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Effect of Thidiazuron and Salicylic Acid on the Vase Life and Quality of Alstroemeria (*Alstroemeria hybrida* L .cv. `Modena`) Cut Flower

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Abstract

In this research, the effects of thidiazuron pulse treatment and salicylic acid were examined to improve vase life and maintain the quality of *Alstroemeria* 'Modena' cut flowers. The experiment was done in a factorial experiment based on RCD with 16 treatments, 3 replications and 48 plots. The flowers were placed in different concentrations of thidiazuron (0, 10, 20, and 50 µM) and salicylic acid (0, 100, 200, and 300 mg l^{-1}) for 24 hours. Then cut flowers were put in a preservative solution containing 3% sucrose and 300 mg l^{-1} 8-HQS. Then, vase life and quality traits such as fresh weight, dry weight, water uptake, amount of soluble solids (˚brix) and cell membrane stability (electrolyte leakage) were evaluated during examination. The results showed that the concentration of 200 mg l^{-1} salicylic acid, has the highest water uptake and lowest reduction of fresh weight in comparison with the other treatments. In all treatments except for the control, dry weight and soluble solids increased. Also, 20 µM thidiazuron and 100 mg l^{-1} salicylic acid showed the greatest stability of the cell membrane compared to the control treatment. Finally, 20 µM thidiazuron and 200 mg l^{-1} salicylic acid with the highest vase life of cut alstroemeria 'Modena' compared to the other treatments is recommended to extend the vase life.

Keywords: *Alstroemeria,* Salicylic acid, Thidiazuron, Vase life.

INTRODUCTION

Alstroemeria (*Alestroemeria hybrida* L.) is one of the most beautiful of flowers family's *Alstroemeria* which is also known as Peruvian Lilies (Kim, 2005). In the past 20 years, *Alstroemeria* varieties and hybrids are known as important and new business cut flowers in the world due to their long life of postharvest, beautiful flowers and different patterns and colors (Ferrant *et al.,* 2002). Greenhouse cultivation of this flower has been increased significantly in recent decades in Iran. Despite the economic value of cut flowers, postharvest *Alstroemeria* is exposed to vulnerability and corruption like other horticultural crops and is faced with postharvest problems like yellow leaves, petal fall, turgor loss of leaves, dried florets and petal senescence and wilt (Naseri and EbrahimiGaravi, 1999). Studies show that the external application of cytokinin delay senescence due to lack of cytokinin during the senescence process. Synthetic cytokinin like thidiazuron are effective in delaying senescence (Fathi and Esmaeilpor, 2002). Thidiazuron (TDZ), is a combination of non-metabolized phenyl urea with potential cytokinin-like activity that affects some postharvest traits via ethylene biosynthesis (Ferrant *et al*., 2002; Ferrant *et al.*, 2003). Salicylic acid is a phenolic derivatives which involved in a wide range of oxidativet stress and has effects on the longevity of cut flowers through inhibition of the activity of ACC synthase and ACC oxidase (Zhang, 2003). Due to the importance of durability and maintaining the quality of cut flowers in their business in recent years, this study examined the effects of thidiazuron and salicylic acid on improving the vase life and maintaining the quality of alstroemeria cut flowers life.

MATERIALS AND METHODS

In June 2012, *Alstroemeria* 'Modena' cut flowers were harvested in commercial stage from the greenhouse located in Tehran and transferred to horticultural lab of Rasht Azad University. The flowers were recut 52 cm height and after weighing they were located in two liter volume vase and were pulse treated for 24 hours. During testing, the flowers were kept in 20±2 ˚C temperature, relative humidity (RH) of 60-70% with a12 hour light-dark photoperiod and light intensity of 12 µmol s^{2-} m^2.

This study based on RCD with 8 treatments, 3 replications, 24 plots and 96 cut flowers. The flowers were treated 24 hour in TDZ (0, 10, 20 and 50 µM) and salicylic acid (0, 100, 200, and 300 mgl^{-1}). After the end of pulse period and vase replacement, the flowers were put in preservative protective solution containing %3 sucrose and 300 mg l^{-1} 8-hydroxyquinoline sulfate.

