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Improvement of vase life of cut tuberose (*Polianthes tuberosa* cv. 'Single') with aluminum sulfate

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ABSTRACT

To study the effect of antimicrobial compounds on vase life of cut tuberose flowers, an experiment based on complete randomized design with four levels of aluminum sulfate (0, 50, 100 and 150 mg l^{-1}) was conducted. The results of data analysis indicated a significant effect of aluminum on enhancing vase life, fresh weight, solution uptake, protein and carotenoid content. Mean comparison showed that aluminum sulfate with concentration of 100 mg l^{-1} had the maximum vase life, solution absorption, protein and pigments content and least fresh weight loss.

Key words: tuberose, antimicrobial compounds, vase life, solution absorption, carotenoids

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INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) belongs to the Agavaceae family which has traditionally been considered for the treasured scent. Among different species of tuberose, more researches have been done on the species *Polianthes tuberosa* [14]. Tuberose is a fragrance cut flower which is in worthy consideration in the perfume industry [12]. Tuberose cut flower has two major reducing agents in its postharvest life including ethylene sensitivity and vascular blockage. Various studies have found that bacterial contamination is one of the most important factors in reducing postharvest life of cut flowers with the negative impact on respiration, photosynthesis and water uptake, also with increasing the evaporation, caused water imbalance and indirectly stimulates ethylene production and shortens postharvest life of cut flowers like tuberose [1, 20]. Therefore, the use of antimicrobial compounds, such as aluminum sulfate to increase postharvest life of cut flowers like tuberose is recommended [10]. It has been shown that the use of calcium, aluminum, boron, copper, nickel and zinc salts extends the vase life of cut flowers. In addition to the inhibitory effect of aluminum sulfate on reducing microorganism's activities, it reduces the transpiration rate in cut roses. In cut carnation flower, the effects of aluminum sulfate on transpiration rate and stomata exchanges reduce according to the leaf formation and cuticle thickness. Studies show that the use of aluminum sulfate, especially at high concentrations may cause damage to the leaves of plants such as rose (*Rosa hybrida* L.) [8, 9]. Liao et al. [18] investigated the effect of 50, 100 and 150 mg l^{-1} of aluminum sulfate on vase life of lisianthus (*Eustoma grandiflorum*) and concluded that the 150 mg l^{-1} of it extended vase life up to 15.4 days. Aluminum sulfate also improved water absorption and fresh weight. Hojjati et al. [13] investigated the effect of different chemical treatments like cobalt chloride and aluminum sulfate on vase life of cut lisiyanthus and found that these treatments can increase the vase life. In this study, the effect of different concentrations of aluminum sulfate on vase life and postharvest quality of cut tuberose was mentioned.

MATERIALS AND METHODS

Cut tuberose flowers (*Polianthes tuberosa* L.) were obtained from a commercial supplier in Tehran province on early morning, which are in 1 m length and 20 to 30 pair's florets. Cut flowers were immediately taken to the postharvest laboratory, Islamic Azad University, Rasht, Iran. 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 aluminum sulfate (0, 50, 100 and 150 mg l^{-1}) in 3 replications, 12 plots and 5 cut flowers per plot. The assessed traits were vase life, water absorption, fresh weight loss, and protein and carotenoid content. The end of vase life was determined based on Wilkins et al. [28] 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 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. Vase evaporation rate and reduction of water content in evaporation pots were recorded. Then, with 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 5^{th} day and obtained according to Mazumdar and Majumdar [19] method. To determine the protein content of petals, at the 5^{th} day, another cut flower was exited from each pot and was held in liquid nitrogen until testing was done according to Bradford [4] method. SPSS software was used to analyze the data and means comparison of data was performed using LSD test.

