Int.J.Curr.Microbiol.App.Sci (2018) *7*(9): 817-823

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 09 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.709.097

Effect of Zinc (Zn) and Boron (B) on Growth, Yield and Quality of Cape Goose Berry (*Physalis peruviana* L.)

Sudha Narahari[1*], K.P. Rao[2] and Vijay Bahadur[3]

[1]Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P., India
[2] Department of Biological Sciences, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P., India

**Corresponding author*

Keywords

Micronutrient, Boron, Zinc, Growth, Quality, Yield, Cape gooseberry

Article Info

Accepted:
06 August 2018
Available Online:
10 September 2018

A B S T R A C T

A Field experiment was conducted during the Rabi season of 2017-2018. The experiment conducted of local cape gooseberry variety and ten treatments T_1 Control (Spray Of Water), T_2 (0.1% Zinc+0.1% Boron), T_3 (0.2% Zinc + 0.2% Boron), T_4 (0.3% Zinc + 0.3% Boron), T_5 (0.4% Zinc + 0.4% Boron), T_6 (0.5% Zinc + 0.5%Boron), T_7 (0.6% $ZnSO_4$ + 0.6% Boron), T_8 (0.7% Zinc + 0.7% Boron), T_9 (0.8% Zinc + 0.8% Boron), T_{10} (0.9% Zinc + 0.9% Boron) to evaluate growth yield and quality of Cape Goose Berry (*Physalis peruviana* L.). The treatment T_9 (0.8% Zinc + 0.8% Boron) showed high plant height, leaf area (Cm2), Days to first flowering, Days to 50% flowering, Number of fruits/plant, Average weight of fruit, Fruit yield (q/ha), Acidity, T.S.S, Ascorbic acid, significant differences under Zinc and Boron treatments.

Introduction

The cape gooseberry (*Physalis peruviana* L.) which belongs to the family Solanaceae, has more than 70 species but only a few have economic value. It is native to Brazil.

The cape gooseberry is an annual in temperate regions and a perennial in the tropics. In northern India, it is not cultivated above 1200 m, but in Southern India it thrives up to 1800 m above the mean sea level. It is an herbaceous, semi-shrub that is upright, perennial in subtropical zones and can grow until reaches 0.9 m. The fruit is 4–5 g in weight, remains protected by a calyx and covered by a brilliant yellow peel (Mayorga, *et al.*, 2001). The fruit is rich in vitamins A (3, 000 I.U.), C and B complex namely (thiamine, niacin, and vitamin B 12). It also contains higher amount of vitamin C than orange and is good source of dietary fiber. First flowering of Physalis occurs between 70 and 80 days after seed germination. The period from floral bud initiation to anthesis is 19 to 23 days (Gupta and Roy, 1981).

Many medicinal properties have been attributed to cape gooseberry, including antiast hmatic, antiseptic, and strengthener for the op tic nerve, treatment of throat infections and elimination of intestinal parasites, amoebas as well as albumin from kidneys. It has an anti-ulcer activity and is effective in reducing cholesterol level (Arun and Asha, 2007).

The role of boron in carbohydrate metabolism and translocation of sugars has already been well established and number of physiological disorders in plants is attributed to boron deficiency (Mitra *et al.,* 1990). Boron is an essential micronutrition for higher plants (Blevins and Lukaszewski, 1998). Boron is important in sugar transport, cell wall synthesis and lignification. Cell wall structure, carbohydrate metabolism, RNA metabolism, respiration, indole acetic acid metabolism, phenol metabolism, an d membrane transport (Blevins and Lukaszewski., 1994) Plant enzymes activated by Zn are involved in carbohydrate metabolism, maintenance of the integrity of cellular membranes, protein synthesis, regulation of auxin synthesis and pollen formation (Marschner, 1995). The present study was therefore conducted in order to investigate the effect of Zinc (Zn) and Boron (B) on growth, Yield and fruit quality of Cape gooseberry.

