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Research Article

EFFECT OF ZINC AND BORON ON GROWTH AND YIELD OF TRANSPLANTED ONION (*ALLIUM CEPA* L.) IN ALIFISOLS OF TAMIRABARNI TRACT

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Abstract: Field experiment was conducted at Agriculture College and Research Institute, Killikulam, Tamil Nadu during *rabi* season of 2017-18 to study the effect of soil test crop response (STCR) application of N, P and K along with zinc and boron on growth and yield onion. The experiment was laid out in a randomized block design with three replications. Biometrics such as plant height, number of leaves per plant, fresh leaves weight, bulb lets clump^{-1}, polar diameter, equatorial diameter, weight of bulb and bulb yield were recorded. The growth and yield were significantly influenced by the soil and foliar application of zinc and boron with STCR dose of NPK. Application of STCR (106:97:54 kg of NPK ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + 0.5% foliar spray significantly influenced the growth, yield characters and bulb yield. The lowest growth, yield characters and bulb yield were recorded under control. The fertilizer treatment of STCR (106:97:54 kg of NPK ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} with 0.5% foliar spray was found to be the best suitable method and dose for transplanted onion production.

Keywords: *Onion, STCR, Zinc, Boron, Growth, Bulb yield*

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Introduction

Onion (*Allium cepa* L.), the 'Queen of Kitchen' is one of the major important commercial vegetable crops cultivated extensively in India. It belongs to the family Alliaceae. Onion is the cool season crop. However, it can be grown under wide range of agro-climatic condition. It grows well under mild climate without extreme heat or cold or extreme rainfall. The edible part of onion is green leaves, immature and mature bulbs. Onion has strong flavor due to presence of sulphur containing compound in very small quantity in the form of volatile oil allyl propyl disulphide responsible for distinctive smell and pungency. Essential amino acids like lysine and phenylalanine are present in onion bulb. It is cultivated for food, medicines, religious purpose, spices and condiments since early times. It has medicinal and diuretic properties, relieves heat sensation, hysterical faintness, insect bites and also heart stimulation [1]. India ranks second position in both area and production after China in the world. In India, onion is being grown in an area of 12.94 lakhs ha with production of 2017.18 tonnes and the productivity is 16.8 t ha^{-1} during 2016-17. The total area under onion production in Tamil Nadu was 347.03 MT in an area of 34.08 thousand ha with the productivity of 10.18 t ha^{-1}[2]. The low production of onion is due to improper application of fertilizers and growing unsuitable varieties under the agro-climatic condition of an area. Optimum fertilizer application for onion and cultivation of suitable varieties in proper environment are necessary for obtaining good yield of onion. Among the many constraints for low productivity in onion, imbalanced nutrition is the main limiting factor[3]. Micro nutrients play an active role in the plant metabolic process from cell wall development to respiration, photosynthesis, chlorophyll formation, enzymes activity, nitrogen fixation *etc*. It also plays an essential role in improving better growth, yield and quality [4]. Soil application of micronutrients during crop growth period was successfully used for correcting their deficits and improving the mineral status of plant [5].

The onion like any other crops not only needs macronutrients, but also micronutrients in adequate and balanced amounts [6]. Zinc is a micronutrient which is required plant growth and development relatively in small amount. Zinc is involved in the formation of chlorophyll and carbohydrate and is also involved in a diverse range of enzyme system [7]. Improvement in onion growth and yield has been reported through micronutrient by many scientists at different types of soils. However little information is available on the use of zinc and boron with inorganic fertilizers for onion in Alfisols of Tamirabarani tract. Keeping this in view, the experiment was undertaken.

Materials and Methods

The investigation was carried out at Agricultural College and Research Institute, Killikulam, Tamil Nadu during the *rabi* season of 2017-2018 in onion variety of CO (On) 5, to study the effect of soil test crop response application of N, P, K along with zinc and boron. Killikulam is situated in the southern agro climatic zone of Tamil Nadu in Thoothukudi district at 80°46' latitude and 77°42' longitude and at an altitude of 40 m above MSL. The mean annual rainfall at Agricultural college and research institute, Killikulam is 750 mm. The minimum and maximum temperature prevailed during the crop growing season are from 26.3°C to 35°C respectively. The experiment soil is reddish brown sandy clay loam with low in organic carbon (0.46%), pH 6.68, non-saline, electrical conductivity (0.22 ds/m), available nitrogen (236 kg ha^{-1}), available phosphorus (16.8 kg ha^{-1}), available potassium (245 kg ha^{-1}) and available zinc (1.02 ppm) and Boron (0.32 ppm). Zinc sulphate as a zinc source and borax for boron were used in different doses and methods for this experiment and based on the soil test values N, P, K fertilizer were added. The experiment consists of eight treatments *viz*., STCR as 106:97:54 kg of NPK ha^{-1}, STCR + $ZnSO_4$ @ 25 kg ha^{-1}, STCR + $ZnSO_4$ @ 0.5% foliar spray, STCR + $ZnSO_4$ @ 25 kg ha^{-1}+ 0.5% foliar spray, STCR + borax @ 10 kg

