Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2013, 4 (1):256-259
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

Improving Water Relations and Postharvest Quality of Cut Rose (*Rosa hybrida* L. cv. 'Avalanche') by Ethanol

Mahfam Hamidi Imani[1]*, Davood Hashemabadi[2], Behzad Kaviani[2] and Mohammad Zarchini[3]

[1]MSc Student, Department of Horticulture, Rasht Branch, Islamic Azad University, Rasht, Iran
[2]Department of Horticulture, Rasht Branch, Islamic Azad University, Rasht, Iran
[3]Young Researchers Club, Rasht Branch, Islamic Azad University, Rasht, Iran

---

ABSTRACT

This research was done in order to study the effect of ethanol on vase life, water relations and some other qualitative traits of cut rose (Rosa hybrida L. cv. 'Avalanche') flower. Used concentrations of ethanol were 0, 2, 4 and 6%. Results showed that the longest vase life (12.041 days) and minimum ethylene production (0.555 nl l^{-1} g^{-1} FW) were obtained by 6% ethanol. Also, the maximum of water uptake (3.0846 ml gr^{-1} FW) was seen in 2% ethanol. Ethanol altered the content of sucrose percentage (°Brix) and protein content of cut rose.

Key words: ethanol, water uptake, *Rosa hybrida*, chlorophyll loss, vase life

---

INTRODUCTION

Rose (*Rosa hybrida* L.), one of the valuable cut flowers, belongs to the Rosaceae family which has dedicated fourth ranking of production [2]. Type and variety of flower have important role in postharvest consideration [10]. Cut rose flower has short vase life that relates to the ethylene production and causes wilting, bent neck and vascular blockage by air and microorganisms [5, 6, 11, 19]. Nowadays, the use of preservative and anti-ethylene compounds (biocide and germicide) such as silver nitrate, silver thiosulfate, hydroxy quinoline derives, 1-MCP and ethanol prevent vascular blockage and ethylene activity [4, 9, 17]. Ethanol is one of the anti-ethylene compounds that reduces ethylene activity and increases vase life of cut flowers [7, 14]. Study on *Allamanda cathartica* var. Grandiflora showed that alcohols such as ethanol and acetaldehyde delayed leaf chlorosis and extended vase life [18]. Nematollah Sani et al. [13] demonstrated that the 6% of ethanol increased water uptake of cut Anthurium (*Anthurium andreanum*) flowers compared to the control. The aim of this study was to evaluate the effect of different concentrations of ethanol on the vase life, water relations, ethylene production, the content of sucrose percentage (°Brix) and protein content of rose (*Rosa hybrida* L. cv. Avalanche) cut flowers.

MATERIALS AND METHODS

Plant Materials

Cut roses (*Rosa hybrida* L. cv. Avalanche) were grown in a standard greenhouse conditions in Amol city, Iran. Flowers were harvested at half open stage and were brought to the laboratory of Islamic Azad University, Rasht Branch, immediately. Prior to imposition of treatments, the stems were uniformly re-cut under distilled water, so as to remove the basal 5 cm in order to avoid stem-end air emboli. Re-cut stems were ~60 cm long. Cut flowers were pulse treated for 24 h with certain concentrations of ethanol and the cut flowers were then kept in 500 mL sucrose 3% and 300 mg L^{-1} 8-hydroxyquinoline stock vase solution.

Experimental Design
The experimental design was a randomized completely blocks design (RCBD) with a factorial arrangement of treatments containing four ethanol concentrations (0, 2, 4 and 6%) with three replications. In each plot, four cut rose flowers were placed into 1000 mL vase filled with 250 mL of preservative solutions including the aforementioned matters. Then, these cut rose stems were placed into 1000 mL vases filled with 500 mL of preservative solutions supplemented with 3% sucrose and 500 mg L^{-1} 8-hydroxyquinoline sulphate. Distilled water was used as a control. The mouths of the vases were covered with a sheet of paper to minimize evaporation and to prevent contamination. The flowers were kept in a vase life room under the following conditions: 24 ± 2°C, relative humidity of 70-75%, 15-20 $\mu molm^{-2}s^{-1}$ light intensity (cool white florescent tubes) and a daily light period of 12 h.

Vase Life
Vase life of the cut stems was assessed daily; throughout the vase life evaluation. The end of vase life is defined taking into consideration the visible wilting and stem bending more than 90°.

