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Effect of Boron on Buds and Flowers Number of *Tagetes Erecta* in Ahvaz Climate

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ABSTRACT

Boron (B) is a necessary micronutrient for higher plants and plays a part in germination and pollen tube growth. The purpose of this research was to determine the best levels of B spray on *Tagetes* flowers and to study the effects of these sprays on number of flower buds and flowers in short-stemmed *Tagetes*. A pot experiment in completely randomized design with 3 replications was conducted that included 4 B spray treatments (control: T_0, 0.5 PPt: T_1, 0.75 PPt: T_2, and 1 PPt: T_3). Results indicated that maximum number of flower buds belonged to the T_3, followed by T_2, and T_1 treatments with 67.06, 63, and 43.71% increases in the number of flower buds, respectively, compared to the control. Moreover, B sprays at 1, 0.75, and 0.5 PPt yielded the largest number of flowers (1.55, 1.22, and 0.65, respectively). Therefore, B spray at 1 PPt yielded the best results in this research.

***Keywords**:* Boron, Spray, Tagetes flowers, Ahvaz

INTRODUCTION

Welch *et al.,* (1991) reported that 40% of the world's population suffered from micronutrient deficiencies. Sillanpaa (1982) reviewed the situation concerning micronutrients in 30 countries and found their hidden deficiencies were far more widespread than was thought. He stated that more than 30% of the soils in these countries were deficient in one or more micronutrients. The direct effect of B on cell growth and meristematic cell differentiation is attributed to its role in the structure and function of cell walls and membranes (O'Neil *et al.,* 2002).

Boron application increases chlorophyll content and the rate of photosynthesis in leaves, enhances dry matter accumulation in plants, improves translocation of photosynthetates from vegetative to reproductive organs, and can thereby significantly increase yield (Nasef *et al.,* 2006).

Boron deficiency causes flower drop because flowers are not fertilized, or results in small fruit production.In almond trees, B deficiency causes gum duct development in young almond fruit (Castor and Sotomayor, 1997).

MATERIALS AND METHODS

Study area

Ahvaz has an average annual rainfall of 213 mm, yearly averages for maximum and minimum temperatures of 48 C˚(in summer) and 4 C˚(in winter), and yearly averages for maximum and minimum relative humidity levels of 84.5 and 12.2%.

Sample treatment

This study was conducted in Ahvaz using a completely randomized design (CRD) with 3 replications and 4 treatments (T_0: the control, T_1: 0.5 PPt (PPt is the abbreviation of part per thousands), T_2: 0.75 PPt, and T_3: 1 PPt of B spray, with B in the form of boric acid). Boron was sprayed once during the vegetative growth and once before flowering. Number of flower buds and flowers were recorded in the experiment.Seeds were obtained from PanAmerican Seed.

RESULTS AND DISCUSSION

Table 1 shows the results of the initial soil test. As seen in the table, the soil is non-saline with a neutral to alkaline pH and clay loam texture.

Table 1. Results of the initial soil test

EC(dS/m)	pH	OC (%)	TNV (%)	B_{soil} (mg/kg)	Sand (%)	Silt (%)	Clay (%)	SOIL Texture
1.62	7.45	1.07	47	0.52	44	26	30	CL

Effects of B sprays on number of buds

Experimental treatments had significant effects on number of Tagetes flower buds. There were significant differences between the treatments so that the number of leaves increased when B concentration in the sprays was raised (Figure 1). The maximum number of flower buds belonged to the treatments of spraying B at 1 PPt (T_3), followed by 0.75 PPt (T_2), and 0.5 PPt (T_1) treatments. These treatments increased number of flower buds by 67.06, 63, and 43.71%, respectively, compared to the control treatment (which had the minimum number of flower buds).

Researchers have shown B delays plant senescence through influencing leaf chlorophyll content and by increasing indoleacetic acid synthesis. This prolongs photosynthetic activity, which improves production of carbohydrates and their translocation to the growing parts of the plant. Therefore, plants have sufficient opportunities to grow resulting in the production of more flower buds and flowers (Wang and Duan, 2006).

