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Short Note

GROWTH, YIELD AND BULB QUALITY OF ONION (*Allium cepa* L.) IN RESPONSE TO FOLIAR APPLICATION OF BORON AND ZINC

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Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops and is widely grown in almost all over the world. Onion has its own distinctive flavour and is used in soups, different dishes, salads, sandwiches and is also cooked alone as a vegetable. Its pungency is due to the presence of *allyl propyl disulphide*, a volatile oil (Malik, 1994). It contains carbohydrates, protein, vitamin A, thiamine, riboflavin, niacin and ascorbic acid.

India ranks next to China, accounting for 26.8 percent of world area and 19.9 percent of onion production. The area and production of onion in India are about 1.064 million hectares and15.1 million tonnes of bulb, respectively, with an average yield of 14.2 t ha^{-1} (Anonymous, 2011). The yield is very low as compared to the world average yield of 19.1 t ha^{-1}. Intensive cropping, imbalanced fertilization and minimal usage of micronutrients and limited application of organic manures have resulted in the depletion of soil fertility in India. Boron and zinc are the most important micro-nutrients and are essential for cell division, nitrogen and carbohydrate metabolism and water relation in plant growth (Brady, 1990). Application of boron can increase bulb size, number of cloves/bulb and yield of onion (Smriti et al., 2002). Response of onion to zinc application has also been reported (Lal and Maurya, 1981). Mishra et al., (1990) have shown that application of $ZnSO_4$ (0.5%) and $FeSO_4$ (1.0%) as foliar spray recorded significantly higher plant height and other growth parameters as compared to other treatments in onion. However, information on the use of micronutrient in combination with inorganic fertilizers for onion is scanty in India. Therefore, an attempt was made to study the response of onion to zinc sulphate and boric acid application in presence of nitrogen (N), phosphorus (P), potash (K), and sulphur (S) in the New Alluvial Zone of West Bengal.

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The study was done at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal (23.5°N latitude, 89°E longitude having an average altitude of 9.75m from the sea level) on Onion cultivar Sukhsagar during rabi season (November- April) of 2010 and 2011. The seedlings were planted at a spacing of 15 cm x 10 cm, and recommended cultural practices were followed. Before fertilizer application, random soil samples were taken from the experimental site and were analyzed. The analysis revealed that the field contained 0.04% N; 22.61 kg ha^{-1} P; 183.21 kg ha^{-1} K; 0.25 ppm boron and 0.43 ppm Zinc; 0.35% Organic carbon and had a pH of 6.8.

The experiment was conducted in a randomized block design with four replications. The treatments included 4 levels of boron (0, 0.1, 0.2 and 0.5 %) and 4 levels of zinc (0, 0.1, 0.2 and 0.5 %). Onion plants were sprayed three times with these micronutrients at monthly intervals starting from 30 days after transplanting. The crop was planted, fertilized and irrigated as per the recommended practices. Ten plants were selected from each plot as a unit for all observations on growth and yield. Based on the net plot yield, yield per hectare was calculated and expressed in tonnes per hectare. Total soluble solids (TSS) were determined by Refractometer, and pyruvic acid content of onion bulb was estimated by using standard method given by Yov et al. (1995). Statistical analysis was done using standard procedure given by Panse and Sukhatme (1978). Foliar application of boric acid and zinc sulphate ($ZnSO_4$) significantly improved vegetative growth, yield and quality of onion (Table 1).

Application of 0.5% boron significantly increased the plant height (63.9 cm) over control. No significant differences were detected in case of number of leaves per plant. Maximum number of leaves (7.25) was recorded with 0.1% boron. This result is in conformity with that of Dake et al. (2011), who reported improvement in growth, yield and quality of onion cv. Baswant 780 with application of boron. Application of boron caused significant improvement in bulb diameter, neck thickness, individual bulb weight, marketable and total yield. Maximum bulb diameter (4.84 cm), neck thickness (1.39 cm), bulb weight (57.1 g) was produced by 0.5% boron leading to highest marketable (25. 9 t h^{-1}) and total yield (30.7 t h^{-1}) of onion. Similar results were obtained by Smriti et al. (2002). Dry matter content in bulb was also significantly increased with the application of boron. Foliar application of boron and zinc significantly affected quality parameters of onion in terms of total soluble solid (TSS) and pyruvic acid content. These results are in conformity with those of Sliman et al. (1999). Maximum plant height (67.25 cm) was recorded with 0.5% $ZnSO_4$ and it was observed that zinc application significantly affected plant height but not the number of leaves, similar results were reported by Mishra et al. (1990). Application of zinc had significant effect on yield and yield contributing characters. The highest values of bulb diameter (5.1 cm), neck thickness (1.5 cm), individual bulb weight (57.0 gm), marketable (31.5 t h^{-1}) and total yield (33.3 t h^{-1}) were recorded with 0.5% $ZnSo_4$ while the lowest with control (0% $ZnSo_4$). The

results of Khan et al., 2007 and Mukesh et al. 2000 are similar to the present study. Dry matter content in bulb significantly increased with the application of zinc as compared to the control. Meena and Singh (1998) reported that zinc significantly increased dry weight of bulb. Foliar application of zinc significantly affected quality parameters i.e., total soluble solid (TSS) and pyruvic acid content of onion. These results conform the findings of Abd El-Samad et al. (2011).