Table-1 *Effect of STCR fertilizer along with Zinc and Boron on growth parameters of onion*

Treatments	Plant height (cm)	Number of leaves plant^{-1}	Fresh leaves weight (g)	Total dry matter production (t ha^{-1})	
				Plants	Bulbs
T1 – STCR as 106:97:54 kg of NPK ha^{-1}	46.8	12.8	13.5	0.85	2.74
T2 - STCR + $ZnSO_4$ @ 25 kg ha^{-1}	50.2	15.2	17.8	1.12	4.46
T3 - STCR + $ZnSO_4$ @ 0.5% foliar spray	48.4	14.1	15.5	0.98	3.46
T4 - STCR + $ZnSO_4$ @ 25 kg ha^{-1} + 0.5% foliar spray	55.2	17.2	21.6	1.49	4.83
T5 - STCR + Borax @ 10 kg ha^{-1}	49.5	14.3	16.8	1.09	3.87
T6 - STCR + Borax @ 0.5% foliar spray	46.6	13.4	14.6	0.89	3.18
T7 - STCR + Borax @ 10 kg ha^{-1} + 0.5% foliar spray	52.2	16.2	19.3	1.22	4.62
T8 – control	44.8	11.9	11.7	0.61	2.48
SEd	0.68	0.43	0.44	0.32	1.16
CD (p = 0.05)	1.47	0.90	0.92	0.68	2.48

Table-2 *Effect of STCR fertilizer along with Zinc and Boron on yield attributes and bulb yield*

Treatments	Polar diameter (cm)	Equatorial diameter (cm)	Bulb lets clump^{-1}	Bulb weight (g)	Bulb yield (t ha^{-1})
T_1 – STCR as 106:97:54 kg of NPK ha^{-1}	2.12	1.94	4.3	62.8	12.42
T_2 - STCR + $ZnSO_4$ @ 25 kg ha^{-1}	2.74	2.56	5.6	77.6	15.14
T_3 - STCR + $ZnSO_4$ @ 0.5% foliar spray	2.53	2.32	5.1	69.8	13.73
T_4 - STCR + $ZnSO_4$ @ 25 kg ha^{-1} + 0.5% foliar spray	3.35	2.98	6.4	85.2	16.85
T_5 - STCR + Borax @ 10 kg ha^{-1}	2.58	2.37	5.3	73.7	14.3
T_6 - STCR + Borax @ 0.5% foliar spray	2.38	2.18	4.8	66.6	13.23
T_7 - STCR + Borax @ 10 kg ha^{-1} + 0.5% foliar spray	2.97	2.62	6.1	81.5	15.92
T_8 – Control	1.84	1.63	3.7	57.8	9.67
SEd	0.1	0.12	0.11	1.74	0.35
CD (p = 0.05)	0.22	0.26	0.26	3.54	0.74

ha^{-1}, STCR + borax @ 0.5% foliar spray, STCR + borax @ 10 kg ha^{-1} + 0.5% foliar spray and Control. Foliar application was done at 30 and 45 days after transplanting. Observations on growth, yield characters and bulb yield were recorded. The data were subjected to statistical analysis as prescribed by [8].

Results and Discussion

Effect of STCR fertilizer along with Zinc and Boron on growth characters

The growth characters such as plant height, number of leaves, fresh leaf weight and total dry matter production were influenced significantly due to application of soil test crop response (STCR) application of N, P and K along with zinc and boron [Table-1]. In the present study, application of STCR + $ZnSO_4$ @ 25 kg ha^{-1} + 0.5% foliar spray significantly exhibited its superiority to increase the maximum plant height (55.2 cm), number of leaves (17.2), fresh leaf weight (21.6 g) and total dry matter production of plants (1.49 t ha^{-1}) and bulbs (4.83 t ha^{-1}). It was followed by the application of STCR + Borax @ 10 kg ha^{-1} + 0.5% foliar spray. It is quite obvious that the experimental soil is deficient in zinc and boron and external application would have favorably enhance the growth of onion. The results are in conformity with the findings of [9] and [10].

