Int.J.Curr.Microbiol.App.Sci (2021) *10*(01): 2190-2195

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 10 Number 01 (2021)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2021.1001.251

Effect of Micronutrient Management Zinc and Boron on Crop Growth, Yield and Quality of Onion (*Allium cepa* L.)

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Keywords

Micronutrient, Zinc, Boron, NPK, growth, Bulb yield, Quality and Onion

Article Info

Accepted:
12 December 2020
Available Online:
10 January 2021

A B S T R A C T

The present study entitled "Effect of micronutrient management zinc and boron on crop growth, yield and quality of Onion (*Allium cepa* L.)" was undertaken in the Horticulture Research Farm, Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj, 211007 during the Rabi season of 2019-2020. The Experiment was laid out in a Randomized Block Design with 10 treatments and 3 replications. Results revealed that the application of T_9:3.5 Zn + 3.5 B + RDF (100:50:50) influenced most of the characteristics significantly and recorded the highest values of plant height (73.52), number of leaves plant^{-1} (10.45), neck diameter (1.42 cm) fresh weight of bulb (94.18), dry weight of bulb (89.51), days to first bulb harvesting (49.71), diameter of bulb (9.65cm), bulb yield per plot (18.84), bulb yield (t ha^{-1}) (62.79), ascorbic acid (mg/10g fresh weight) (14.35) and TSS (ºBrix) (11.93).

Introduction

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops cultivated extensively in India and it belongs to family Alliaceae. It is liked for its flavour and pungency which is due to the presence of a volatile oil 'allyl propyl disulphide'- organic compound rich in sulphur. The bulb is a rich source of minerals like phosphorus, calcium and carbohydrates. It also contains protein and vitamin C. It has got good medicinal value.Itis one of the most important monocotyledonous, cross-pollinated and cool season vegetablecrop. Onion has its own distinctive flavor, used in soups, meat dishes, salads and sandwiches and is cooked alone as a vegetable.

India is the world's second largest producer of vegetables next to China. According to estimation, India produces 87.50 million tonnes of vegetables from an area of 5.80 million hectares. Thus, India shares about 12% of world's output of vegetables (Thamburaj and Singh, 2001). Due to lower yields, though India has the highest area under onion, it stands second in the production of onion in the world. India is also the largest exporter of onion. Productivity

could be increased by use of suitable varieties.

Onion (*Allium cepa* L.), the "Queen of Kitchen" is one of the most important commercial crops not only in India but also in the world (Selvaraj,1976; Griffiths *et al.*, 2002). It`s pungency is due to the presence of volatile oil "Allyl propyl di sulphide" (Khan *et al.,* 2007).Generally100 g of edible bulb of onion contains 86.6 g of moisture, 11.0 g of carbohydrates, 1.2 g of protein, 0.6 g of fibre and 0.4 g of minerals. It also contains calcium (180mg), phosphorous (50 mg), iron (0.7mg), thiamine and nicotinic acid (0.4mg).

Zinc plays vital role in carbohydrate metabolism. It is involved in diverse range of enzyme system. Zinc is taken up by plants as Zn+2. The functional role of Zn includes auxin metabolism, influence on the activities of dehydrogenase and carbonic anhydrate enzymes, synthesis of cytochrome and stabilization or ribosomal fraction (Tisdale *et al.,* 1984).

Boron is one of the important micronutrient for onion production and is essential for cell division, nitrogen and carbohydrate metabolism, protein formation and water relation in plant growth (Brady, 1990). Although it is quickly taken up from the soil, it is relatively immobile in the plant. It is important to maintain the correct balance of calcium, nitrogen and boron in the soil. High calcium and high nitrogen levels can reduce boron uptake. Boron deficiency has been observed in soils with high organic matter contents.

Materials and Methods

The experiment was conducted in the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during Rabi Season (October – March, 2019-2020).The variety used in this experiment is Nasik Red N-53, which were collected from local Prayagraj market (Alopibhag). The observations were recorded on five randomly selected plants per replication was conducted in Randomized block design (RBD) with 10 treatments and 3 replications T_0:Control, T_1:3 Kg Zn +RDF (100:50:50), T_2:5 Kg Zn +RDF (100:50:50),) , T_3:7 Kg Zn + RDF (100:50:50), T_4:3 Kg B + RDF (100:50:50), T_5:5 Kg B +RDF (100:50:50), T_6:7 Kg B +RDF (100:50:50), T_7:1.5+ 1.5 Zn + B + RDF (100:50:50), T_8:2.5+ 2.5Zn + B+ RDF (100:50:50), T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50). Onion is a high nutrient requiring crop and it responsive well to nutrition.

Application of "B" can increase bulb size, no. of scales/bulb and yield of onion and application of "Zn" as foliar spray recorded significantly higher in plant height &other growth parameters. Soto check this research trial was laid on "Effect of micronutrient management of Zinc and Boron on crop growth, yield and quality of Onion" with the following objectives are to find out suitable treatments of micro nutrient management along with RDF for crop growth, yield and quality of onion and to work out the economics of treatments. The significance and non – significance of the treatment effect was judged with the help of "F'' variance ratio test. Calculated "F" value was compared with the table value of F "at 5 % level of significance.

