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Effects of Boric Acid on Postharvest Characteristics of Cut Carnation (*Dianthus caryophyllus* L. cv. 'Nelson')

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ABSTRACT

To investigation on the effect of boric acid on vase life and postharvest qualitiy of cut carnation cv. 'Nelson', an experiment carried out based on complete randomized design with four levels of boric acid (0, 100, 200 and 300 mg l^{-1}) and 3 replications. The results indicated that significant effect of boric acid on measured traits ($p \leq 0.05$). Mean comparison showed that 200 mg l^{-1} boric acid caused the maximum vase life, °brix and petal's protein level and also the least fresh weight loss.

Key words: carnation, boric acid, vase life, fresh weight loss

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INTRODUCTION

Carnation (*Dianthus caryophyllus* L.) belongs to caryophyllaceae family and is one of the most popular cut flowers in the world. *Dianthus* with about 300 species of annual, biennial and perennial, is native to the mediterranean region, southern Europe and central Asia [2] . Carnation vase life is reduced by ethylene and stem end bacteria. Anti-ethylene compounds can be used to control ethylene production , so use of anti-ethylene compounds has been advised [1, 7, 8, 11, 12] . Boric acid is a mild acid that is mostly used for sterilization and disinfection. Boric acid as a precursor to some other materials is considered. Boric acid is available in two forms: a colorless crystal or water soluble white powder, it's chemical formula is $B(OH)_3$or H_3BO_3 with 61.83 g mol^{-1} molecular mass [2] Malakouti et al. (2008) stated that boron is a metalloid element and tend to absorb oxygen, and in the nature it is found in the form of hydrated borate ions with oxygen. Usually, it doesn't participate in oxidation-reductions. It was reported that boric acid have chemical properties that inhibits the initial increase in ethylene production and improves the vase life of cut carnation and also can be a good competitor with affordable price. The aim of this study was to investigation the effect of boric acid on vase life and postharvest quality of cut carnation flowers cv. 'Nelson'.

MATERIALS AND METHODS

In April 2012, cut carnation flowers cv. 'Nelson' was purchased from a commercial greenhouse located in 'Mahallat' city and immediately transferred to the postharvest laboratory under standard conditions. All cut flowers were cut in the same size at 60 cm, then washed & re-cutted under water and then placed into vases containing determined boric acid concentrations for 24 hour pulse treatment. After pulse treatment, cut flowers were transferred to preservative solution containing 8- hydroxyquinoline sulphate 250 mg l^{-1} + sucrose 3%. This study was carried out based on complete randomized design with four levels of ethanol (0, 100, 200 and 300mg l^{-1}) at 3 replications and 12 plots. The measured traits were vase life, fresh weight loss, °Brix, and petals protein content. The end of vase life was

characterized based on petals inroling index [9], fresh weight was measured with the digital balance at the first day and also at the end of vase life, and fresh weight loss calculated by this formula [10] :
Fresh weight loss=First fresh weight-(Fresh weight in final day+recut's weight)

To measure the °brix loss at the first day and last day of vase life, 2 cm stem end was cutted and their extract was spread on sensitive screen of refractometer N-α (Japanese production) and brix loss calculated by this formula [10]:
brix loss= brix in first day-brix in final day

At the fifth day of vase life, one flower was selected from each plot and their petals wrapped in aluminum foil separately and placed in liquid nitrogen, then according to Bradford Method (1976), petals protein content were evaluated. Data Analysis was performed using SPSS and MSTATC software and mean comparisons was done by Duncan test.

RESULTS AND DISCUSSION

Analysis of variance indicated that the effect of boric acid on measured traits was statistically significant at 1 or/and 5 percent probability levels. Mean comparisons showed that 200 mg l^{-1} boric acid was the most effective treatment in all traits which had 15.71 days vase life, 13.02 g fresh weight loss, 4.84% °brix (the maximum level) and 36.39% petals protein content (Table 1) (Fig. 1, 2, 3 and 4).

Table 1- Effect of boric acid on cut carnation cv. 'Nelson'

Treatmenst	Vase life (days)	Fresh weight loss (g)	°Brix (% sucrose)	Petals protein content (%)
B_0: control	14.73b	13.55a	5.42b	32.68b
B_1: 100mg l^{-1} boric acid	14.53b	14.45a	5.86ab	29.55c
B_2: 200mg l^{-1} boric acid	15.71a	13.02a	4.84a	36.39a
B_3: 300mg l^{-1} boric acid	14.87b	14.09a	5.70b	31.73b

**According to LSD test, in each column, means with the same letters are not significantly different.*

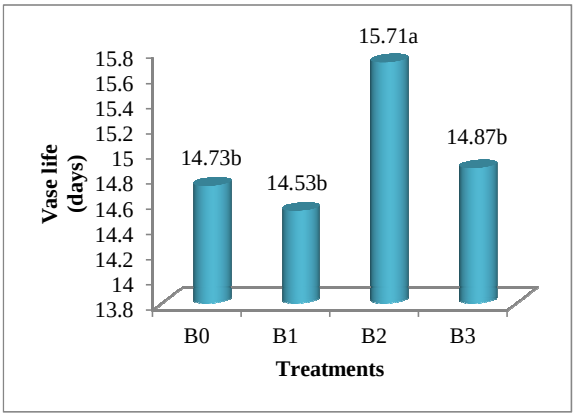

Fig 1- Effect of boric acid on vase life of cut carnation cv. 'Nelson'.
B_0: control, B1: 100 mg l^{-1} boric acid, B2: 200 mg l^{-1} boric acid, B3: 300 mg l^{-1} boric acid.
According to LSD test, in each column, means with the same letters are not significantly different.