The favourable effect of micronutrients on plant growth might be due to their role in many physiological processes and cellular functions within the plants. In addition, they play an essential role in improving plant growth, through biosynthesis of endogenous hormones which are responsible for promoting of plant growth (Battal, 2004 and Hänsch and Mendel, 2009). The yield improvement was due to better growth and development. Higher photosynthates accumulation in the bulbs would ensure higher individual bulb weight, large bulb diameter and neck thickness. From the above results, it can be concluded that, the foliar application of boron and zinc @ 0.5% significantly enhance the growth, yield and quality of onion in the New Alluvial Zone of West Bengal.

REFERENCES

Abd El-Samad, E.H., Khalifa, R.Kh.M., Lashine, Z.A. and Shafeek, M.R. 2011. Influence of Urea Fertilization and Foliar Application of Some Micronutrients on Growth, Yield and Bulb Quality of Onion. *Australian Journal of Basic and Applied Sciences*, 5(5): 96-103.

Battal, P. 2004. Effects of some mineral nutrients on gibbrellic acid levels in maize plants. *Economic Botany*, 58(2): 195-203.

Brady, N.C. 1990. The nature and properties and soils. 10th edition, A.K. Ghosh. Printing-Hall of India Pvt. Ltd., New Delhi. p. 383.

Dake, S.D., Hiwale, B.G., Patil, V.K. and Naik, P.G. 2011. Effect of micronutrients on growth, yield and quality of onion (*Allium cepa* L.) cv. Baswant 780. National symposium on Alliums: current Scenario and Emerging Trends, 12-14 March, 2011, Pune. pp-205.

Hänsch, R. and Mendel, R.R. 2009. Physiological functions of mineral micronutrients (Cu, Zn, Mn, Fe, Ni, Mo, B, Cl). *Current Opinion in Plant Biology*, 12: 259-266.

Khan, A.A., Zubair, M., Bari, A. and Maula, F. 2007. Response of onion (allium cepa) growth and yield to different levels of nitrogen and zinc in swat valley. *Sarhad Journal of Agriculture*, 23(4): 933-936.

Lal, S. and Maurya, A. N. 1981. Effect of zinc on onion. *Haryana J. Hort. Sci.* 10**:** 231-235.

Malik, M.N. 1994. Bulb crops, Onion. In Horticulture.National Book Foundation Islamabad Pakistan. pp. 500- 501.

Meena, O.S., and Singh, D. 1998. Effect of sulphur and zinc application on onion yield and sulfur and zinc uptake in three Soil Orders. *Journal of the Indian Society of Soil Science,* 46(4): 636-640.

Mishra, H. P., Singh, K. P. and Yadav, J. P. 1990. Influence of Zn, Fe, B and Mn and their uptake on onion grown in calcareous soil. *Haryana Journal of Horticultural Sciences*, 19(1&2): 153-159.

Mukesh, K., Das, D.K., Chattopadhyay, T.K. and Kumar, M. 2000. Effect of zinc and sulfur application on yield and quality of onion (*Allium cepa* L.). *Environment and Ecology*, 18(3): 561-565.

NHB. 2011. Indian horticulture database, 2011. National Horticulture Board (NHB), Gurgaon. p. 162-169.

Panse, V. G. and Sukhatme, P. U. 1978. Statistical Methods for Agricultural Workers, *Indian Council of Agriculture Research,* New Delhi.

Sliman, Z.T., M.A. Abdelhakim and A.A. Omran, 1999. Response of onion to foliar application of some micronutrients. *Egyptian Journal of Agricultural Research*, 77(3): 983-993.

Smriti. S., Kumar, R. and Singh, S. K. 2002. Effect of sulphur and boron nutrition on growth, yield and quality of onion *(Allium cepa* L.). *Journal of Applied Biology*, 12**:** 40-46.

Yov, K. S., Pike, L. M. and Hamilton, B. K. 1995. A simplified pyruvic acid analysis suitable for onion breeding programs. *Horticulture Science*, 30(6): 1306.

Table 1: Effect of foliar spraying of boron and zinc on growth, yield and quality of onion. (Pooled data for two year)

Treatments	Plant height (cm)	Leaf number	Bulb diameter (cm)	Neck thickness (cm)	Bulb weight (g)	Marketable yield ($t.ha^{-1}$)	Total yield ($t.ha^{-1}$)	TSS (^{0} B)	Dry matter (%)	Pyruvic acid ($\mu mol\ g^{-1}$)
Boron (%)										
0	53.50	5.75	4.29	1.11	44.31	18.81	21.59	9.77	13.42 (21.47)	3.05
0.1	56.25	6.56	4.68	1.22	50.70	21.03	23.41	11.62	13.99 (21.89)	3.88
0.2	60.275	6.87	4.77	1.30	54.90	24.50	27.47	12.72	14.11 (22.06)	4.19
0.5	63.93	7.25	4.84	1.39	57.14	25.89	30.74	13.45	14.65 (22.54)	5.94
CD at 5%	7.267	NS	0.275	0.152	4.981	2.237	2.713	2.396	0.761	0.651
Zinc (%)										
0	60.14	5.92	3.97	1.19	43.95	19.62	24.43	9.60	13.83 (21.81)	2.85
0.1	62.95	6.50	4.35	1.29	47.57	27.59	30.53	11.52	14.06 (22.06)	3.32
0.2	65.75	7.05	4.80	1.40	51.77	28.73	31.17	12.55	14.24 (22.14)	4.23
0.5	67.25	7.75	5.13	1.47	57.04	31.52	33.34	14.57	14.94 (22.71)	5.86
CD at 5%	5.102	NS	0.258	0.135	6.097	4.116	6.086	1.927	0.397	0.619

Figures within parentheses indicate angular transformation data of dry matter percentage. NS: Non significant ($P > 0.05$).