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EFFICACY OF ZINC WITH NITROGEN AS FOLIAR FEEDING ON GROWTH, YIELD AND QUALITY OF TOMATO GROWN UNDER POLY TUNNEL

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Zinc (Zn) deficiency is considered one of nutritional constraints for crop yield worldwide. In recent past, the deficiency of Zn has heavily declined the quality of vegetables, especially tomato. Thus, a study was planned to enhance the growth, yield and quality of tomato plant using Zn and N alone and in combination. $ZnSO_4$ was used as a source of Zn (10% and 12%) and urea as source of N (1% and 2%). The results showed that application of either Zn or N alone at both concentrations enhanced growth, yield and quality of tomato plants under poly tunnel. However, the combined use of both Zn and N further enhanced the growth, yield and fruit quality with application of Zn (12%) plus N (2%). Hence the combined use of Zn and N can be a viable strategy for improving yield and quality of tomato.
Keywords: Zinc, nitrogen, foliar feeding, tomato, poly tunnel

INTRODUCTION

Zinc is one of the essential elements for plants, and human's growth, but most calcareous soils are deficient in Zinc and, consequently, in plant and human diets. Zn deficiency is a major problem globally; however, low availability of Zn in the soil may lead to depress plant growth and yield (Cakmak *et al*., 2008). Many agricultural countries around the world are affected by zinc deficiencies. Zinc deficiencies can cause yield losses. Balanced crop nutrition supplying all essential nutrients, including zinc, is a cost effective management strategy. Zinc fertilization can increase crop yields, where zinc deficiency is a limiting factor. Even with zinc-efficient varieties, zinc fertilizers are needed to apply when the available zinc in the topsoil becomes depleted.

Foliar application of Zn focused on alleviating its deficiencies, particularly on crops cultivated in semiarid or arid regions of the world (Alloway, 2004; Cakmak, 2008). It was also documented that zinc foliar application is a simple way for making quick correction of plant nutritional status, as reported for wheat (Erenoglu *et al*., 2002) and maize (Grzebisz *et al*., 2008). The objective of the present study was to determine the efficacy of Zn foliar spray to increase tomato yield in poly tunnels.

MATERIALS AND METHODS

Nursery of tomato cv. Sahil, was grown on raised beds containing normal field soil mixed with well rotten farm yard manure with a ratio of 2:1. Seeds were sown at the end of September. Nursery beds were kept just moist throughout the nursery raising duration. Six week old seedlings were transplanted on both sides of raised beds under polytunnel with uniform spacing of 45 cm as plant to plant distance and 75 cm as bed to bed distance. All treatments replicated thrice. Small holes were made with common soil auger in the soil for each nursery transplant. The holes were then filled with soil after keeping the seedlings in each hole. The plastic sheet over the tunnel structure was expanded during the 2nd fortnight of November.

Foliar spray of Zn as $ZnSO_4$ and N as urea was applied. The fertilizer treatments were control, N (1%), N (2%), Zn (10%), Zn (12%), N (1%) + Zn (10%), N (2%) + Zn (10%), N (1%) + Zn (12%) and N (2%) + Zn (12%). The treatments were applied by diluting 100 times. Data on morphological parameters, i.e. plant height (cm), number of flowers and fruit per plant were recorded. For the assessment of fruit quality, parameters like acidity (%) and vitamin C (mg/ 100ml of juice) were also studied. The experiment was conducted according to completely randomized design with three replications (Steel *et al*., 1997).

RESULTS AND DISCUSSION

***Growth parameters*:** Data in relation to growth parameters is given in Table 1. Among all treatments, combined application of Zn (12%) and N (2%) performed exceptionally well for all growth parameters such as plant height, number of leaves and number of flowers. The only application of either N or Zn has enhanced the growth parameters but the mixture of both these nutrients exhibited substantial results. Zn (12%) and N (2%) enhanced plant

Table 1. Effect of foliar appliaton of Zn and N on plant growth, yield and fruit quality parameters of tomato