Table 1: Mean comparison of the effect of different concentrations of aluminum sulfate on fresh weight, vase life, water absorption, petals protein content and petals carotenoid content of cut tuberose cv. 'Single'

Aluminum sulfate (mg l^{-1})	Fresh weight loss (g)	Vase life (days)	Water absorption (mg l^{-1} fresh weight)	Petals protein content (%)	Petals carotenoid content (mg g^{-1} dry weight)
Control	27.00abcd	10.00abcd	1.45bcdf	27.80c	0.05n
50 mg l^{-1}	18.88cd	11.50ab	1.52abcdf	30.10b	0.55e
100 mg l^{-1}	17.53d	12.00a	1.65abc	38.07a	0.97a
150 mg l^{-1}	26.96abcd	9.50bcd	1.57abcdf	28.02c	0.25j

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

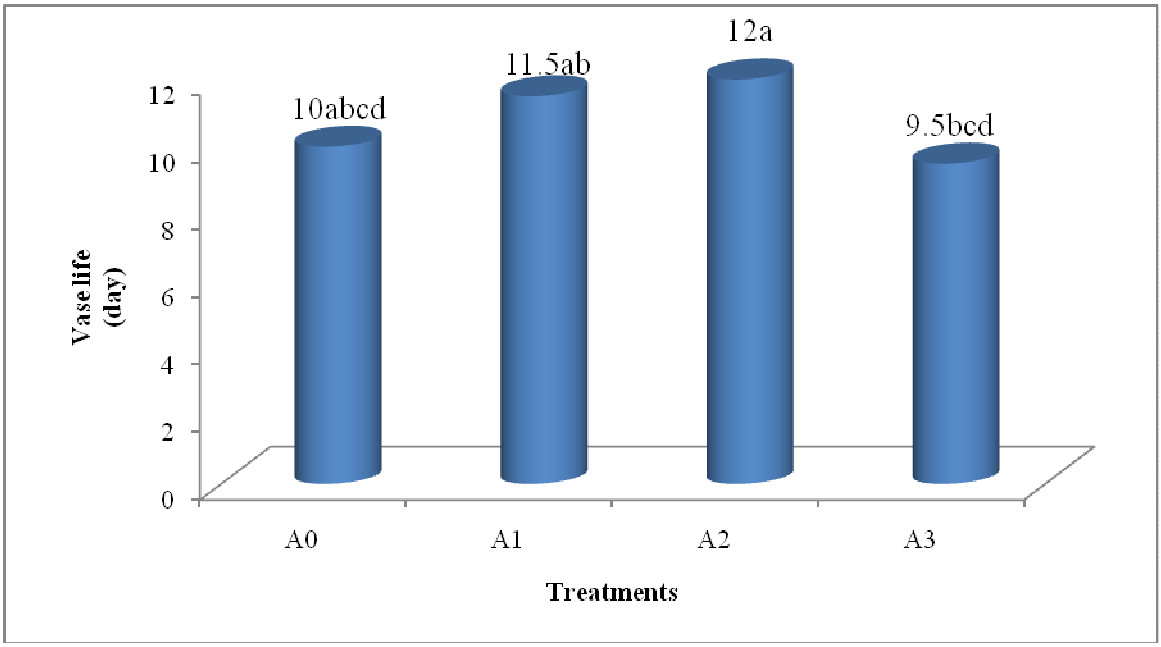

Fig. 1: The effect of different concentrations of aluminum sulfate on vase life of cut tuberose cv. 'Single'

