Effect Of Foliar Application Of Zinc And Boron On GrowthParameter And Yield Attributes On Pea (*Pisum Sativum* L.)

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ABSTRACT: The present study was carried out to assess the "Effect of Foliar Application of Zincand Boron on Growth parameters and Yield attributes of Field pea (*Pisum sativum* L.) var. GS- 10." was conducted during the Rabi seasons of 2022-2023 at Crop Research Centre, School of Agriculture, Uttaranchal University, Dehradun. The summers in the region are hot and humid whilethe winters are moderate. The seven treatments were evaluated on the var. GS-10 in Randomized Block Design with three replications. The treatments are T_1 (Control), T_2(RDF + Zn @ 0.5%), T_3(RDF+ Zn @ 0.75%), T_4 (RDF + B @ 0.5%), T_5 (RDF + B @ 0.75%), T_6 (RDF+ Zn @ 0.25% + B @ 0.25%), T_7 (RDF + Zn @ 0.5% + B @ 0.5%). The study revealed that almost growth characters are influenced and found significantly higher by the application of both zinc and boron.The growth characters viz., Plant height, number of branches per plant, number of pods per plant,Leaf area index, number of leaves per plant, green pod yield per plant, were recorded maximum with the application of treatment 7(N_{30} P_{60} K_{80} + Zn @ 0.5% + B @ 0.5%) and the minimum in the control. It shows that the combination of micronutrient along with NPK at recommended dose performed significantly and wide difference regarding parameters. The micronutrients applicationaids in improving crop productivity and yield matters.

INTRODUCTION

Pea (*Pisum sativum* L.) is a leguminous crop that belongs to family Fabaceae and cultivatedwidely all over the world. It is the third most cultivated crop at global level. Being a cool season crop it requires cool growing season with moderate temperature throughout the life. Seeds of peaare rich source of protein amount, carbohydrate content and minerals. The nutritional content of the pea seeds varies according to the varieties and environmental conditions. Many various kindsof soil, including clay and sandy loam, could promote its growth. It performs best when planted insoil with a pH ranging from 6 to 7.5 that drains effectively.

Marketed as a dry, shelled product for use as food for humans or livestock, field peas are sometimes known as dry peas. Field pea contain significant levels of tryptophan and lysine, two essential amino acids that are typically deficient in grain crops. Field peas vary between a 21 to 25% protein content range. Peas make a superior animal feed because they are high in carbohydrates, low in fibre, and contain 86–87 per cent of the nutrients that are digestible. Besides,field pea is helpful in improved soil fertility by biological nitrogen fixation (approx. 30-50 kg nitrogen per hectare) to the soil of organic matter (Erman et al., 2009). Being a leguminous crop, it enriches the soil by fixing atmospheric nitrogen in the soil and also provides an effective cover to the land and thus restricts soil erosion.

A new technique for crop feeding is called foliar spraying, which involves injecting liquid micronutrients into leaves **(Nasri *et al.,* 2011).** Application of micronutrient on leaves is more beneficial than soil application. Since application rates are lower than for applying nutrients to soil, it is easier to apply the same amount of nutrients, and crops respond to nutrient applications right away. Micronutrient foliar spraying is highly beneficial when the roots are unable to supply the required nutrients.

Zinc plays significant role in the production of protein and chlorophyll both, which also controls how much water is absorbed **(J.R. Rohith, *et al.*,2020).** zinc foliar application is very important in crops. The formation of chlorophyll and the operation of pollen both depend on zinc. Lack of zinc and iron led to growth restriction, symbiosis, nodulation, photosynthesis, dry matterproduction, and plant nutritional problem.