Results and Discussion

The Experiment was conducted to determine the "Effect of micronutrient management zinc and boron on crop growth, yield and quality of Onion (*Allium cepa* L)". The results of the experiment are summarized below table 0.1

Table.1 Performance of Micro nutrient management zinc and boron on crop growth, yield and quality of onion (*Allium cepa*. L) N-53

Treatment Symbol	Treatment combination	Plant height 90 DAS	No.of leaves per plant 90 DAS	Neck diameter (cm)	Days to first bulb harvesting	Fresh weight of bulb (g)	Dry length of bulb (g)	Bulb diameter (cm)	Bulb yield per plot (kg) $4m^2$	Bulb yield (t/ha)	Ascorbic Acid (mg/100 g fresh wt.)	TSS (^{0}Brix) (%)
T_0	Control	55.81	4.95	1.05	78.85	63.14	56.82	6.33	12.63	31.57	11.68	10.68
T_1	3 Kg Zn +RDF (100:50:50)	63.95	6.48	1.16	61.54	81.20	73.08	8.61	16.24	40.60	12.32	11.48
T_2	5 Kg Zn +RDF (100:50:50)	64.97	6.16	1.20	63.52	78.60	70.74	9.16	15.72	39.30	14.20	11.60
T_3	7 Kg Zn + RDF (100:50:50)	64.47	6.88	1.29	58.83	86.62	77.95	8.97	17.32	43.30	13.55	11.40
T_4	3 Kg B + RDF (100:50:50)	69.47	7.71	1.25	51.24	87.85	79.06	8.58	17.57	43.92	14.32	11.56
T_5	5 Kg B + RDF (100:50:50)	68.47	7.65	1.28	51.60	82.54	74.28	8.45	16.51	41.27	13.10	11.66
T_6	7 Kg B + RDF (100:50:50)	64.15	8.13	1.26	57.44	79.71	71.73	8.75	15.94	39.85	13.44	11.61
T_7	1.5Kg Zn + 1.5Kg B+ RDF (100:50:50)	65.74	9.15	1.38	56.47	89.32	80.38	9.34	17.86	44.65	13.62	11.84
T_8	2.5 Kg Zn+2.5 Kg B+RDF (100:50:50)	68.83	8.40	1.36	52.45	88.75	79.87	9.48	17.75	44.37	13.36	11.80
T_9	3.5Kg Zn + 3.5 Kg B+ RDF(100:50:50)	73.52	10.45	1.42	49.71	94.18	84.76	9.65	18.84	47.10	14.35	11.93
F-Test		**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S.Ed. (+)		**1.566**	**0.418**	**0.024**	**0.282**	**1.656**	**0.032**	**1.118**	**0.331**	**0.019**	**0.205**	**0.282**
C. D. at 0.5		**3.290**	**0.879**	**0.050**	**0.592**	**3.479**	**0.067**	**2.349**	**0.696**	**0.041**	**0.431**	**0.592**

The maximum plant height (73.52) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50) and the minimum plant height was recorded as (55.81) in treatment $T_{0:}$ Control.

The maximum number of leaves plant^{-1} (10.45) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50) and minimum number of leaves plant^{-1} was recorded as (4.95) in treatment $T_{0:}$ Control. The maximum Neck diameter (cm) (1.42cm) was recorded in treatment T_9:3.5+3.5 Zn + B + RDF (100:50:50). The minimum Neck diameter (cm) (1.05cm) was recorded in treatment T_0 Control.

The maximum fresh weight of bulb (94.18) was recorded in treatment T_9:3.5+ 3.5 Zn+ B+ RDF (100:50:50) and the minimum fresh weight of bulb (63.14) was recorded in the treatment T_0 Control.

The maximum dry weight of bulb (84.76) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50) and the minimum dry weight of bulb (56.82) was recorded in the treatment T_0 Control. The minimum days to first bulb harvesting (49.71) was recorded in treatment T_9:3.5+3.5 Zn + B+RDF (100:50:50) and maximum days to first harvesting (78.85) was recorded in treatment $T_{0:}$ Control.

The maximum diameter of bulb (9.65cm) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50) and minimum diameter of bulb (6.33cm) was recorded in treatment $T_{0:}$ Control. The maximum bulb yield per plot (18.84) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50) and minimum bulb yield per plot (12.63) was recorded in treatment T_0 Control.

The maximum bulb yield (t ha^{-1}) (47.10) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50) and minimum bulb yield (t ha^{-1}) (31.57) was recorded in treatment $T_{0:}$ Control.

The maximum ascorbic acid (mg/10g fresh weight) (14.35) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50) and minimum ascorbic acid (mg/10g fresh weight) (11.68) was recorded in treatment $T_{0:}$ Control. The maximum TSS (^{0}Brix) (%) (11.93) was recorded in treatment T_9:3.5+ 3.5 Zn + B+ RDF (100:50:50). The minimum TSS (^{0}Brix) (10.68%) was recorded in treatment $T_{0:}$ Control.

In conclusion among the various levels of micronutrient (Zinc and Boron) and NPK used in the experiment, treatment T_9:3.5 Zn + 3.5 B + RDF (100:50:50) for plant height (73.52), number of leaves plant^{-1} (10.45), fresh weight of bulb (94.18), dry weight of bulb (84.76), days to first bulb harvesting (49.71), diameter of bulb (9.65cm), bulb yield per plot (kg) (18.84), bulb yield (t ha^{-1}) (47.10), ascorbic acid (mg/10g fresh weight) (14.35) and TSS (^{0}Brix) (%) (11.93) was the best for the maximum growth, yield and quality of onion under Prayagraj Agro-climatic condition when compared with control and the other treatments.

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How to cite this article:

Chandan, S., P. L. Kumar and Deepanshu. 2021. Effect of Micronutrient Management Zinc and Boron on Crop Growth, Yield and Quality of Onion (*Allium cepa* L.). *Int.J.Curr.Microbiol.App.Sci.* 10(01): 2190-2195.
doi: https://doi.org/10.20546/ijcmas.2021.1001.251