Vase life, fresh weight, dry weight, water uptake, soluble solids and membrane stability (electrolyte leakage) were measured.Vase life defined as leaves'yellowing and petals' wilting process and is expressed as days. Fresh weight was measured by digital scale (0.01 g) and fresh weight loss, dry weight and water uptake calculated by followed formula:

Fresh weight loss = fresh weight in lst day – (fresh weight in final day + recuts weights).

Dry weight = (dry weight in final day / fresh weight in final day)× 100

Solution uptake = 500 – (Amount of vase solution in final day + Amount of room evaporation) / fresh weight in frist day.

To determine the amount of soluble solids in stem (˚brix), the carried out with refractometer ATAGO Ltd. Model 1 α, Japan..

Cell membrane stability, carried out according to protocol of Ezhilmathi *et al.,* (2007).

Data analysis was performed using SPSS software and mean comparison carried out with test in 1 and 5 percent probability level.

RESULTS AND DISCUSSION

Vase life

the effect of different concentrations of TDZ and salicylic acid was significant ($p \leq 0.01$). In comparison with other treatments, thidiazuron with 20 µM concentration and control treatment showed the most (14.32 days) and the least (8.33 days) vase life, respectively. In this analysis, sal-

icylic acid in a concentration of 200 and 300 mg l^{-1} showed the most (14.44 days) and the least (8.64 days) vase life (Fig. 1). The researchers reported that thidiazuron delays the programmed cell death through increased protein synthesis and decreased levels of reactive oxygen species and thereby increases the durability of cut flowers life (Weaver *et al.,* 1998). Rezvanipoor *et al.* (2012) examined the effect of thidiazuron and benzyl adenine in postharvest *Alstroemeria* cut flowers, their results showed that the highest durability were observed in 10 µM thidiazuron . Also salicylic acid increases cut flowers life by preventing the production of ethylene (Srivastava and Dwivedi, 2000). Pulse treatment (18 hours) salicylic 150 mg l^{-1} acid on 'Yellow Island' rose cut flowers increases the vase life in comparison to control (Geraylou and Ghasemnejad, 2011). These results are with the findings of other researchers Macnish *et al.* (2010).

Fresh weight

The effect of thidiazuron and salicylic acid loss of fresh weight was significantat ($p \leq 0.01$). Thidiazuron in a concentration of 20 µM and control treatment showed the most (8.87 g) and the least (5.40 g) loss of fresh weight, respectively. In salicylic acid effects the most and least loss of fresh weight were observed in 200 and 300 concentrations, respectively (Fig. 2). As decreasing fresh weight during maintenance of the flowers is a sign of senescence, applying the two compounds in order to keep cut flowers from oxidative stress caused by lack of water has been effective and these results are consistent with the findings of other researchers (Rezvanipour *et al.*, 2012; A'laee *et al.*, 2010).

Dry matter

The effect of thidiazuron and salicylic acid on dry matter of cut flowers is significantat ($p \leq 0.01$). Thidiazuronin and control treatment showed the most (26.06%) and the least (14.77%) dry matter respectively (Fig.3).The investigation of salicylic acid 200 mg l^{-1} and control treatment showed the most (24.70%) and the least (16.92%) dry matter respectively. It seems that thidiazuron and the salicylic acid prevented oxidative stress through increased water absorption and increased dry matter percentage through protein degradation and respiration rates reduction.

Water uptake

Effect of thidiazuron and salicylic acid had a significant on the solution absorption ($p \leq 0.01$). In comparison of data means, 50 µM TDZ and control treatment showed the most (2.44ml g-1 F.W.) and the least (1.18ml g-1 F.W.) solution absorption, respectively. Results on salicylic acid showed that 200 and control showed that 2.85 and 1.26 mg L^{-1} solution absorption. Researchers said that water balance is the most important factor in determining the quality and durability of cut flowers and the. Also, balance between water absorption and transpiration is highly