Ethylene Content
Ethylene content was determined by gas chromatography, using a Shimidzu gas chromatograph. Ethylene production (nl g^{-1} h^{-1}) was measured 24 h after pulse treatment. Three flowers were sealed in a glass jar and all jars were kept at 20°C. After 24 h, 10 mL gas samples were withdrawn for ethylene determination. Ethylene content was determined using a Shimidzu gas chromatograph equipped with an activated aluminum column fitted with a flame ionization detector.

Protein Content
At the 5^{th} day of vase life, one cut flower of each plot was used for determination of total protein content of petals. It was measured based on the Kjeldahl Digestion Method for the quantitative determination of nitrogen; then the results were used for calculating the protein content of petals as following expressions:

$$0.56 \times t \times (a-b) \times v/w \times 100/d.m,$$

Where; t: acid concentration used for titration (0.05) (mL), a: acid concentration used for treatments titration (mL), b: acid concentration used for the control titration (0) (mL), v: digestion extract volume (mL), w: petal weight used for digestion (g), and d.m: dry matter percent.

Sucrose Percentage (°Brix)
The 2 cm samples of stem were taken to determination of total soluble solid (TSS) contents of rose's stems. TSS content was measured by using hand refractometer. The hand refractometer with the range of 0 to 30 °Brix was used to determine TSS by placing 1 to 2 drops of rose stem juices on the prism.

Water Uptake
Water uptake was measured in the end of the vase life. The volume of water uptake was calculated by subtracting the volume of water evaporated from a flask of the same volume without cut flowers that of the total volume of water lost from the flask with cut flowers [1]. This amount was calculated as ml g^{-1} FW.

Data Analysis
Data were subjected to analysis of variance in MSTATC statistical software and means were compared by the least significant difference (LSD) test at the 0.05 and 0.01 of probability level.

RESULTS AND DISCUSSION

Vase Life
Statistical analysis showed that the effect of ethanol on vase life was significant at 5% of probability level (Table 1). Longest vase life (12.041 days) was obtained in 4% ethanol (Table 2). Positive effect of ethanol on vase life of cut rose led to anti-ethylene activity, so it can be act as the senescence inhibitor agent. Our results confirm the results obtained by other researches [7, 16]. Podd et al. [14] found that alcohols like ethanol could extend vase life of cut carnation (*Dianthus caryophyllus* L.).

°Brix
Ethanol had significant effect on the sucrose percentage (°Brix), and the 6% of ethanol induced the highest °Brix (4.82) (Tables 1 and 2). Improving Brix index is because of the continuous re-cutting under water and osmotic potential [9]. Danayee et al. [3] showed that ethanol in combination with gibberellins and sucrose improved total

soluble solid content in petals and delayed senescence in cut carnation. Mohammadi et al. [12] reported that anti-ethylene compounds improved total solid solution in *Gladiolus grandiflora*.

Water Uptake

Statistical analysis showed that the effect of ethanol is significant at 5% level (Table 1). Also, based on mean comparison, the maximum of water uptake (3.08 ml g^{-1} FW) was achieved in 2% ethanol (Table 2). Ethanol has anti-ethylene and antimicrobial properties that able to prevent the vascular blockage and reduces ethylene production, so it can delay senescence in cut flowers [3, 7]. Danayee et al. [3] showed that ethanol improved solution uptake and prevented vascular blockage. Nematollah Sani et al. [13] found that the 6% of ethanol had positive effect on water uptake in cut *Anthurium andreanum* cut flower. Ethanol in higher level increased solution uptake compared to the control in cut carnation (*Dianthus caryophyllus* L.). Our results confirm previous findings about solution uptake.

Protein Content

Effect of ethanol on the protein content was significant in 1% level (Table 1). The 6% ethanol induced the highest amount of protein (Table 2). The use of anti-ethylene compounds on the cut rose cv. 'Yellow island' caused high protein content [8]. Our results are in agreement with this finding.

Ethylene Production

Data analysis showed that the effect of ethanol was significant on ethylene production ($p \leq 0.01$). Mean comparison among different concentrations of ethanol indicated that the minimum ethylene (0.555 nl l^{-1} g^{-1} FW) was produced in 6% ethanol as compared to the control (Table 1). Farrokhzad et al. [7] showed that the least ethylene in cut *Eustoma grandiflorum* flowers was produced in flowers treated with 6% ethanol. Studies of Podd and Van Staden [15] on the effect of ethanol on cut carnation revealed that ethanol inhibited ethylene production.