Materials and Methods

The experiment was conducted at field of Horticulture Research Farm, Department of horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, during the period October to April in the year 2017-2018. A portion of recommended dose of nitrogen and entire quantity of phosphatic and potassic fertilizers were applied as basal. The calculated amount of NPK (100, 80 and 60 kg/ha) was applied in each plot, but the nitrogen was applied in two equal split doses after one month of transplanting and remaining dose after two months of transplanting. Organic manure (20 tonnes farm yard manure) was applied fifteen days before planting of seedlings. As per treatment combinations, the calculated quantities of organic manure were applied in experimental plots. Foliar Spray is the method of application of micronutrients to the plant. The micronutrients Zinc (Zn) and Boron (B) are applied in two splits of dosages at the 42 days and 73 days after the transplanting of the plant. (Prakash, O., 2017). The growth characters such as the Plant height, Number of leaves/plant, Leaf area recorded from 25 days after transplanting at an interval of 20 days at successive stages of growth and then mean was calculated. The different dates of first flowering were recorded from the date of sowing. It was considered with the anthesis of flower and the day on which 50% of the plants in each net plot show the flowering was considered as Days to 50% flowering. The yield characters such as the Number of fruits per plant are counted from all the picking for each selected plants. The Polar Diameter and Radial Diameter were measured along and across the periphery with the help of electronic Vernier caliper in centimeter and average length was calculated and statistically analyzed. The Fruit from the tagged plants were selected randomly. The total weight was noted at the time of harvesting and the average weight per fruit was calculated. The quality characters such as Total soluble solids are assessed with the help of Erma Hand Refractometer and data were expressed in °Brix by calibrating at 20^0c, acidity was determined by titration in terms of citric acid and Ascorbic acid by Mukherjee and Choudhuri (1983). The experiment will be conducted in Randomized Design having 10 number of treatments in 3 replications. The seeds of cape goose berry were obtained from the market and were sown in well prepared nursery bed sized of 3.0 m x 1.0 m. After four weeks, seedlings of uniform height (about 15

cm tall) were selected and transplanted in the plots in 1m row to row and 1m plant to plant distance and transplanting is done. The analysis of variance was worked out to test the significant differences among Treatments by F- test. RBD at 5% was used to separate the significant treatment means.

Results and Discussion

Growth characters under Zn and B treatments

The growth parameters under Zn and B treatments were significantly influenced as presented Table 1. The maximum plant height was observed in T_9 (0.8%Zinc +0.8% Boron) (114.33 cm). Similar results were reported by Shnain *et al.,* (2014). Increased plant height might be due to enhanced uptake of nutrients from soil resulting in assimilation of carbohydrates and other metabolic activity (due to leaf number and leaf area) which led to an increase in various plant metabolites responsible for cell division and cell elongation. The number of leaves significantly increased with application T9 (0.8% Zinc +0.8 % Boron) (14.48) at all the dates of observation, however, beyond this dose i.e. (0.8%Zinc +0.8%Boron) significant increase in the number of leaves over control was noticed.

The highest Leaf area recorded was (162.33) in treatment T_9 (0.8%Zinc+0.8%Boron), followed by T_8 (0.7% Zinc+0.7%Boron) was (158.15) and minimum was T_0 (Control) with (102.00). The minimum days to first flowering recorded was (62.00) in treatment T_9 (0.8% Zinc +0.8% Boron), followed by T_8 (0.7%Zinc +0.7% Boron) was (63.00) and maximum was T_1 (Control) with (84.67). Earliness (flowering and fruiting) might be because of better absorption of the nutrients which involved in the metabolic activity and also activated the hormone which influence the earliness in these treatments. Therefore T9 (0.8%Zinc +0.8% Boron), were showed earlier flowering and fruiting. These findings also supported by Manju Nath *et al.,* (2009) who have also reported that earlier flowering with foliar feeding of micronutrients. The reason for early flowering might be due to rapid initial plant growth because of favourable environment and due to proper and appropriate concentrations of micronutrients. Similar results had also been reported by Naz *et al.,* (2012) and Ali *et al.,* (2013).The minimum days to 50% flowering recorded was (69.33) in treatment T_9 (0.8%Zinc +0.8%Boron), followed by T_8 (0.7%Zinc+ 0.7% Boron) was (69.67) and maximum was T_1 (Control) with (96.67).

Yield characters under Zn and B treatments

The growth parameters under Zn and B treatments were significantly influenced as presented Table 2. The highest number of fruit/plant recorded was (82.66) in treatment T_9 (0.8% Zinc + 0.8% Boron), followed by T_8 (0.7% Zinc + 0.7% Boron) was (80.49) and minimum was T_1 (Control) with (38.53). The results obtained are in conformity with the findings of Ali *et al.,* (2013). The highest average fruit weight recorded was (6.20) in treatment T_9 (0.8% Zinc + 0.8%Boron), followed by T_8 (0.7% Zinc +0.7%Boron) was (6.07) and minim um was T_1 (Control) with (3.97). The improvement in this character may be because of better absorption of micronutrient which ultimately increase the accumulation of carbohydrate in the fruits and provide better environment for growth and developmental processes, thus, better results were obtained due to the availability of favourable conditions in these treatments. The results of present investigation are in accordance with the finding of Hatwar *et al.,* (2003), Raghav and Sharma (2003), Rafique *et al.,* (2004) and Bhatt *et al.,* (2006).

