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EFFECT OF FOLIAR APPLICATION OF ZINC ON YIELD AND QUALITY OF *ALLIUM SATIVUM* VAR. OPHIOSCORODON

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ABSTRACT

The impact of individual micronutrients on the production course processes and their impact on the quality of *Allium sativum* is an important concern in horticultural sciences. In the present study it was revealed that fertilization with microelements in the minimum and optimal norms contributed to a significant increase in yield, the application of maximum norms led to a decrease in productivity. Our results revealed that all four applied treatments of Zinc foliar application on garlic exhibited difference in plant height, stem diameter, leaf length and number of leaves per plant. The effect of foliar zinc treatments applied were observed in the form of bulbs germination after 90, 100, 110 and 120 days according to the variant and storage regime. Further research is to study the combinations of the studied micronutrient on physiological processes and biochemical parameters to optimize their norms for local fertilization.

Keywords: *Allium sativum*, Zinc, Foliar Application

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INTRODUCTION

Garlic is an important vegetable crop of Allaceae family in bulbous group that was originated from central Asia and later spread to Mediterranean region ((Mahala et al.,

2022; Simon, 2001; Kigori, 2001). Garlic is commonly used as a spice or in the medicinal purposes and is generally cultivated for both local and export purposes. The bulb of garlic holds numerous natural compounds, bulblets, so called as cloves and these cloves are different in size surrounded by layers of white scale leaves. Allicin is the main biological active component of freshly crushed garlic cloves, which is produced by the degradation of Allin, from results of alliinase activity (Bocchini, et al., 2001). Micronutrients play an active role in the plant metabolic process from cell wall development to respiration, photosynthesis, chlorophyll formation, enzymes activity, nitrogen fixation etc. Micronutrients work as a co-enzyme for many enzymes (Lawrence et al., 2011; Ameri et al., 2012).

The use of micronutrients in soil nutrition is the pillars of agriculture in developed proper plant nutrition are one of the most important factors in improving the quality and quantity of plants product. Zinc is required in small but critical concentrations to allow several key plant physiological pathways to function normally (Alloway, 2002; Mousavi et al., 2011; Yousuf et al., 2016). By utilizing of fertilizers contain zinc and other micronutrients, performance on quality of crops is increasing and with shortage of these elements due to declines in plant photosynthesis and destroyed RNA, amount of solution carbohydrates and synthesis of protein decreased and then performance and quality of crop will be decreased (Mousavi et al., 2007).

Zinc (Zn) is a vital mineral element for plant development and holds great beneficial impact on various plant growth aspects. It is involved in several biochemical processes, for instance, the synthesis of proteins, chlorophyll, enzymes, and metabolic turnover (Alloway et al., 2008). However, the deficiency of Zn has negative consequences on plants; therefore, utilizing Zn oxide nano-fertilizer (ZNF) as a ZnO NPs is an intriguing concept that is presently being investigated (Choudhary et al., 2014). For instance, positive effects of the application of nano-ZnO were reported on seed germination, seedling vigour, leaf chlorophyll content, stem and root growth in peanut (Yadav et al., 2018), and the positive effects of nano-ZnO contrasted with the negative effects on vegetable seed germination of a bulk form of ZnO (Manna, 2013).

The effects of applied micronutrient as a foliar spraying on growth and yield of garlic plants Mondal et al. (2016) and Yousuf

et al. (2016) recorded that the foliar application with micronutrient improved the vegetative growth enhanced yield and yield attributes of garlic (Chanchan et al., 2015). In this respect, application of zinc and boron has positive effects on plant growth and improvement of production of garlic. In addition, zinc application improves roots system which results in better absorption of water and other dissolved nutrients and consequently improves different organs and entire plant growth. Moreover, roots are unable to absorb some important nutrients such as zinc, Because of soil properties, such as high pH and carbonate. Thus, in this situation, foliar Praying is better as comparedto soil application (Mondal et al., 2011).

Foliar fertilizers are dilute fertilizer solutions applied directly to plant leaves. As with soil application of fertilizer, the goal of foliar fertilization is to supply plants with thenutrients needed for good growth. It is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Plantsare able to absorb essential elements through their leaves. The absorption takes place through their stomata and also through their epidermis. It is the application of fertilizers tofoliage of the crop as spray solution is knownas foliar spray. This method is suitable for

MATERIAL AND METHODOLOGY

application of small quantities of fertilizers, especially micronutrients.

Zinc is one of the seven micronutrients vital for the crop growth. Zincplays a considerable role in various enzymatic and physiological activities andperforms many catalytic functions in plant system besides alteration of carbohydrates, chlorophyll and protein synthesis (Pramanikand Tripathy, 2017). Foliar application of zinc improves morpho-physiological and antioxidant defense mechanisms and agronomic grain biofortification of wheat (*Triticum aestivum* L.) under water stress. Foliar application of zinc (Zn) to crops is an effective way to increase the grain concentration of Zn. However, the development of more efficient foliar Zn fertilizers is limited by a lack of knowledge regarding the distribution, mobility, andspeciation of Zn in leaves once it is taken upby the plant (El-Sayed et al., 2015).

The aim of present study was to determine the optimal microelement (Zn) norms for the garlic to qualify the impact of different concentrations of Zinc on the growth, physiological processes and yield ofgarlic.

