

Effect of cobalt chloride on vase life and postharvest quality of cut tuberose (*Polianthes tuberosa* L.)

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ABSTRACT

In order to evaluate the effect of cobalt chloride on vase life and postharvest of cut tuberose, an experiment based on complete randomized design with 4 levels of cobalt chloride (0, 200, 300, 400 mg l⁻¹) in 3 replications was conducted. Statistical analysis showed that the effect of cobalt chloride on measured traits was significant at 5 and 1% probability level. Mean comparison of the data showed that the 300 mg l⁻¹ of cobalt chloride had the highest effect on longer vase life (10.66 days), water absorption (1.53 ml g⁻¹ F.W.) and loss of fresh weight (19.99 g). Also, the 400 mg l⁻¹ of cobalt chloride showed the maximum effect on petal's carotenoids (0.40 g) and proteins (31.10%).

Keywords: Tuberose, Vase life, Fresh weight, Water absorption.

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) belongs to Agavaceae family which has traditionally been considered for the treasured scent. More researches have been done on the species *Polianthes tuberosa* [6]. Tuberose is a fragrance cut flower which is in worthy consideration in the perfumery industry [5]. Tuberose cut flowers had two major reducing agents in its postharvest life; ethylene sensitivity and vascular blockage [3, 10]. Also, to address the problem of bacterial vascular occlusion, distilled water can be used to make vase solutions, or it is useful to disinfect vases and use the white ones, they will show pollutions. Germicides, especially sodium and calcium hypochlorite, hydroxyl-quinoline derivatives, aluminum sulfate, cobalt chloride, silver nitrate, citric acid and also treatment with new agents such as herbal essences and silver nano-particles are advised to use [2, 15]. Positive effect of cobalt on vase life of cut chrysanthemum, carnation and some other cut flowers have been reported [17]. Cobalt partially inhibits ethylene production and auxins and cytokinins activity. Additionally, it caused stomatal closure to some extent and increases water potential in cut flowers [16]. Monshizadeh et al. [11] studied the effect of different levels of cobalt chloride (0, 25, 50 and 75 mg l⁻¹) on vase life of cut tuberose (*Polianthes tuberosa* cv. 'Pyrole') and concluded that cobalt chloride reduced florets yellowing and wilting and also increased florets prosperity. Thus, the aim of this study was to investigate the effect of different concentrations of cobalt chloride on enhancing the quality and postharvest life of cut tuberose (*Polianthes tuberosa* L. cv. 'Single') flowers.

MATERIALS AND METHODS

Cut tuberose (*Polianthes tuberosa* L. cv. 'Single') flowers was obtained from a commercial supplier in Tehran province, Iran on early morning which are in 1 m length and 20 to 30 pairs florets. Then, the flowers were immediately taken to the postharvest laboratory of Islamic Azad University, Rasht. The 5 cut flowers were placed in 2 liter volume plastic pots and then were treated with the determined concentrations of aluminum sulfate. Experiment was based on complete randomized design with 4 levels of cobalt chloride (0, 200, 300, 400 mg l⁻¹) in 3 replications and 12 plots and 5 cut flowers per plot. The assessed traits were vase life, water absorption, loss of fresh

weight and protein and carotenoid contents. The end of vase life was determined based on Wilkins *et al.* [21] index (loss or wilting of 50% of florets mark the end of vase life). Fresh weight was measured with the digital balance at the end of vase life. According to the first day of vase life fresh weight and the weight of re-cut parts of stem ends, fresh weight loss was also calculated. Re-cutting was done once every 4 days from about 1 cm of stem ends. Re-cutting was done under water to refuse vascular air embolism. Flower preservative solution volume was also determined. The vases evaporation rate and reduction of water amount in evaporation pots were recorded as well. Then, by subtracting the water evaporation from solution reduction, water absorption was calculated. In order to estimate the carotenoids content, one cut flower was chosen from each plots at the 5th day and carotenoids content was measured according to Mazumdar and Majumdar [9] method. To determine the petal's protein content, at the 5th day, another cut flower was exited from each pot and was held in liquid nitrogen until testing was done according to Bradford method. SPSS software was used to analyze the data and means comparison data was performed using LSD test.