Table.1 Growth characters under Zn and B treatments

S. No	Character	Plant height (cm)	No. of leaves/plant	Leaf area (cm^2)	Days to first flowering (days)	Days to 50% flowering (days)
1	**(Control)**	60.67	9.02	102.00	84.67	96.67
2	**(0.1%Zinc+0.1%Boron)**	72.83	10.27	110.33	82	90.33
3	**(0.2%Zinc+0.2%Boron)**	97.83	11.25	115.33	73	85
4	**(0.3%Zinc+0.3%Boron)**	89.50	12.24	121.00	69.33	90.33
5	**(0.4%Zinc+0.4%Boron)**	100.17	12.57	132.33	81	89
6	**(0.5%Zinc+0.5%Boron)**	101.67	12.96	139.00	69.33	79
7	**(0.6%Zinc+0.6%Boron)**	102.67	13.87	141.67	68	76.67
8	**(0.7%Zinc+0.7%Boron)**	107.00	14.02	158.15	63	69.67
9	**(0.8%Zinc+0.8%Boron)**	114.33	14.48	162.33	62	69.33
10	**(0.9%Zinc+0.9%Boron)**	101.00	14.11	152.00	67.67	76
	S.ED	12.267	0.396	5.209	0.717	1.205
	C.D. 5%	25.319	0.817	10.752	1.479	2.487

Table.2 Yield characters under Zn and B treatments

S. No	Character	No. of fruit/plant	Avg. wt of fruit (gm)	Polar Diameter (cm)	Radial Diameter (cm)	Fruit Yield (q/ha)
1	**T1 (Control)**	38.53	3.97	1.67	1.91	92.67
2	**T2 (0.1%Zinc+0.1%Boron)**	42.66	4.60	1.73	2.07	112.50
3	**T3 (0.2%Zinc+0.2%Boron)**	42.75	4.70	1.97	2.16	117.59
4	**T4 (0.3%Zinc+0.3%Boron)**	46.68	5.03	1.90	2.36	135.34
5	**T5 (0.4%Zinc+0.4%Boron)**	55.75	5.33	1.97	2.22	159.76
6	**T6 (0.5%Zinc+0.5%Boron)**	57.62	5.60	1.97	2.07	175.07
7	**T7 (0.6%Zinc+0.6%Boron)**	67.49	5.70	2.13	2.23	207.56
8	**T8 (0.7%Zinc+0.7%Boron)**	80.49	6.07	2.42	2.37	278.17
9	**T9 (0.8%Zinc+0.8%Boron)**	82.66	6.20	2.53	2.50	305.19
10	**T10 (0.9%Zinc+0.9%Boron)**	71.21	5.87	2.30	2.30	225.86
	S.ED	2.048	0.175	0.075	0.114	2.635
	C.D. 5%	2.813	0.362	0.155	0.235	3.278

Table.3 Quality characters under Zn and B treatments

S. No	Character	Ascorbic acid (mg/100g)	Total soluble solids (0Brix)	Acidity (%)
1.	**T1 (Control)**	25	8.67	0.189
2.	**T2 (0.1%Zinc+0.1%Boron)**	33.44	10	0.355
3.	**T3 (0.2%Zinc+0.2%Boron)**	37.33	9.33	0.143
4.	**T4 (0.3%Zinc+0.3%Boron)**	39.18	10	0.384
5.	**T5 (0.4%Zinc+0.4%Boron)**	42.33	10	0.183
6.	**T6 (0.5%Zinc+0.5%Boron)**	47.78	10.33	0.252
7.	**T7 (0.6%Zinc+0.6%Boron)**	51.17	10.67	0.123
8.	**T8 (0.7%Zinc+0.7%Boron)**	56.67	11.67	0.451
9.	**T9 (0.8%Zinc+0.8%Boron)**	60.13	12	0.515
10	**T10 (0.9%Zinc+0.9%Boron)**	54.33	10.67	0.194
	S.ed	2.407	0.607	4.341
	C.D. 5%	4.968	1.252	8.959

The highest Polar Diameter recorded was (2.53) in treatment T_9 (0.8%Zinc+0.8% Boron), followed by T_8 (0.7%Zinc+ 0.7%Boron) was (2.42) and minimum was T_1 (Control) with (1.67). The highest Radial diameter recorded was (2.50) in treatment T_9 (0.8%Zinc +0.8% Boron), followed by T_8 (0.7%Zinc+ 0.7% Boron) was (2.37) and minimum was T_1 (Control) with (1.91). The highest fruit yield (q/ha) recorded was (305.19) in treatment T_9 (0.8% Zinc+0.8%Boron), followed by T_8 (0.7% Zinc +0.7%Boron) was (278.17) and minimum was T_1 (Control) with (92.67) and increase in yield was due to increase in number of fruits per plant, fruit weight.

