Research Article

Effect of zinc as a foliar spray on growth and flower production of Marigold (*Tagetes erecta* L.)

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Abstract

An experiment was conducted to check the response of Marigold (*Tagetes erecta* L.) to foliar spray of zinc on growth and flower production at the Ornamental Horticulture Nursery, Department of Horticulture, The University of Agriculture Peshawar during 2014. The experiment was laid out at Completely Randomized Design (CRD) with one factor repeated three times. In this study Marigold plants were sprayed with five levels of zinc sulphate (0, 0.3, 0.5, 0.7 and 0.9 %). Result revealed that most of the traits were significantly affected by zinc while leaf area showed non-significant differences. Maximum plant height (25.84 cm), stem diameter (0.75 cm), number of flower plant⁻¹ (14.66), fresh flower weight (4.67 gm), number of branches plant⁻¹ (23.22) and number of leaves branches⁻¹ (40.36) were recorded at 0.5% Zinc sulphate application. So, it is concluded that 0.5% Zinc should be spray good for quality flower production of Marigold flowers, hence recommended for the farmers of the agro-climatic condition of Peshawar.

Key words: Marigold; Zinc; Growth; Production; Foliar

Introduction

Marigold botanically known as *Tagetes erecta* L. belongs to the family *Asteraceae*. It has easily culture and adaptability. Commercially grown flower plant that is gaining worldwide popularity and increasing the demand [1]. These marigold flowers are

sold in the market as loose flowers in bulks, garland and especially cut flowers. For protein synthesis, regularity of many coenzymes, photosynthesis, cell division, maintenance of membrane structure and sexual fertilization zinc play important role [2]. Zinc after iron involve in various

biological process in many organisms [3]. It is important micronutrient for plant growth and development. The supply of this nutrient improves the quality flower production [4], [5]. Foliar application of micronutrients directly affects the quality and yield [6]. In optimum concentration zinc increasing plant height, number of flowers, flower diameter and flower yield. Otherwise, increase doses than normal cause stunted growth of the plant [7]. [8] Zinc improve the biological machines, and these are consist of proteins and enzymes. Foliar application on plants functional the leaves and leaves are green factories where as many chemical process of photosynthesis that produce the compounds, are required for plant growth [9]. These establishment processes of nutrient application improve nutrient utilization and lower environmental pollution. These nutrients pass to the plant body easily and where its require [10]. In this study, we will a report about main characteristics of flowering of marigold under application of zinc sulphate in foliar spray application.

Materials and Methods

This experiment was conducted to find out the effect of foliar application of Zinc on Marigold, at the Ornamental Horticulture Nursery, Department of Horticulture, The University of Agriculture Peshawar during 2014.

Planting Materials

The experiment was conducted with a Completely Randomized Design (CRD) with one factor repeated three times. The local variety of marigold (*Tagetes erecta*) was selected. The seedlings were taken from “Elite Nursery” Peshawar. Seeds were sown on 17th August and seeds were germinated up to 25th August 2014. On 27th August 2014 seedlings were transplanted when reached at 3-4 true leaves stages to well-prepared plastic bags. Bag size is 15cm diameter which contains farm soil. Zinc levels (0, 0.3, 0.5, 0.7 and 0.9%) were

applied to plants through foliar spray. For each treatment the five plants are kept in one plot and total twenty five numbers of plants in each replication. All the cultural practice such as (pest control, irrigation, hoeing and weeding etc) was kept constant. The following growth attributes were studied during the course of the experiment.

Plant Height (cm)

Plant height was measure with measuring tape from three plants and then their average was calculated.

Stem diameter (cm)

Diameter of the stem of three randomly selected plants from all treatment in each replication was measured with the help of vernier caliper.

Branches plant⁻¹

Sampling the branches from three plants and average was calculated.

Leaves branch⁻¹

Number of leaves per branch was counted from three randomly selected plants from each treatment.

Leaf area (cm²)

Leaf area was determined with the help of Leaf area machine and average was calculated.

Number of flowers plant⁻¹

Flowers were counted from three randomly selected plants and average was calculated.

Flower fresh weight (gm)

From each treatment three plants were randomly selected, the fresh weight was determined by digital weight balance and average was calculated.

Statistical Analysis

Analysis of the parameters was determined through statistical software [11].

Results and discussions

Plant height (cm)

Plant height (cm) was significantly affected by foliar spray of zinc (Table-1). By the comparison of means, we came to know that maximum plant height (25.84 cm) was recorded at (0.5 %) zinc, while minimum

plant height (17.73 cm) was observed in control treatment (0%) zinc. Foliar spray of Zn significantly increased plant height of Gerbera [12], increased height of Iris plants [13]. Similar results were observed by [14] in pot marigold. The result of [15] expressed that, the use of foliar fertilizers stimulate plant growth and better development of plants, leads to the increase in morphological characters such as plant height.

Stem diameter (cm)

Data presenting that, different zinc level had a significant effect on stem diameter (cm) of marigold plant (Table-1). By the comparison of means, we came to know that maximum stem diameter (0.75 cm) was recorded at (0.5 %) zinc, while minimum stem diameter (0.02 cm) was observed in control treatment (0%) zinc. which was statistically similar with stem diameter (0.03 cm) at 0.3 and 0.7% respectively. It may be due to zinc is an essential constituent of cell component and constituents of the various cell membranes that are also important for the maintenance of cell structure and induce cell division resulted enhanced the vegetative growth like stem diameter [16]. The improvements in these characters might be due to enhancement in vegetative growth which is likely to be responsible for more accumulation of photosynthetic materials, hence resulted in giving maximum value in

these characters. These findings are very similar to the findings of [17] and [18] in chrysanthemum.