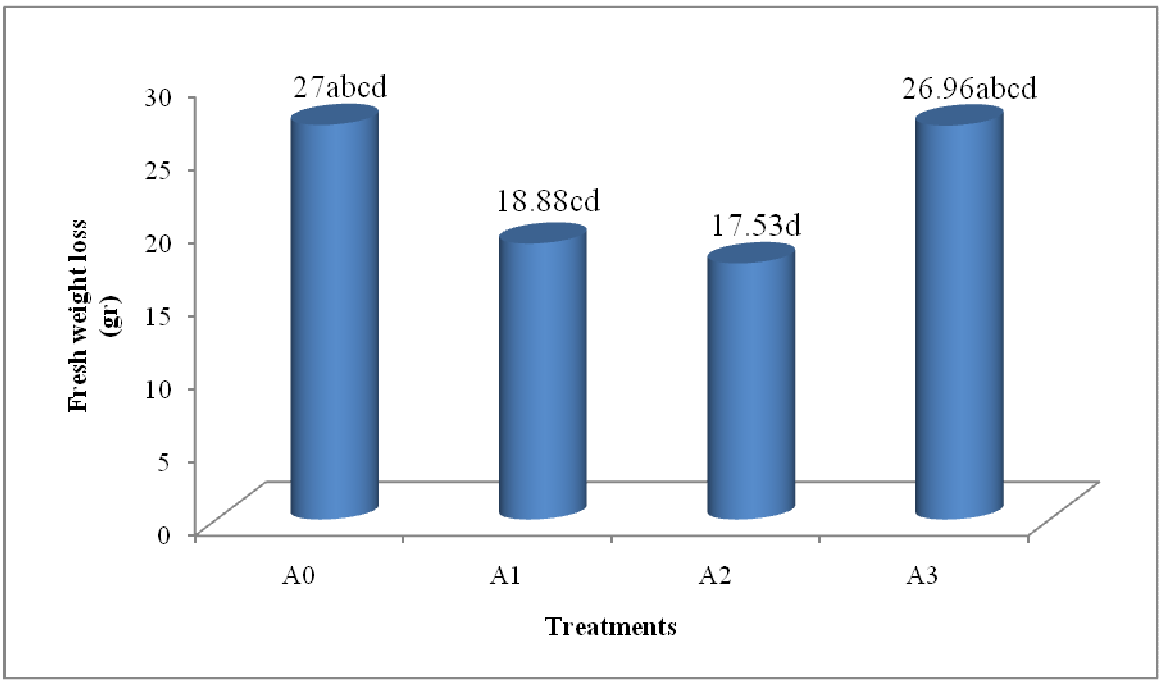

Fig. 2: The effect of different concentrations of aluminum sulfate on fresh weight loss of cut tuberose cv. 'Single'

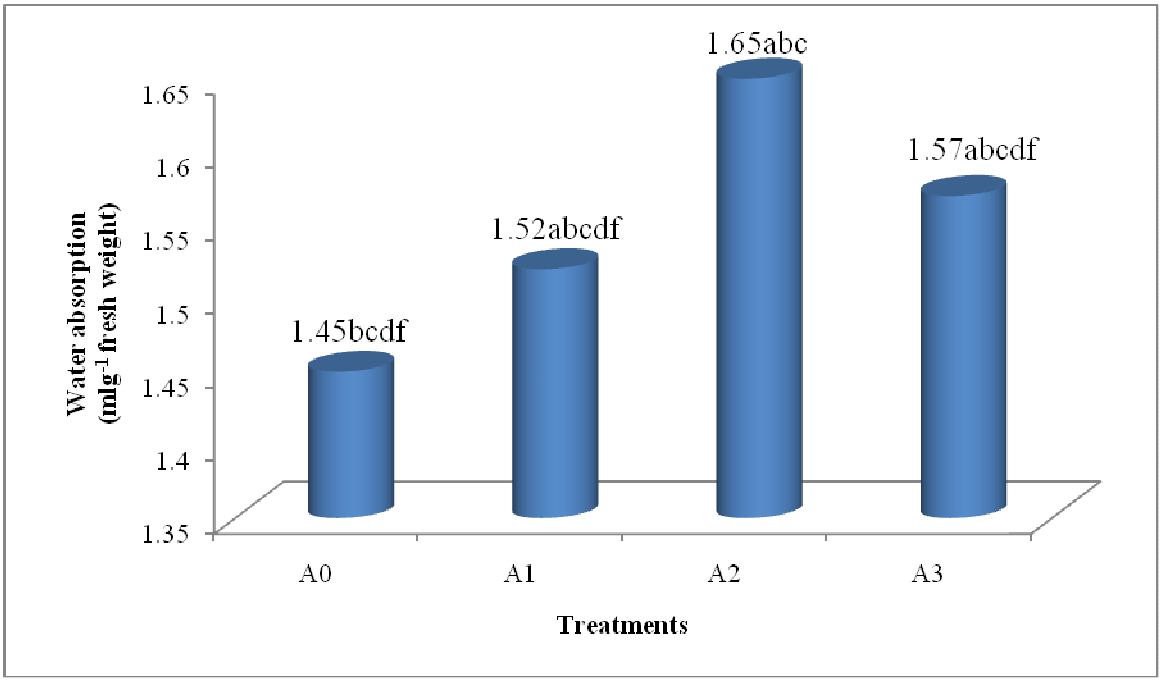

Fig. 3: The effect of different concentrations of aluminum sulfate on water absorption of cut tuberose cv. 'Single'