Zinc insufficiency has become a significant issue across the country, rising from 44% to 48% and predicted to reach 63% by 2025 due to the intense farming system and high yielding varieties that are depleting the zinc in the soil. The ineffectiveness of soil zinc treatment forced thesearch for alternatives, leading to the study and adoption of numerous modalities **(Yashona *et al.,*2018).** According to several research, zinc application is required for high-quality product, and itsfoliar spray has demonstrated some beneficial benefits in a variety of crops **(Borah L. *et al,*.2021).**

Boron is a essential micronutrient which requires trace amount but its insufficiency affectsthe yield and nutrient uptake

of various crops, particularly in legumes. The growth and development of plants are significantly influenced by boron. Crop plants require boron for cell division, DNA synthesis, calcium absorption, and the transfer of carbohydrates (Bose and Tripathi, 1996). According to **Nonnecke (1989),** boron is crucial for flowering and fruit development.The use of boron and the foliar application of various mineral fertilisers can help farmers produce more peas with high-quality green pods, which is thought to be an important goal **(Moghazy, 2014).** Its absence impacts the movement of starch, sugar, nitrogen, and phosphorus as well as the synthesisof proteins and amino acids **(Stanley et al., 1995).**

MATERIALS AND METHODS

Field experiment was conducted at School of Agriculture, Uttaranchal University, Dehradun, Uttarakhand, during rabi season of 2022-2023. The experimental site is situated in longitude of 30.3446° N, latitude of 77.9546° E at 640 meters (2,100 feet) above sea level. The soil of the experimental plot was sandy clay loam in texture, nearly neutral in soil reaction (pH 7.3). The experiment was laid out in a Randomized Block Design (RBD) with 7 treatments and replicated thrice. GS-10 variety of pea crop was grown in randomized plot design in three replications with 7 treatments. The Treatments comprised of combination of foliar application of zinc and boron along with recommended dose of fertilizers. The source of nitrogen, phosphorus, potash, zinc and boron were urea, single super phosphate, murate of potash, Chelated Zinc EDTA- 12% zinc and Di-sodium Octaborate Tetrahydrate 20% Boron respectively. NPK was incorporatedand applied day before sowing. Zinc foliar application done in two stages one at vegetative stage(30DAS) and another at Flowering stage. Boron foliar application done in 45 days after sowing. The plot area was 6.5 m^2. Growth observations were recorded at 30, 60, 90 DAS and at harvest days after sowing of the crop. Yield attributes were recorded at harvest.

RESULTS AND DISCUSSION

Plant height:

The plant height was observed highest (66.0 cm) at the application of NPK along with foliar application of Zinc @0.5% and Boron @0.5% over control and the lowest (56 cm). This indicates Foliar spraying with boron and zinc was beneficia for growth in terms of plant height, leaf number, branch number, and seed yield **Rajni and Meitei (2004)**. The foliar spray of micronutrient supplies zinc and boron which creates a stimuli in the plant system and enhancing the cell division increasing growth in plant, ultimately promoting the required growth anddevelopment. Similar findings were reported by **Khoja et al. (2002)** and **Verma et al. (2004).**

Number of Leaves:

Application of recommended doses of NPK along with Zinc @0.5% and Boron @0.5% perform the highest number of leaves (65.5 cm) and lowest at control (53.567 cm) bearing per plant. Due to higher fertility levels and application of both micronutrient zinc and boron at higher doses than the rest of the combinations effects the growth and quantity of number of leaves. Similar findings of investigation in accordance with (**Moghazy *et, al.,* 2022, Rajni and Meitei 2004)**. And also **Sajid *et al.,* (2016),** revealed that more number of leaves were observed in plants where zinc was applied as foliar spray.

Number of Branches:

The number of branches bearing was always found maximum (15.3 cm) at application of NPK along with Zn@ 0.5% and B @ 0.5% with higher fertility levels comparing to the other treatment combinations and the lowest found at control (13.8 cm). The maximum number of branches bearing is due to the interaction influence of both zinc and boron along with recommended NPK. Foliar spray of zinc and boron along with RDF also enhance in growth parameters like plant height, number of primary branches per plant, number of secondary branches per plant. Similar findings were stated in accordance with **(Yathis.C. *et, al.,* 2021, Rohith J.R *etal.,* 2020). Thalooth *et al.,* (2006)** also reported that number of branches per plant increased withfoliar application of Zinc EDTA @ 300 ppm on Mungbean grown under water stressed conditions.