CONCLUSION

It will be possible to extend vase life of cut rose cv. 'Avalanche' flower with ethanol. This compound has positive effect on qualitative traits and freshness in cut roses. However more research is needed to include other rose varieties and on alternative pulsing solutions that can further enhance the quality and vase life of roses.

Table 1. Analysis of variance of the effect of ethanol on some traits of cut rose (*Rosa hybrida* L. cv. Avalanche) flowers

Source of variation	df	MS				
		Vase life	°Brix	Water uptake	Protein content	Ethylene production
Ethanol	3	4.479*	2.228**	0.625*	81.847**	0.039**
Error	32	2.593	0.446	0.203	0.040	0.010
Total	47	-	-	-	-	-
CV (%)	-	14.449	15.490	15.970	8.859	16.016

**: significant at 1%, *: significant at 5%

Table 2. Mean comparison of effects of ethanol on some traits of cut rose (*Rosa hybrida* L. cv. Avalanche) flowers

Ethanol (%)	Vase life (days)	°Brix	Water uptak (ml g^{-1} FW)	Protein content (%)	Ethylene production (nl l^{-1} g^{-1} FW)
0	10.666b	3.950b	2.738ab	20.646d	0.692a
2	10.916ab	3.950b	3.084a	22.046b	0.637b
4	10.958ab	4.520a	2.911ab	21.207c	0.612b
6	12.041a	4.820a	2.552b	26.395a	0.555b

Means followed by the same letters in each column are not significantly different by LSD test in 5% level

REFERENCES

[1] Bayleyegen, A., Tesfaye, B., Workueh, T.S. **2012**. *Afr. J. Biotech*., 11 (16): 3800-3809.
[2] Butt, S.J. **2003**. Rose Ann., Pakistan (Abstrect).
[3] Danayee, E., Mostofi, Y., Moradi, P., Aziznezhad, R. **2011**. *J. Crop. Improv*., 13 (1): 21-29.
[4] Darras, A., Loannidou, A., Pompodalis, N. **2010**. *Sci. Hort*. 124: 376-380.
[5] Edrisi, B. **2010**. *Payame Digar Press*, Iran, 150 p (In Persian).
[6] Elgimabi, M.E. **2011**. *J. Am. Agric. Biol. Sci*., 6 (1): 128-133.
[7] Farrokhzad, A., Khalighi, A., Mostofi, Y., Naderi, R. **2005**. *J. Agric. Soc. Sci*., 1 (4): 309-312.
[8] Gerailoo, S., Ghasemnezhad, M. **2011**. *J. Fruit Ornament. Plant Res*., 19 (1): 183-193.
[9] Hashemabadi, D. **2005**. *Ph.D. Thesis, Islamic Azad Univ., Sci. Res. Branch*, Iran.
[10] Ichimura, K., Kawabata, Y., Kishimoto, M., Goto, R., Yamada, K. **2001**. *Bull. Nat. Inst. Flor. Sci*., 2: 9-20.
[11] Loub, M., van Doorn, G. **2004**. *Hort. Sci*., 32: 281-288.
[12] Mohammadi, N., Zarei, H., Ghasemnezhad, A. **2011**. *Proc. 7th Hortic. Sci. Cong.*, pp 2432-2434.

[13] Nematollahs Sani, R., Kazemi Dogolsar, H., Nozari, S. **2010**. *First Proc. Natl. Sym. Agric. Sustainable Dev*., pp 1-4.
[14] Podd, L.A., Hills, P.N., van Staden, J. **2002**. *Plant Growth Reg*., 38: 107-117.
[15] Podd, L.A., van Staden, J. **1999**. *J. Plant. Physiol*., 154: 351-354.
[16] Sharif Hossain, A.B.M., Boyce, A.N., Majid, H.M.A., Chandran, S., Zuliana, R. **2007**. *Mj. Int. J. Sci. Technol*., 1 (2): 184-193.
[17] Singh, A.K., Tiware, A.K. **2002**. *South Ind. Hort*., 50: 140-144.
[18] Umbese, C.E., Oji, C.K., Osinaike, T.S. **2010**. *J. Sci. Res. Der*., 12: 1-9.
[19] Van Doorn, W.G., Witte, Y., Dewitte, Y. **1997**. *J. Am. Soc. Hort. Sci*., 122: 263-266.