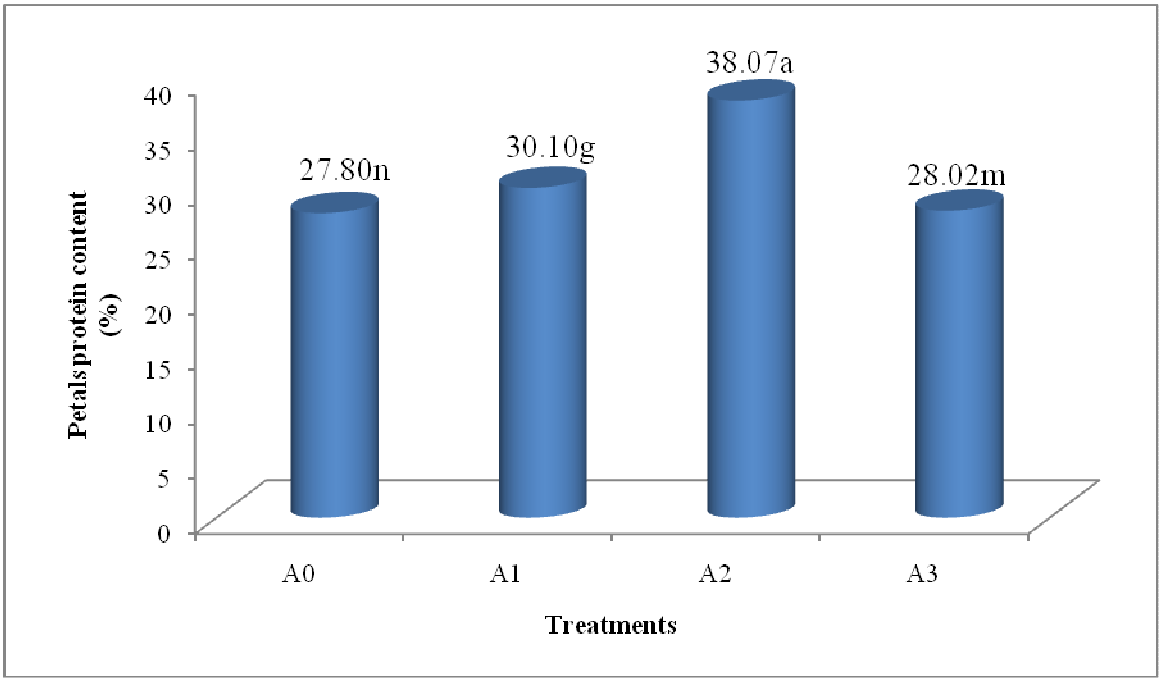

Fig. 4: The effect of different concentrations of aluminum sulfate on petals protein content of cut tuberose cv. 'Single'