Leaf Area Index:

The application of NPK along with Zinc @0.5% and B @ 0.5% significantly increased LAI (4.26 cm) by contributing greater meristematic tissue activity, which increases photosynthetic surface and in return, enhances LAI throughout the crop growth period. It was reported that zinc application accelerated chlorophyll content which impact on LAI by field experiment conducted by **(Jha *et al.,* 2015).** Similarly, **Alam *et al.,* (2010)** also found that the response of micronutrients for vegetable crop leaf area index are significantly influenced by application of Zn.

Number of Pods per Plant:

The highest number of pods (8.70) was observed at Treatment application of NPK along with Zn @0.5% and B @ 0.5% foliar application. The lowest number of pods (6) was found at Control. Foliar application of zinc significantly higher number of pods per plant, seed per pod, seed weight, fresh pod yield and seed yield. Similar findings were reported by **Nasri *et al.,* (2011). Valenciano *et al.,* (2010)** also stated that the response of Zinc application on chickpea and the results showed that application of zinc enhances yield attributes viz; pods/plant, 1000-seed weight.

Green Pod Yield:

Higher yield (4.7 kg) at application of NPK along with Zinc @0.5% and Boron @0.5%, isdue to during the entire crop period micronutrients also improved plant absorption and utilization of available nutrients, increased nitrogen fixation and microbial survival andmultiplication. Similar reports were found with **Gowthami and Rao (2014)** foliar application of zinc and boron increase on growth analysis and seed yield.

Table.1 Effect of foliar application of zinc and boron on growth parameters and yield of Pea

Treatments	Plant height (cm)	Numberof leaves plant^{-1}	Number of Branches plant^{-1}	Leafarea index (LAI)	Numberof Pods plant^{-1}	GreenPod Yield (kg)
T_1 Control	56.0	53.567	13.80	2.47	6	3.533
T_2 NPK (30:60:80) kg per hectare + Zn @0.5% ha^{-1}foliar application	61.0	58.233	15.10	2.81	7.06	3.800
T_3 NPK (30:60:80) kg per hectare + Zn @0.75% ha^{-1}foliar application	63.0	59.167	14.733	3.40	8.33	4.433
T_4 NPK (30:60:80) kg per hectare + B @0.5% ha^{-1} foliar application	58.0	56.1	14.333	3.83	6.13	4.033
T_5 NPK (30:60:80) kg per hectare + B@ 0.75% ha^{-1}foliar application	57.0	56.9	15.067	3.80	6.26	4.633
T_6 NPK (30:60:80) + Zn@0.25% ha^{-1}+ B @0.25% ha^{-1} foliar application	64.33	63.6	15.067	4.06	7.40	4.667
T_7 NPK (30:60:80) + Zn@0.5% ha^{-1} + B @0.5% ha^{-1} foliar application	66.0	65.5	15.300	4.26	8.70	4.700
S.Em	0.126	0.039	0.091	0.038	0.018	0.117
CD(P=0.05)	0.393	0.122	0.285	0.119	0.238	0.037

CONCLUSION:

Application of NPK as per the recommended dosage along with Foliar application of zincand boron @ 0.5 percent and 0.5 percent respectively was found maximum plant height, number of leaves, number of branches, leaf area index, number of pods per plant and green pod per plant than other treatment combinations. All the observations recorded significant. Thus, it can be concluded that the application recommended dose of NPK along with zinc and boron improved soil available nutrient and increase all the mentioned observations.