RESULTS AND DISCUSSION

Analysis of variance showed that the effect of cobalt chloride on all measured traits was statistically significant at 1 and 5% probability level. Mean comparisons indicated that the 300 mg l⁻¹ of cobalt chloride had the priority rather than other applied concentrations with 10.66 days vase life, 1.53 ml g⁻¹ F.W. water absorption and 19.99 g loss of fresh weight (Table 1, Figures 1, 2 and 3). Superiority of this combination must be due to improved water absorption which prevents vascular occlusion that eventually led to keeping fresh weight [18, 20]. These results are in consistent with the results of Knee [7]. Saradhi and Ram [17] reported positive effect of cobalt chloride on vase life of cut chrysanthemum and carnation. Cobalt chloride extended the vase life of cut chrysanthemum flower about 5 to 7 days as compared to the control [13]. Murali and Reddy [12] stated that the maximum vase life in cut gladiolus (*Gladiolus grandiflora* cv. 'Friendship') resulted in treatment with 4% sucrose and 0.5 mM cobalt salt which is in agreement with our results. Our study also showed that treatment with 400 mg l⁻¹ of cobalt chloride with 31.10% protein level had noticeable increasing than the control (18.92%) (Figure 4). Increased protein activity could be due to the reduction of peptidase activity. Decreasing the water stress and enhancing water relations in cut flowers might be another reason for increased protein activity, which prevent cell membrane destruction and cause cell membrane stability [8, 19]. Our results are in consistent with the Nikbakht *et al.* [14] and Hashemabadi *et al.* [4]. Also, the 400 mg l⁻¹ cobalt chloride showed the highest percent of petal's carotenoids and proteins (Figures 4 and 5). It may be due to the improved water absorption and shows antimicrobial activity of cobalt chloride [3, 4]. Basiri *et al.* [1] found that the use of high concentrations of antimicrobial compounds increased the amount of carotenoids in cut carnation cv. 'White Librty' flowers. The present study showed that the use of 300 mg l⁻¹ cobalt chloride extended the vase life and enhanced water uptake in cut tuberose (*Polianthes tuberosa* L. cv. 'Single') flowers.

Table 1: Mean comparison for the effect of cobalt chloride on measured traits.

Cobalt chloride (mg l ⁻¹)	Fresh weight loss (g)	Vase life (days)	Water absorption (ml g ⁻¹ fresh weight)	Petal's protein content (%)	Petal's carotenoid content (mg g ⁻¹ dry weight)
0	29.46abc	8.00df	1.40df	18.92p	0.03o
200	29.42abc	8.00df	0.65ab	28.50i	0.27i
300	19.99bcd	10.66abc	1.53abcd	29.10j	0.23k
400	27.00abcd	9.00cdf	1.40df	31.10d	0.40g

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

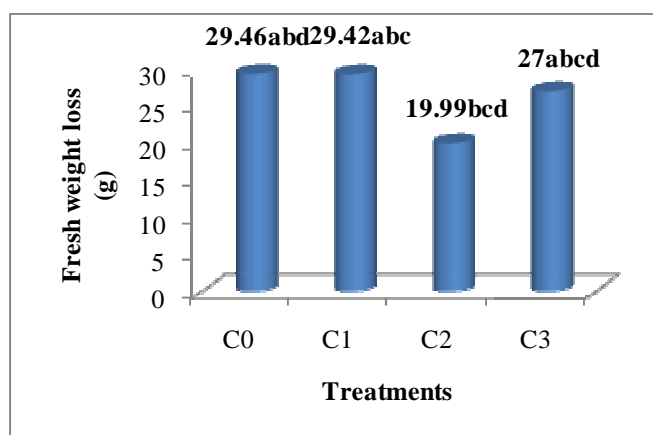


Figure 1: The effect of cobalt chloride on loss of fresh weight of cut tuberose cv. 'Single'.