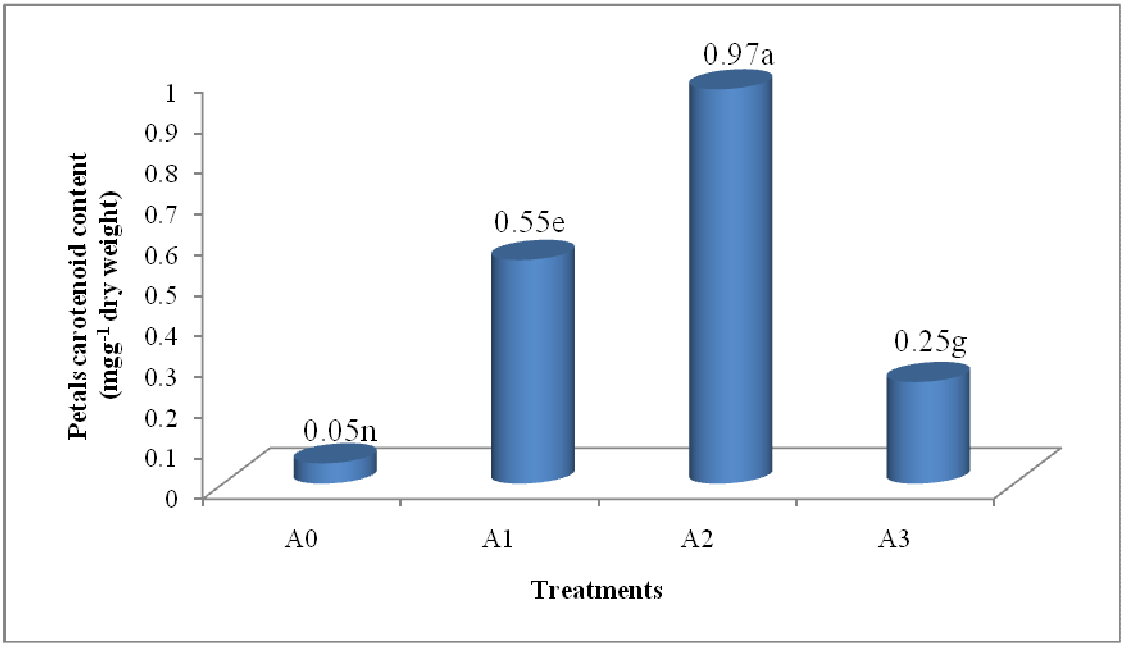

Fig. 5: The effect of different concentrations of aluminum sulfate on petals carotenid content of cut tuberose cv. 'Single'

RESULTS AND DISCUSSION

Analysis of variance showed that different levels of aluminum sulfate had significant effect on vase life, solution absorption, fresh weight loss, carotenoids and pigments content at 1 and 5% probability level. Mean comparison between different levels of aluminum sulfate showed that treatments with 50 and 100 mg l^{-1} extended vase life to 11.5 and 12 days, respectively (Table 1, Fig. 1). The priority of aforementioned treatments may be because of solution uptake enhancement, improved water relations and prevent vascular blockage by microorganisms which finally resulted extension in vase life [10, 15]. De Stitger [5] showed that the use of aluminum ions improves postharvest quality of cut roses. Kiamohammdi [16] studied the effect of antimicrobial compounds on the vase life of cut lisiyanthus (*Eustoma grandiflorum*) and reported that the 160 mg l^{-1} of aluminum sulfate caused the most vase life extension in comparison to the control which is in agreement with our results. Effect of aluminum sulfate on

solution absorption showed that the 100 mg l^{-1} was the unique treatment with 1.65 ml per gram fresh weight absorption (Figs. 1 and 2). Effectiveness of aluminum sulfate as an antimicrobial compound can be attributed to its impact on hydraulic conductivity which is ultimately controlled vascular occlusion [10, 21, 28]. Kiamohammdi [16] studied the effect of antimicrobial compounds on the vase life of cut lisiyanthus and found that 160 mg l^{-1} of aluminum sulfate increased the relative water content about 2% as compared to the control. Liao et al. [18] revealed that the use of 150 mg l^{-1} of aluminum sulfate in the vase solution increased water absorption and improved the vase life of cut lisiyanthus flowers. Among the different concentrations of aluminum sulfate, 100 mg l^{-1} of it with 17.53 g fresh weight loss had the most superiority than the control (Table 1, Fig. 2). Superiority of this combination must be due to improved water absorption which prevents vascular occlusion that eventually led to keeping fresh weight [3, 23, 26]. Liao et al. [18] studied the effect of aluminum sulfate on cut lisiyanthus and found aluminum sulfate enhanced fresh weight which confirms our results. The results of means comparison showed that 100 mg l^{-1} of aluminum sulfate with 38.07% protein content increased the protein level approximately 10% as compared to the control (Table 1, Fig. 4). The other reason can be inhibition of drought stress and water absorption enhancement which prevents membrane destruction and improved cell membrane stability [6, 17, 22, 24, 25]. Nikbakht et al. [22] reported that the use of antimicrobial agents keep proteins in cut gerbera (*Gerbera jamesonii*). Also, our results confirmed by study of Hashemabadi [11] on the effect of antimicrobial compounds on the membrane stability and protein levels in cut carnation (*Dianthus caryophyllus* cv. 'Tempo'). Means comparisons showed that 100 mg l^{-1} of aluminum sulfate had 0.973 micrograms per gram of fresh tissue which had the most priority as compared to the control (0.593 micrograms per gram of fresh tissue). This might be due to improvement in water absorption which somehow shows antimicrobial activity and affects all traits positively [10, 11]. Hashemabadi [11] reported that antimicrobial compounds increased pigments content with increasing water absorption. Basiri and Zareii [2] found that the use of high concentrations of antimicrobial compounds increases the amount of carotenoids in cut carnation petals. These results are in consistent with our results (Fig. 5).

