray of boron and different levels of zinc on growth attributes of Greengram.

Treatment No.	Treatments Combination	Plant height (cm) 60 DAS	Number of Nodules 60 DAS	Dry weight (g) 60 DAS	Crop Growth Rate (gm^{-2}/day) 45-60 DAS	Relative growth rate ($g\ g^{-1}\ day^{-1}$) 45-60 DAS
T1	Boron 0.5% + Zinc 0.5%	31.97	11.92	8.66	0.1296	0.017
T2	Boron 0.5% + Zinc 1%	34.67	12.08	8.80	0.1209	0.016
T3	Boron 0.5% + Zinc 1.5%	35.60	12.47	10.45	0.2177	0.025
T4	Boron 0.75% + Zinc 0.5%	37.00	13.22	10.00	0.1533	0.018
T5	Boron 0.75% + Zinc 1%	37.49	14.93	10.19	0.1342	0.015
T6	Boron 0.75% + Zinc 1.5%	38.69	15.52	10.55	0.1296	0.014
T7	Boron 1% + Zinc 0.5%	39.21	15.87	11.26	0.1553	0.016
T8	Boron 1% + Zinc 1%	40.15	16.48	12.58	0.2256	0.021
T9	Boron 1% + Zinc 1.5%	41.50	17.10	13.30	0.2627	0.023
T10	Control: N:P: K, 20:40:20 kg/ha	30.40	10.65	7.07	0.1284	0.021
	F- test	S	S	S	S	NS
	S. Ed. (±)	1.51	1.27	0.59	0.028	0.003
	C. D. (P = 0.05)	4.49	3.78	1.7	0.08	0.01

Table 2: Effect of foliar spray of boron and different levels of zinc on yield and yield attributes of Green gram

Treatment No.	Treatments Combination	Number of Pod plant^{-1}	Number of seeds Pod^{-1}	Seed yield (Kg ha^{-1})	Stover yield (Kg ha^{-1})	Harvest index
T1	Boron 0.5% + Zinc 0.5%	16.20	7.33	876.70	1547.33	36.10
T2	Boron 0.5% + Zinc 1%	16.83	7.67	966.41	1650.00	36.58
T3	Boron 0.5% + Zinc 1.5%	17.67	7.33	952.46	1794.67	34.74
T4	Boron 0.75% + Zinc 0.5%	17.33	8.00	1045.62	1847.00	36.18
T5	Boron 0.75% + Zinc 1%	18.20	8.33	1152.08	1925.33	37.51
T6	Boron 0.75% + Zinc 1.5%	18.50	8.00	1122.87	2285.33	33.02
T7	Boron 1% + Zinc 0.5%	19.16	8.67	1271.30	2386.00	34.81
T8	Boron 1% + Zinc 1%	18.80	8.67	1201.69	2417.33	33.28
T9	Boron 1% + Zinc 1.5%	19.58	9.33	1386.47	2579.33	34.99
T10	Control: N:P: K, 20:40:20 kg/ha	15.33	7.00	785.15	1369.33	36.51
	F- test	S	S	S	S	NS
	S. Ed. (±)	0.6	0.23	49.7	89.5	1.36
	C. D. (P = 0.05)	0.81	0.70	147.9	266.04	4.06

Table 3: Effect of foliar spray of boron and different levels of zinc on economic attributes of Green gram

Treatment No.	Treatments Combination	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
T1	Boron 0.5% + Zinc 0.5%	33194.00	72250.67	39056.67	1.18
T2	Boron 0.5% + Zinc 1%	34794.00	79505.11	44711.11	1.29
T3	Boron 0.5% + Zinc 1.5%	36394.00	78778.55	42384.55	1.16
T4	Boron 0.75% + Zinc 0.5%	33644.00	86175.86	52531.86	1.56
T5	Boron 0.75% + Zinc 1%	35244.00	94675.57	59431.57	1.69
T6	Boron 0.75% + Zinc 1.5%	36844.00	93297.19	56453.19	1.53
T7	Boron 1% + Zinc 0.5%	34094.00	105126.40	71032.40	2.06
T8	Boron 1% + Zinc 1%	35694.00	99775.15	64081.15	1.80
T9	Boron 1% + Zinc 1.5%	37294.00	114592.99	77298.99	2.07
T10	Control: N:P: K, 20:40:20 kg/ha	30694.00	64665.03	33971.03	1.11

Conclusion

On the basis of one year experimentation, it concludes that with the application of Boron 1% along with Zinc 1.5% in (T9). Performed better in growth and yield of Greengram has recorded highest test weight, grain yield, stover yield, net return and benefit cost ratio and as well as economically profitable.

Acknowledgement

I am grateful to my advisor as well as all of the faculty members of Department of Agronomy for their unwavering support and advice throughout the entire experimental research study.

Competing Interests

Authors have declared that no competing interests exits.

References

1. Alam MA, Bhuiyan MSH. Effect of organic manures and nitrogen levels on plant height and number of branches per plant of greengram. J Sub Trop Agric Res Dev. 2006;5(3):291-6.
2. Amruta N, Devaraju PJ, Mangalagowri, Kiran SP, Ranjitha HP, Kalavati P. Effect of integrated nutrient management and spacing on seed quality parameters of greengram cv. LBG-625 (Rashmi). J Appl Nat Sci. 2017;8(1):340-5.
3. Awomy TA, Singh AK, Kumar M, Bordoloi LJ. Effect of phosphorus, molybdenum, and cobalt nutrition on yield and quality of greengram (*Vigna radiata* L.) in acidic soil of North East India. Indian J Hill Farming. 2012;25(2):22-6.
4. Azadi E, Rafiee M, Hadis N. The effect of different nitrogen levels on seed yield and morphological characteristics of mungbean in the climatic condition of Khorramabad. Ann Biol Res. 2013;4(2):51-5.
5. Chowdhury AR, Parbhakarysetty TK, Nagarathna TK. Growth and yield of mungbean as influenced by micronutrients. Karnataka J Agric Sci. 2010;23:495-6.
6. Kaisher MS, Rahman MT, Amin MHA, Amanullah ASM, Ahsanullah ASM. Effect of sulphur and boron on the seed yield and protein content of mungbean. Bangladesh Res Publ J. 2010;3(4):1181-6.
7. Kumar V, Channakeshwa S, Kumar A. Effect of soil and foliar application of Zinc on growth and yield of greengram. Int J Curr Microbiol Appl Sci. 2020;9(4):2319-706.
8. Nabi G, Rafique E, Salim M. Source, level, and methods of boron application on the dry matter production, yield attributes, and yields of mungbean. J Plant Nutr. 2006;29:717-25.
9. Naser M, Hossain M, Quddus A. Effect of zinc and boron on yield and yield-contributing characters of mungbean. Bangladesh J Agril Res. 2011;36(1):75-8.
10. Patil SB, Vyakaranahal BS, Deshpande VK, Shekhargouda M. Effect of boron and zinc application on seed yield and quality of mungbean. Karnataka J Agric Sci. 2006;19:708-10.