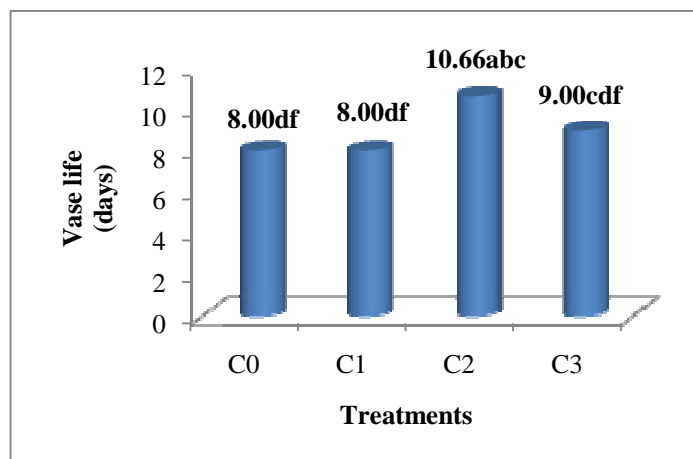


Figure 2: The effect of cobalt chloride on vase life of cut tuberose cv. 'Single'.

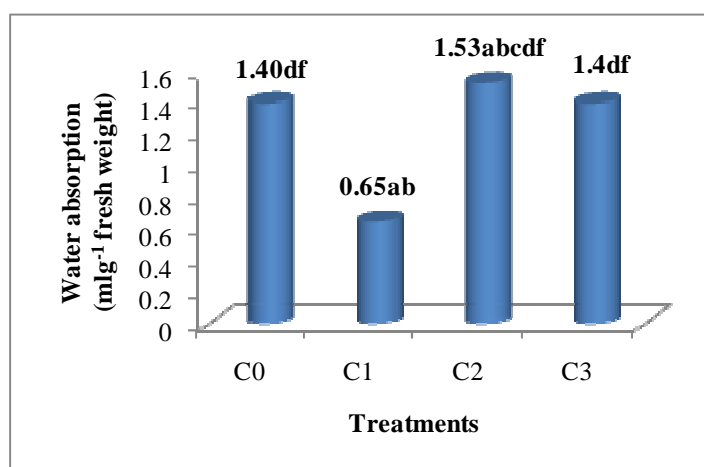


Figure 3: The effect of cobalt chloride on water absorption of cut tuberose cv. 'Single'.

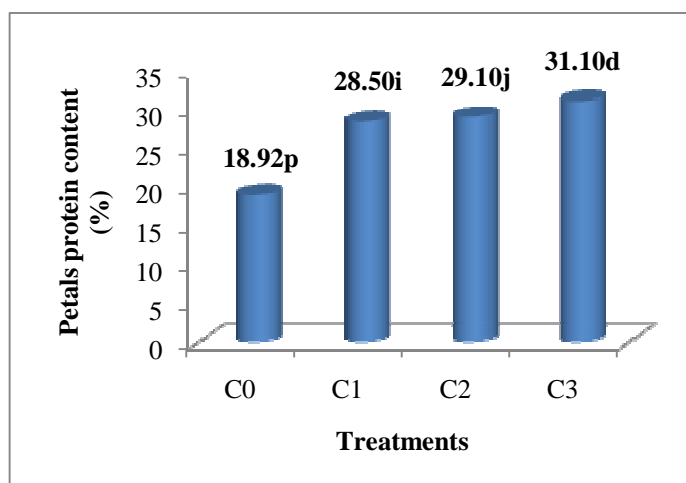


Figure 4: The effect of cobalt chloride on petal's protein content of cut tuberose cv. 'Single'.

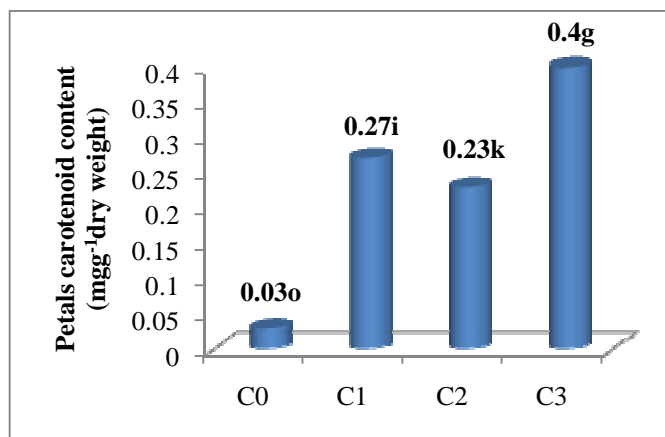


Figure 5: The effect of cobalt chloride on petal's carotenoid content of cut tuberose cv. 'Single'.

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