REFERENCES

[1] Balestra, G.M., Rita, A., Bellincontro, A., Mencarelli, F. and Varvaro, L. **2005**. *Phytopathol. Mediterr*., 44: 291-299.
[2] Bassiri, Y., Zareii, H. **2011**. *Proc. 7th Int. Cong. Iranian Hortic. Sci*., pp 2478- 2479.
[3] Bayat, H., Azizi, M., Shoor, M., Vahdati, N. **2011**. *J. Hortic. Sci*., 25 (4): 384-390.
[4] Bradford, M.M. **1976**. *Ann. Biochem*., 72: 248-254.
[5] De Stitger, H.C.M. **1981**. *Z. Pflanzen. Physiol*., 101: 95-105.
[6] Eason, J.R., Webster, D. **1995**. *Sci. Hortic*., 63: 13-21.
[7] Edrisi, B. **2003**. *2nd Sci. Conf. Appl. Flowers Ornam. Plants* (Abstract).
[8] Edrisi, B. **2005**. *Seminar on Flowers and Ornamental Plants industry* (Abstract).
[9] Edrisi, B. **2009**. *Payam-e-Digar Pub*., 150 p.
[10] Figueroa, I., Colinas, T., Mejia, J., Ramirez, F. **2005**. *Cien. Inv. Agr*., 32: 167-176.
[11] Hashemabadi, D. **2011**. *Final Rep. Res. Project Islamic Azad Univ., Rasht Branch, Rasht, Iran*, 101 p.
[12] Hertogh, A.D., Nard, M.L. **1993**. *Handbook*, The Netherlands.
[13] Hojjati, Y., Khalighi, A., Farrokhzad, A.R. **2007**. *J. Agric. Soc. Sci*., 3 (3): 75-78.
[14] Khaliqi, A. **2010**. *Ruzbehan Pub*., 392 p.
[15] Kiamohammadi, M. **2009**. *M.Sc. Thesis, Islamic Azad Univ*., Abhar, 150 p.
[16] Kiamohammadi, M. **2011**. *J. Ornam. Hortic. Plants*, 1 (2): 115-122.
[17] Lerslerwonga, L., Ketsa, S., van Doorn, W.G. **2009**. *Postharvest Biol. Technol*., 52: 84-90.
[18] Liao, L.J., Lin, Y.H., Huang, K.L., Chen, W.S. **2001**. *Bot. Bull. Acad. Sin*., 42: 35-38.
[19] Mazumdar, B.C., Majumdar, K. **2003**. *www.sundeepbooks.com*., 187 p.
[20] Meman, M.A., Dabhi, K.M. **2006**. *J. Appl. Hort*., 8: 147-150.
[21] Monshizadeh, S., Rabieii, V., Mortazavi, S.N. **2011**. *Proc. 7th Cong. Iranian Hortic. Sci*., pp 199-200.
[22] Nikbakht, A., Kafi, M., Babalar, M., Xia, A., Luo, A., Etemadi, N.A. **2008**. *J. Plant. Nutr*., 31: 2155-2167.
[23] Solgi, M., Kafi, M., Taghavi, T.S., Naderi, R. **2009**. Postharvest Biol. Technol., 53: 155-158.
[24] Sood, S., Nagar, P.K. **2003**. *Plant Growth Regul*., 39: 155-160.
[25] Sultan, S.M., Farooq, S. **1997**. *Acta Physiol. Plant*, 19: 41-45.
[26] Van Doorn, W.G. **1998**. *J. Am. Soc. Hort. Sci*., 123: 146-149.
[27] Wilkins, P., Harold, F., Dole, J.M. **2005**. *Printed in USA Press*.
[28] Zadeh Bagheri, M.R., Namayandeh, A., Solati, M.R., Javanmardi, Sh. **2011**. *J. Modern Farming*, 19: 41-50.