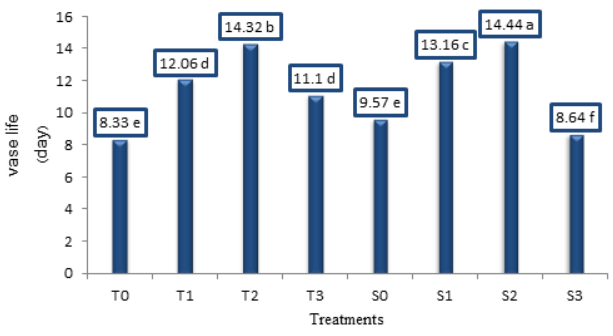

Fig. 1. Effect of different treatments on vase life of cut *Alstroemeria* cv. Modena.
T_0: control, T_1: 10 µM, T_2: 20 µM, T_3: 50 µM
S_0: control, S_1: 100 mg l^{-1}, S_2: 200 mgl^{-1}, S_3: 300 mg l^{-1}

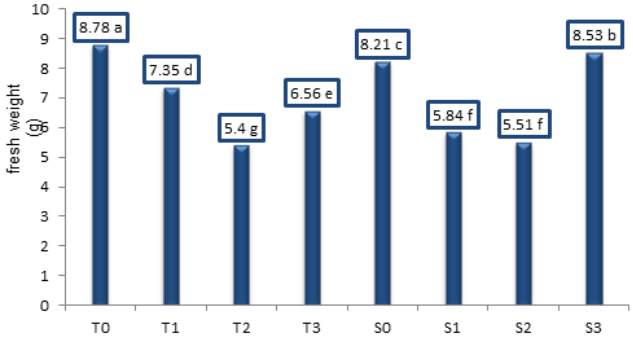

Fig. 2. Effect of different treatments on fresh weight loss of cut *Alstroemeria* cv. Modena.
T_0: control, T_1: 10 µM, T_2: 20 µM, T_3: 50 µM
S_0: control, S_1: 100 mg l^{-1}, S2: 200 mgl^{-1}, S_3: 300 mg l^{-1}

influence in the quality of the flower. Rezvanipour *et al.* (2012) examined the effects of thidiazuron on alstroemeria ' Saint Point ' increase and said the most solution absorption is obtained in 10µM thidiazuron treatment. Application of salicylic acid with acidic preservative solution prevents accumulationand proliferation of bacteria in cutting areas and improves the solution absorption. Increased water absorption and fresh weight cut flowr. (Samadi *et al.*, 2012).

Total soluble solids (°brix)

Effects of TDZ and salicylic acid on soluble solids is significant ($p \leq 0.01$). According to the table data means comparison, thidiazuron in concentration of 20 µM and control treatment showed the most (2.54%) and the least (1.39%) soluble solids reduction, respectively. In salicylic acid, control treatment and concentration 300 mg l^{-1} it showed the most (2.44%) and the least soluble solids reduction (Fig.5). Rezvanipour *et al.* (2012) said that thidiazuron (10 µm) had the most amount of soluble solids in alstroemeria 'Saint Point' cut flowers.

Loss of cell membrance stability

Effects of thidiazuron and salicyli cacid on cell membrane stability is significant ($p \leq 0.01$). And control flowers and 20 µm TDZ had the most (81.75%) and the least (25.75%) cell membrane stability reduction. Also in salicylic acid, control treatment (77%) and of 100 mg l^{-1} (37%) showed the most and the least loss of cell membrane stability reduction (Fig.6). Lorentez *et al.* (2002) indicated that during *Alstroemeria* senescence,the ratio of saturated to unsaturated fatty acids increased and semi-permeability feature of cell membranes and cell stability are decreased. Existence of sucrose in preservative solution inhibits protein and ribonucleic acid break down increases the

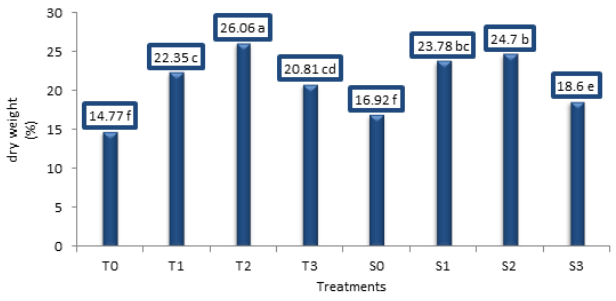

Fig. 3. Effect of different treatments on dry matter loss of cut *Alstroemeria* cv. Modena.
T_0: control, T_1: 10 µM, T_2: 20 µM, T3: 50 µM
S_0: control, S_1: 100 mg l^{-1}, S_2: 200 mg l^{-1}, S3: 300 mg l^{-1}