Treatments	Growth			Yield		Fruit quality	
	Plant height (cm)	No. of leaves	No. of flowers	No. of fruits	Average fruit weight (g)	TSS %	it. acidity %
control	147.3f	28.0f	93.3c	92.7d	66.7f	4.50b	0.40a
N 1%	161.0e	32.0e	102.0b	99.0c	82.0e	5.30ab	0.43a
N 2%	162.2cde	33.0de	102.7ab	102.3abc	87.0d	5.60ab	0.43a
Zn 10%	161.2de	32.0e	103.3ab	100.3bc	82.0e	5.24ab	0.42a
Zn 12%	162.0de	34.0cde	102.3b	100.8bc	86.0d	5.50ab	0.43a
Zn (10%) + N (1%)	165.0bcd	35.0bcd	104.0ab	102.9abc	92.0c	5.80ab	0.43a
Zn (10%) + N (2%)	168.0ab	37.0ab	104.3ab	104.0ab	100.0b	6.00a	0.44a
Zn (12%) + N (1%)	166.0bc	36.0abc	104.5ab	103.3ab	99.0b	5.90a	0.44a
Zn (12%) + N (2%)	170.0a	38.0a	106.5a	105.7a	104.0a	6.20a	0.45a

Means sharing similar letters in a coloumn are statistically non-significant (P>0.05)

height, number of leaves and number of flowers by 15, 35 and 14%, respectively, over control treatment. This premise is likely due to the supply of N and Zn at early stage of tomato growth where the deficiency of both these nutrients strikes. The similar results for growth parameters were observed by Sudhan and Shakila (2003).

***Yield parameters*:** The combined application of Zn (12%) and N (2%) performed well for all yield parameters (Table 1, Fig.1). Plants also exhibited variations in their yield parameters with different dozes of Zn or N applied by foliar method as compared to control. The alone application of either N or Zn improved the yield parameters compared to control, but the combined application of both these nutrients showed significant results. Zn (12%) and N (2%) enhanced yield per plant, number of fruits and average fruit weight by 56, 15 and 55%, respectively, over control treatment. This is more likely due to the foliar supply of N and Zn at the critical stage of tomato growth which not only fulfilled plant requirement but maximized the yield as well (Ejaz *et al.*, 2011a).

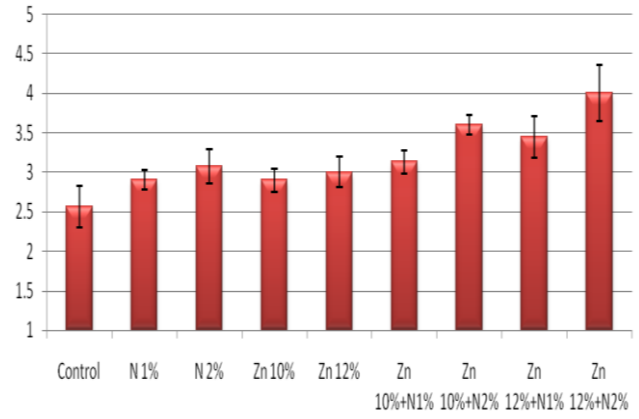

Figure 1. Effect of foliar application of Zn and N on yield of tomato

***Fruit quality parameters*:** Figure 2 clearly illustrates the positive influence of foliar application of Zn and N on improved vitamin C contents of tomato fruit. Similarly data compiled in Table 1 also confirm the same positive impact of foliar application on other quality parameters such as total soluble solids (TSS) and titratable acidity. As compared to control the plants treated with foliar application of Zn and N showed enhanced quality of tomato fruit. The application of N or Zn alone has also enhanced the quality but the combination of both these nutrients revealed substantial results. Zn (12%) and N (2%) enhanced vitamin C contents, TSS and titratable acidity by 22, 38 and 13%, respectively, over control treatment. This is due to the supply of N and Zn on tomato soon after transplantation which enhanced the quality of tomato fruit. Similar results were observed by Ejaz *et al.* (2011b).

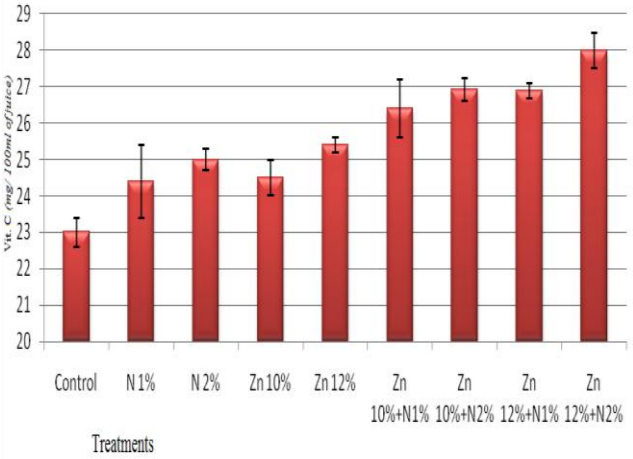

Figure 2. Effect of foliar application of Zn and N on vitamin C (mg/100ml of juice) contents in tomato

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