The experiment was conducted at the experimental field of Vegetable Crops Research Program, Horticultural Research Institute, National Agricultural Research Centre (NARC) Islamabad during 2022-23. Garlic cloves were sown in pots under plastic tunnel. The experiment conducted under tunnel. Three treatments were selected for Zinc foliar sprays viz; T1 (0.1%), T2 (0.2%), T3 (0.3%) and readings were taken after four different intervals. Four different plant parameters were recorded after Znapplication viz: Plant height (cm), Stem diameter (mm), Leaf length (cm) and number of leaves per plant^{-1}. The data analysis was performed by analysis of variance (ANOVA) and means were separated using Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

Our results revealed that all four applied treatments of Zn foliar application on garlic exhibited difference in plant height, stem diameter, leaf length and number of leaves per plant, respectively. Whereas it is pertinent to mention that highest plant height was recorded 26.67 in T3 after 120 DAS and lowest was recorded 21.67% in T2 (Table 1). Maximum stem diameter was measured 1.49 in T1 after 110 DAS and minimum was recorded 1.29 after 90 DAS (Table 2). Leaf length and number of leaves per plant after applying all treatments were recorded (Table 3; Table 4).

Table 1: Comparison of plant height under different foliar applications of Zn

Treatments	90 DAS	100 DAS	110 DAS	120 DAS
CK: Control	22.10 b	24.07 b	24.93 b	27.47 b
T_1: 0.1 % Zn foliar spray	24.73 a	25.67 a	30.60 a	31.27 a
T_2: 0.2 % Zn foliar spray	21.67 c	22.27 c	25.93 b	26.47 c
T_3: 0.3 % Zn foliar spray	22.27 b	22.73 c	25.60 b	26.67 c

DAS: days after sowing

Table 2: Comparison of stem diameter under different foliar applications of Zn

Treatments	90 DAS	100 DAS	110 DAS	120 DAS
CK: Control	1.31 a	1.34 a	1.43 a	1.49 a
T_1: 0.1 % Zn foliar spray	1.41 a	1.47 a	1.49 a	1.55 a

T_2: 0.2 % Zn foliar spray	1.37 a	1.39 a	1.43 a	1.46 a
T_3: 0.3 % Zn foliar spray	1.29 a	1.36 a	1.39 a	1.47 a

DAS: days after sowing

Table 3: Comparison of leaf length under different foliar applications of Zn

Treatments	90 DAS	100 DAS	110 DAS	120 DAS
CK: Control	18.00 b	20.27 b	21.80 c	22.80 d
T_1: 0.1 % Zn foliar spray	20.67 a	21.53 a	26.00 a	27.20 b
T_2: 0.2 % Zn foliar spray	17.93 c	18.67 c	22.60 b	23.40 c
T_3: 0.3 % Zn foliar spray	18.53 b	20.40 b	22.53 b	28.00 a

DAS: days after sowing

Table 4: Comparison of number of leaves per plant under foliar applications of Zn

Treatments	90 DAS	100 DAS	110 DAS	120 DAS
CK: Control	5.27 a	5.27 a	5.47 a	5.47 a
T_1: 0.1 % Zn foliar spray	4.93 b	5.13 a	5.53 a	5.80 a
T_2: 0.2 % Zn foliar spray	4.87 b	5.07 a	5.47 a	5.60 a
T_3: 0.3 % Zn foliar spray	4.87 b	5.07 a	5.27 a	5.53 a

DAS: days after sowing

DISCUSSION

Our results are in similarity with reported work of Chanchan et al., (2013), where Zn applied as foliar application enhanced garlic yield. Application of zinc (Zn) can reduce Cadmium uptake by plants, as both these metals are generally antagonistic in soil–plant systems (Wang et al., 2018). Similarly, in another study yield parameters and storage quality of garlic (*Allium sativum* L.) var. G-282 were enhanced after Zn application (Yadav et al., 2018).

In another study, application of Zn significantly increased the bulb weight (73.9 g), bulb yield (45 t/ha) when applied with 2, 4-D (3 ppm) as foliar spray. Zinc application significantly influenced the bulb quality and recorded the highest a grade bulbs and the lowest poor quality C grade bulbs when

applied with 2, 4-D (81.9%) as foliar spray (Manna et al., 2016). Arif et al. in (2006) reported that foliar application can guarantee the availability of nutrients to crops for obtaining higher yield. Srivastava et al. (2005) reported that boric acid at 0.1% and zinc sulfate at 0.4% resulted in maximum bulb yield and total soluble solids. The application of micronutrients soil or foliar spray significantly influenced bulb yield of onion crop (Pramanik and Tripathy, 2017; Singh et al., 2015).

CONCLUSION

It is pertinent to mention that balanced application of zinc holds highest influence on *Allium sativum* growth various physiological parameters. After the zinc application at maximum norm a significant positive impact was observed on plant height, stem diameter, leaf length and number of leaves per plant. The most significant increase in bulb weight was influenced by all applied foliar treatments of zinc at different days interval. The use of zinc contributed to higher accumulation and extended the marketability of garlic bulbs.

CONFLICT OF INTEREST

No potential Conflict of Interest is declared.

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