Number of branches plant⁻¹

Different Zinc level had a significant effect on number of branches plant⁻¹ of marigold plant. As regarding foliar application of zinc, more number of branches plant⁻¹ (23.22) was recorded at (0.5%). While less number of branches plant⁻¹ (12.33) was observed in control treatment (0 %). Spraying of zinc significantly affect number of branches, the result are similar with the [19] reported that, number of branches increase in anise (*Pimpinella anisum*).

Number of leaves branch⁻¹

The statistical analysis of the data revealed that Zinc level had a significant effect on number of leaves plant⁻¹ of marigold plant. As regarding foliar application of zinc, more number of leaves branch⁻¹ (40.36) was recorded at (0.5%). While less number of leaves branch⁻¹ (30.66) was observed in control treatment (0 %). Foliar application of ZnSO₄ significantly increased the number of leaves per plant in Iris [13]. Similarly, [12] observed a significantly higher number of leaves per plant in Gerbera due to foliar application of Zn. [20] reported that, spraying *Antholyza aethiopica* with Zn had a promoting effect on increasing the leaf number per plant.

Table 1. Effect of zinc level on plant height (cm), stem diameter, number of branches plant⁻¹, number of leaves branch⁻¹ of marigold plant

Zinc Levels	Parameters			
	Plant Height	Stem Diameter	Number of Branches Plant ⁻¹	Number of leaves branch ⁻¹
0	17.73 c	0.02 c	12.33 c	30.66 d
0.3%	22.50 b	0.03 bc	17.33 b	33.66 c
0.5%	25.84 a	0.07 a	23.22 a	40.36 a
0.7%	22.41 b	0.03 bc	17.11 b	33.11 c
0.9%	22.67 b	0.04 b	18.22 b	35.66 b
LSD (P<0.05)	2.21	0.01	3.35	1.65

Means followed by varying letter significantly differ at 5% level of significance

Leaf area (cm²)

Data regarding leaf area (cm²) shows that different level of zinc had non-significant effect on the leaf area (cm²) of marigold plant (Table 1). However, comparing the means of leaf area, it is clear from the mean table that wider leaves (1.14cm²) were recorded at (0.5 % zinc sulphate), while the minimum leaf area (0.94cm²) was recorded in 0.03% Zinc application.

Number of flowers plant⁻¹

Different level of Zinc had a significant effect on number of flower plant⁻¹ of marigold plant. Comparing the means of number of flowers plant⁻¹, it is clear from mean table more number of flower plant⁻¹ (14.66) was recorded at (0.5 % zinc sulphate). While less number of flowers plant⁻¹ (8) was observed in control treatment (0 %). Foliar application of nutrients is in advance more significance in fertilization of various field and floricultural crops, in many countries. The advantages of foliar fertilizers were more noticeable under growing conditions restricting the incorporation of nutrients from the soil, as reported by [21]. Foliar application affect better than soil

application on flower production [22]. Biomass of the flower related with zinc [23]. Chlorophyll production, pollen function and fertilization require zinc [24]. Many researchers reported that, zinc had a significant effect on flower production in Gladiolus [25].

Fresh flower weight (gm)

Zinc levels significantly affect fresh flower weight of marigold plant. Comparing the means of flower weight, it is clear from mean table that maximum fresh flower weight (4.67 gm) was recorded at (0.5 % zinc sulphate) while minimum flower weight (2.12gm) was observed in control treatment (0 %). which was statistically similar with flower weight (2.67 gm) at 0.3 % respectively. Increase in fresh weight of flowers might be attributed to increased fresh weight of complete stem due to good growth of plants. These findings are in accordance with the results of [26], who observed increase in fresh weight of rose flower as a result of foliar application of micronutrients. [13] also noted Iris flowers fresh weight increase was due to either foliar application of ZnSO₄ applied singly.

Table 2. Effect of zinc level on leaf area (cm²), number of flower plant⁻¹ and fresh weight of marigold plant

Zinc Levels	Parameters		
	Leaf Area (cm ²)	Number of Flowers Plant ⁻¹	Fresh Weight (gm)
0%	1.13	8.00 d	2.12 d
0.3%	0.94	11.66 b	2.67 cd
0.5%	1.14	14.66 a	4.67 a
0.7%	0.96	10.00 c	3.57 b
0.9%	1.09	10.33 bc	3.12 bc
LSD (P<0.05)	Ns	1.40	0.75

Means followed by varying letter significantly differ at 5% level of significance

Conclusion and recommendation

From the above results 0.5% foliar application of Zinc Sulphate shows better for all of the parameters such as plant height, stem diameter, number of flowers

plant⁻¹, fresh flower weight, branches plant⁻¹ and number of leaves branch⁻¹, while number leaf area was not positively affected by zinc application. For well growth and quality of flowering zinc performed better

and recommended at the rate of 0.5% for marigold.

Authors' contributions

Conceived and designed the experiments: ST Shah & S Ullah, Performed the experiments: M Sajid, A Rab & N Amin, Analyzed the data: M Iqbal, A Naeem & FA Shah, Contributed reagents/ materials/ analysis tools: A Iqbal, S Rawan, SU Haq & S Rahman, Wrote the paper: N Khan.

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