Effect of STCR fertilizer along with Zinc and Boron on yield attributes and yield

The data strongly showed that there was a significant effect of soil and foliar application of zinc and boron along with STCR fertilizers on yield attributes and yield of onion [Table-2]. Significantly maximum values for polar diameter (3.35 cm), equatorial diameter (2.98 cm), bulb lets clump^{-1} (6.4), average bulb weight (85.2 g) and bulb yield (16.85 t ha^{-1}) were recorded in STCR fertilizer with $ZnSO_4$ @ 25 kg ha^{-1} and 0.5% foliar spray. Further the improvement of bulb yield was due to better vegetative growth as observed in the present study. This result corroborates the findings of [11] who reported that a high yield was a reflect of vigorous vegetative growth and healthy plants. Similar findings have also been reported in onion by [12-14]. The increase in total bulb yield was 42.6 percent over control treatment. The next best treatment was the application of STCR + borax @ 10 kg ha^{-1} with 0.5% foliar spray which had significantly superior to all other treatments. The results are in confirmation with the findings of [15] and [16]. The lesser bulb yield was recorded in control treatment which registered 9.71 t ha^{-1}. This might be due to unavailability of required quantity of nutrient present in soil during crop period. This is in conformation with earlier finding of [17].

Conclusion

Based on the experimental finding, it can be concluded that application of soil test crop response application of N, P and K along with zinc and boron could improve plant growth, yield parameters and onion bulbs. Thus, based on the support warranted from the above data, it can be concluded that growing of onions by judicious use of combined application of the fertilizer treatment of STCR (106:97:54 kg of NPK ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} with 0.5% foliar spray is the best practice in sustaining productivity and soil health and hence can be practiced by the growers effectively under the Alifisols of Tamirabarni tract.

Application of research: Study of combined application of the fertilizer treatment

Research Category: Soil Science

Abbreviations: STCR: Soil Test Crop Response

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Conflict of Interest: None declared

Sample Collection: Agricultural College and Research Institute, Killikulam, Tamil Nadu during the *rabi* season of 2017-2018

Cultivar / Variety name: Onion variety of CO (On) 5

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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References

[1] Khatemenla, Singh V.B., Trudy Tengse, Sangma A. and Maiti C.S. (2018) *Int. J. Curr. Microbiol. App. Sci*., 7(4), 3673-3685.

[2] Agriculture statistical year book (2017) *Government of India Ministry of Statistics and programmeImplementation http,//mospi.nic.in/statistical-year- book-india/2017/177*

[3] Bhat T.A., Chattoo M.A., Mushtaq F., Akhter F., Mir S.A., Zargar M.Y., Wani K.P., Shah M.D., Ejaz and Parry A. (2018) *Int.J.Curr.Microbiol.App.Sci*., 7(4), 3776-3783.

[4] Alam M.N., Abedin M.J. and Azad M.A.K. (2010) *Int. Res. J. Plant Sci*., 1, 56-61.

[5] Kurtz C. and Ernani P. R. (2010) *Revista Brasileira de Ciencia do Solo* 34, 133-142.

[6] Ballabh Rana and Rawat S.S. (2013) *Indian J. Hort.,* 70(2), 260-265.

[7] Tisdale S.L., Nelson W.L. and Beaten J.D. (1984) *Soil Fertility and Fertilizers. Macmillan Publishing Company, New York. Fourth Edition pp*. 382-391.

[8] Gomez K.A. and Gomez A.A. (1984) *Edition 2., p 680 John Wiley and Sons, NewYork,*

[9] Verma S.K., Singh S.S. and Awasthi C.P. (1995) *Vegetable Sci*., 22, 5-8.

[10] Manna D. and Maity T.K. (2016) *J. Plant Nutrition*., 39(3),438-441.

[11] Hatwar G.P., Gondane S.U., Urkude S.M. and Gahukar O.V. (2003) *J. Soil Crops*, 13,123-125.

[12] Khan A.A., Zubair M., Bari A. and Maula F. (2007) *Sarhad J. Agric.,* 23, 933-936.

[13] Thakare R.G., Jadhao B.J., Nandre D.R., Ghawade S.M. and Khewale P. (2007) *Indian J. Plant Archs*., 7(1),275-276.

[14] Waqar A., Niaz A., Kanwal R. and Khalid R. (2009) *J.Agric. Res*. 2, 47-52.

[15] Suman, Kumar R. and Singh S. (2002) *J Applied Bio*., 12(1/2), 40-46.

[16] Devi K.N., Singh L.N.K., Singh M.S., Singh S.B. and Singh K.K. (2012) *J. Agric.Sci*.,4(4),1-10

[17] Nasreen S., Haque M.M. and Hossain M.A. (2007) *Bangladesh J. Agric. Res*., 32(3),413-420.