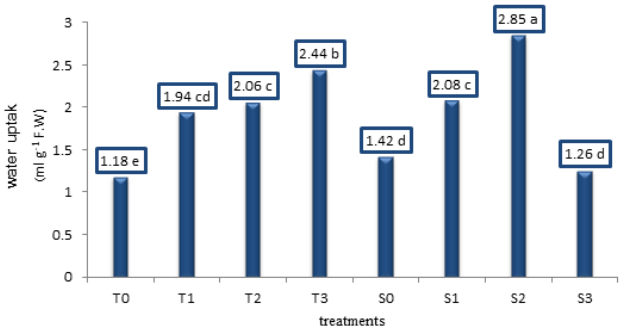

Fig. 4. Effect of different treatments on water uptake of cut *Alstroemeria* cv. Modena.
T_0: control, T_1: 10 µM, T_2: 20 µM, T_3: 50 µM
S_0: control, S_1: 100 mg l^{-1}, S_2: 200 mg l^{-1}), S_3: 300 mg l^{-1}

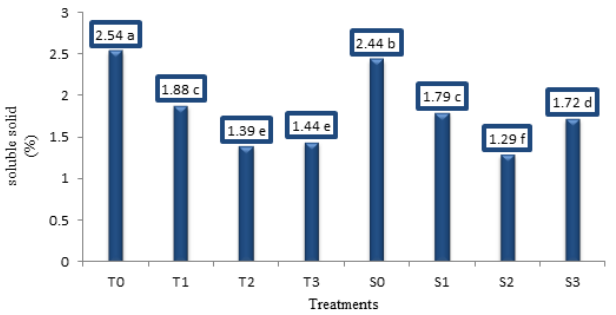

Fig. 5. Effect of different treatments on soluble solid of cut *Alstroemeria* cv. Modena.
T_0: control, T_1: 10 µM, T_2: 20 µM, T_3: 50 µM
S_0: control, S_1: 100 mg l^{-1}, S_2: 200 mg l^{-1}, S_3: 300 mg l^{-1}

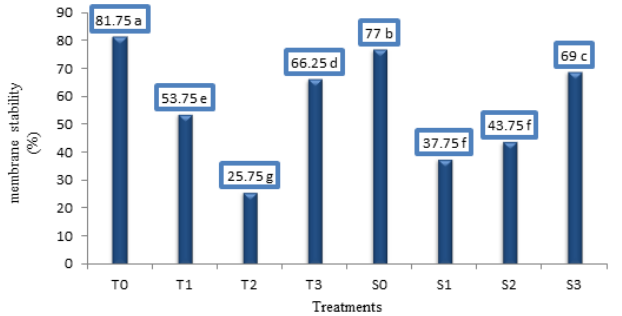

Fig. 6. Effect of different treatments on membrane stability of cut *Alstroemeria* cv. Modena.
T_0: control, T_1: 10 µM, T_2: 20 µM, T_3: 50 µM
S_0: control, S_1: 100 mg l^{-1}, S_2: 200 mg l^{-1}, S_3: 300 mg l^{-1}

cell membrane stability and delays the senescence of flowers (Liao *et al.*, 2000., Steinitz,1982). Based on the findings in Table 1 and 6, there is a direct relationship between the vase life and the amount of cell membrane stability. Treatments with higher cell membrane stability showed higher vase life. Thereby using appropriate concentration of these two compounds, we can increase the vase life of cut flowers by increasing the cell membrane stability.

CONCLUSIONS

In this study, thidiazuron treatments with cytokinin-like activity and salicylic acid with antioxidant system had significant effects on vase life and postharvest qualitative indicators improvement. Due to the qualitative and business value of cut flowers and lack of knowledge about application of effective materials, these compounds can be used to improve the qualitative value and durability of *Alstroemeria* cut flowers.

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