Extending the vase life and prevent fresh weight loss could be due to the prevention of ethylene synthesis, by reducing ethylene production with decreasing the amount of ACC synthase and ACC oxidase activity. These results is in accordance with Hoseinzadeh Liavali & Zarchini (2012), Ezhilmathi et al. (2007) in cut roses . Son et al. (2003) found that silver thiosulfate on cut rose cv. 'Sandra' increases water absorption and ultimately increases fresh weight. Prevention °brix reduction in cut carnation flowers treated with boric acid can be due to inhibition of ATP utilization that is used in respiration [5]. Kazemi et al. (2011) reported that vase life of cut flowers seriously depends on carbohydrate status, and sugars degradation is a factor that is associated with senescence. Bassiri et al. (2011) studied on effect of silver nanoparticles on cut carnation 'White Liberty' and concluded that treatment with anti-ethylene and anti-microbial compounds improves the °brix. Elgimabi & Ahmed (2009) studied on the amount

of carbohydrates (fructose, glucose, sucrose) in cut flowers treated with sucrose and 8-hydroxyquinoline sulfate and found that the amount of these carbohydrates decreased both in petals & stems during the vase life. In this study, boric acid increased °brix content as compared to the control. It can be due to membrane stability and resistance enhancement against senescence-related changes which will increase the amount of protein. Our results is in agreement to Kalatejari et al. (2008) , Kazemi et al. (2011) and Hashemabadi et al. (2009).

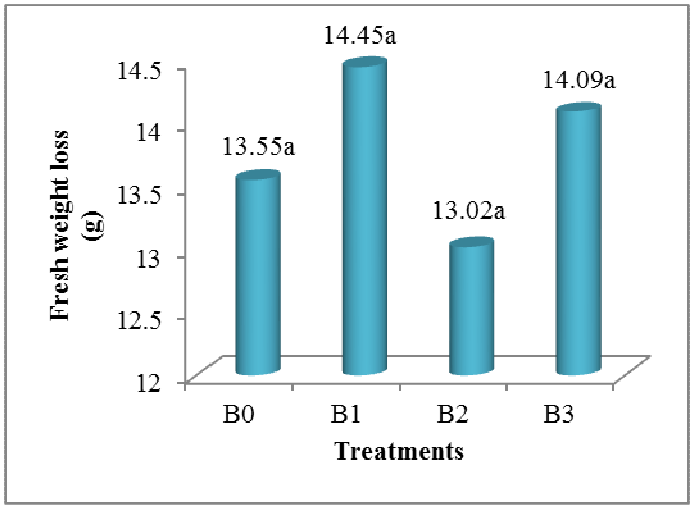

Fig 2- Effect of boric acid on fresh weight loss in cut carnation cv. 'Nelson'.
B_0: control, B1: 100 mg l^{-1} boric acid, B2: 200 mg l^{-1} boric acid, B3: 300 mg l^{-1} boric acid.
According to LSD test, in each column, means with the same letters are not significantly different.

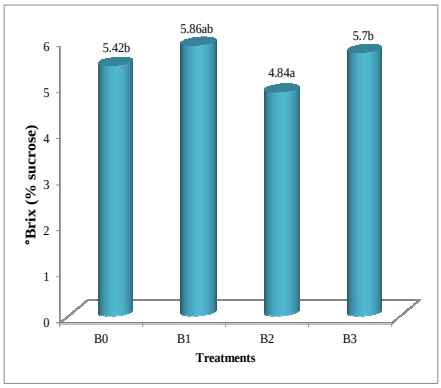

Fig 3- Effect of boric acid on °Brix of cut carnation cv. 'Nelson'.
B_0: control, B1: 100 mg l^{-1} boric acid, B2: 200 mg l^{-1} boric acid, B3: 300 mg l^{-1} boric acid.
According to LSD test, in each column, means with the same letters are not significantly different.

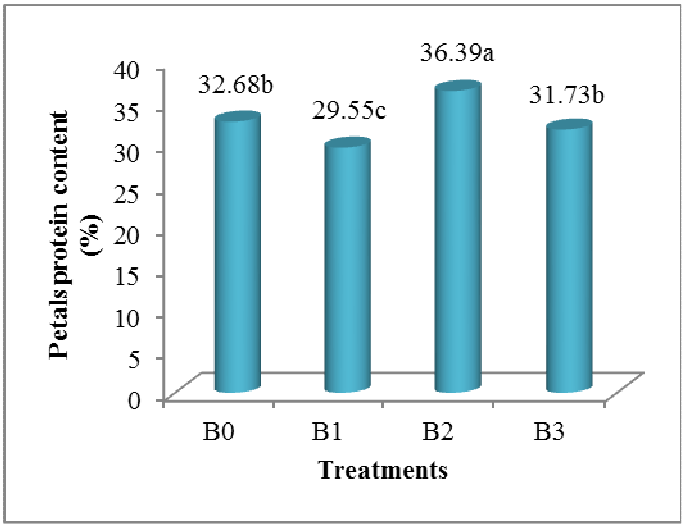

Fig 4- Effect of eboric acid on petals protein content of cut carnation cv. 'Nelson'.
B_0: control, B1: 100 mg l^{-1} boric acid, B2: 200 mg l^{-1} boric acid, B3: 300 mg l^{-1} boric acid.
According to LSD test, in each column, means with the same letters are not significantly different.

CONCLUSION

In present study boric acid extended vase life and increased postharvest quality of cut carnation cv. Nelson

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