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REFERENCES:

1. Alam, M. N., Adedin, M. J. and Azad. M. A. K. 2010. Effect of micronutrients on growth andyield of onion under calcareous soil environment. International research Journal ofPlant Science, 1(3):056-061.
2. Borah, L and Jumi Saikia 2021. Effect of foliar application of zinc on growth and yield of garden pea (*Pissum sativum.*L*)* in Assam condition. *International journal of chemical studies* 2021; 9(2): 869-872.
3. C. Yathish, P.S. Fathima, K. Pushpa, R. Krupashree and T. Theerthana. 2021.Effect of foliar application of calcium nitrate, boron on growth, yield and economics of transplanted of pigeonpea. Int.J.Curr.Microbiol.App.Sci(2021) 10 (05):68-78,ISSN:2319- 7706,2021.
4. Gowthami, P., Rao, K.L.N and Lal, A.M. (2018). Effect of foliar application of potassium, boronand zinc on quality and seed yield in soybean. International Journal of Chemical Studies,6(1): 142-144.
5. Jat, B. L., Gupta, J. K., Meena, R. L., Sharma, R. N. and Bhati. D. S. 2015. Effect of foliar application of zinc sulphate and thiourea on productivity and economics of chickpea (Cicer aritenum). Journal of Progressive Agriculture, 5(2):62-65.
6. Khoja JR, Khangarot SS, Gupta AK, Kulhari AK. Effect of fertility and biofertilizers in growthand yield of chickpea. Ann. Pl. Soil Res. 2002;4(2):357-358.
7. Moghazy, A.M., S. E. Saed and E.S. Awad. 2014.The influence of boron foliar spraying with compost and mineral fertilizer on growth, green pods and seed yield of pea. *Nat. Sci.*,12(7):50-57.
8. Nasri, M., Mansooreh Khalatbari, H.A. Farahani. 2011. Zn foliar application influences on quality and quantity features in Phaseolous vulgaris under different levels of N and Kfertlizers. Advances in Environmental Biology. 5(5):

839-846.
9. Nonnecke, I.B.L., 1989, Vegetable production, Avi Book Publishers., New York, USA. Pp.200-229.
10. Rajni K. and Meitei, W.I. (2004). Effect of boron and zinc on growth and yield of French bean(Phaseolus vulgaris L.). Environment and Ecology. 22: 1,83-85.
11. Rohith, J. R., Arun Alfred David and Tarence Thomas. 2020. Effect of different levels of NPK andZinc on Physico-chemical Properties of Soil, Growth and Yield of Pea [Pisum sativum L.] Var. Bliss-101. *Int.J.Curr.Microbiol.App.Sci.* 9(09): 3307- 3312.
12. Sajid, M., Hussain, A., Rab, A., Shah, S.T. and Jan. I. 2016. Influence of zinc as soil and foliar application on growth and yield of okra (Abelmoschus esculentus L.), 2(2):140-145.
13. Stanley, D.W., Bourne, M.C., stone, A.P and Wismer, W.V., 1995, Low temperature blanching effects of chemistry, firmness and structure of canned green beans and carrots.
14. Thalooth AT, Tawfik MM and Mohamed HM (2006). A comparative study on the effect of foliar application of zinc, potassium and magnesium on growth, yield and some chemical constituents of mungbean plants grown under water stress condition. *World J Agric Sci*2:37 -46.
15. Valenciano, J.B., Boto, J. A., Marcelo. V. 2011. Chickpea (Cicer areitinum L.) response to Zinc, Boron and Molybdenum application under field conditions. New Zealand Journal of crop and Horticultural Science, 39(4):217-229.
16. Verma Lallu CB, Yadav RS. Effect of boron and zinc application on growth and yield ofpigeonpea. Indian J Pulses Res. 2004;17(2):149-151.
17. Yashona DS, Mishra US, Aher SB. Response of pigeonpea(Cajanus cajan) to sole . and combined modes of zinc fertilization. *J Pharmacogn Phytochem* 2018; 7(4): 2703-2710.