Quality characters under Zn and B treatments

The quality parameters under Zn and B treatments were significantly influenced as presented Table 3. The highest Ascorbic acid was (60.13) in treatment T_9 (0.8%Zinc+ 0.8% Boron), followed by T_8 (0.7%Zinc+ 0.7% Boron) was (56.67) and minimum was T_1 (Control) with (25.00). The increase in Ascorbic acid content of fruits may be attributed to growth promoting substances which could have accelerated synthesis of carbohydrates, vitamins and other quality characters. This is in line with the findings of Fageria *et al.*, (2002) and Punith Raj *et al.*, (2012).The highest Total Soluble Solids was (12.00) in treatment T_9 (0.8%Zinc+0.8% Boron), followed by T_8 (0.7% Zinc + 0.7% Boron) was (11.67) and minimum was T_1 (Control) with (8.67). The highest Acidity (%) was (0.515) in treatment T_9 (0.8%Zinc+0.8% Boron), followed by T_8 (0.7%Zinc +0.7% Boron) was (0.451) and minimum was T_1 (Control) with (0.189).

Application of T_9 (0.8%Zinc+0.8%Boron) was favourable influence on the growth parameters Plant height (cm), Leaf area (cm^2), and Number of leaves /plant, Days to first flowering, Days to 50% flowering. The increase in yield attributes was due to role of zinc, and boron which Number of fruits per plant, Average of fruit Weight, and Yield (m^2) of cape goose berry. The quality parameters of cape goose berry, acidity, ascorbic acid TSS and markedly improved with application of zinc, and boron. All these quality parameters of head registered significant increase due to application of T_9 (0.8% Zinc+0.8%Boron) along with the recommended dosage and organic manure application over control. Since these results are based on one-year experiment, further trials may be needed to substantiate the results.

References

Arun, M., and Asha, V.V. (2007) *Preliminary studies on ant hepatotoxic effect of Physalis peruviana Linn. (Solanaceae) against carbon tetrachloride induced acute liver injury in rats.* Journal of Ethno pharmacology, 111: 110−114.

Blevins DG, Lukaszewski KM (1994) *Proposed physiologic functions of boron in plants pertinent to animal and human metabolism.* Environ Health Perspect 102 (Suppl 7):31–33.

Blevins DG, Lukaszewski KM (1998*) Boron in plant structure and function.* Annu Rev Plant Physiol Plant Mol Biol 49:481–500.

Gupta, S. K., and Roy, S. K. (1981). *The floral biology of Cape gooseberry (Physalis peruviana L.; Solanaceae, India).* Indian Journal of Agricultural Sciences, 51 (5): 353-355.

Marschner H. *Mineral nutrition in higher plants.* (2^{nd} ed). London; Academic Press; 1995.

Mayorga, H., Knapp, H., Winterhalter, P., and Duque, C (2001) *Glycosidically bound, flavour compounds of Cape gooseberry*

(Physalis peruviana L.*)*. Journal of Agriculture and Food Chemistry 49: 1904−1908.

Mukherjee, S.P. and Choudhari, M.A. (1983). *Implications of water stress-induced changes in the levels of endogenous ascorbic acid and hydrogen peroxide in vigna seedlings*. *Physiol. Plant*., 58: 166-170.

Raj, Punith, T.S., Nagaraja, M.S., Dhumgond, Prabhudev, Reddy, Sharanbhoopal and Shivakumar, K.M. (2012).*Effect of foliar application of secondary and micro nutrients on yield and quality of tomato*. Asian J. Soil Sci., 7 (2): 194-199.

Raja Mohib Muazzam Naz, Sher Muhammad, Abdul Hamid and Farida Bibi (2012). *Effect of boron on the flowering and fruiting of tomato*. Sarhad J. Agric. Vol.28, No.1,

Rawaa ShakirShnain and Prasad V.M. (2014). *Effect of zinc and boron on growth, yield and quality of tomato (Lycopersicon esculentum. Mill) cv. Heem Sohna, under protected cultivation*. European Academic Research. Vol. II, Issue 3.

Sajid Ali, Hafiz Umer Javed, Rana Naveed Ur Rehman, Irfan Ali Sabir, Muhammad Salman Naeem, (2013). *Foliar application of some macro and micro nutrients improves tomato growth, flowering and yield*. International Journal of Biosciences. Vol. 3, No. 10, p. 280-287.

How to cite this article:

Sudha Narahari, K. P. Rao and Vijay Bahadur. 2018. Effect of Zinc (Zn) and Boron (B) on Growth, Yield and Quality of Cape Goose Berry (*Physalis peruviana* L.). *Int.J.Curr.Microbiol.App.Sci.* 7(09): 817-823. doi: https://doi.org/10.20546/ijcmas.2018.709.097