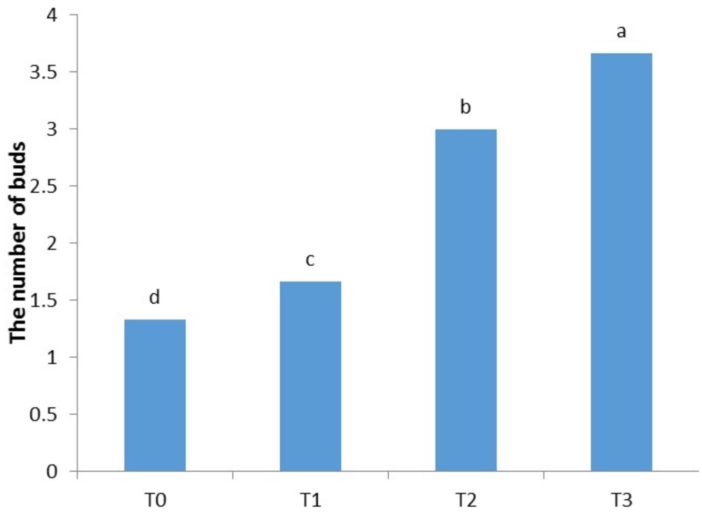

Figure 1. The number of buds in various treatments

Boron plays a role in various plant activities including cell division in meristematic tissues, leaf and flower bud formation, and pollen germination.

Hosseini *et al*. (2005) studied the effects of various levels of B and Zn (from two sources) on rice growth and chemical composition.They found that B application at all levels considerably increased B concentration in rice plant tissues, and observed the minimum and maximum B concentration in plant dry matter (25 and 685 mg/kg) in the control and treatment of applying 80 mg of B, respectively.

The effects of B sprays on number of flowers

As shown in Figure 2, there were significant differences between treatments regarding number of flowers. The maximum number of flowers (1.55) was observed in T3 treatment in which B was sprayed at 1 PPt, and followed by treatments with B sprays at 0.75 and 0.5 PPt with 1.22 and 0.56 flowers, respectively. The minimum number of flowers (0.44) belonged to the control. Considering the role of B in the reproductive stage, B sprays prevented flower drop and increased the number of flowers.

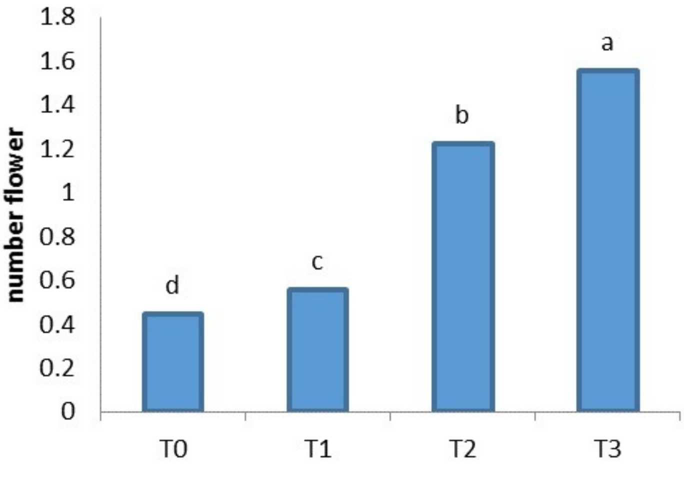

Figure 2.The number of flower in various treatments

Boron has many functions in plants including pollen germination, pollen tube growth, and prevention of plant tissue destruction, nucleic acid synthesis, sugar translocation, cell membrane infiltrability, and plant hormone regulation (Kasraei, 1993).

Castor and Sotomayor (1997) studied the effects of B and Zn sprays on flowering in almond trees and reported that B deficiency caused flower drop (because flowers were not fertilized) or resulted in production of small fruit, and resulted in gum duct development in almond fruit.

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