jpht

Research Article

Journal of Postharvest Technology
03 (04): 097-100, Oct' 2015
www.jpht.info

Sucrose, Cobalt Chloride and Aerated Soft Drink Improves the Vase Life and Quality of Cut Scapes of *Hemerocallis fulva*

Z. Mohmad Arief*[1] and Inayatullah Tahir[1]

[1] Department of Horticulture Department of Botany,
University of Kashmir, Hazratbal-190006, Srinagar, India.

Received : 25 Aug 2014
Revised : 13 Jan 2015
Accepted : 24 March 2015

Keywords

Cobalt Chloride
Cut flowers
Hemerocallis fulva
Soft drink
Vase Life

Abstract

A study was conducted to examine the post-harvest characteristics of cut scapes of *Hemerocallis fulva* cv. Royal Crown. The scapes were harvested at 0900 hrs., one day before anthesis of the first bud. The scapes were held in following test solutions: Soft Drink (25%); Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM). Distilled water alone served as control. Soft Drink (25%) +Sucrose (0.15M) significantly prolonged the vase life of scapes by six days as compared to control. Besides significantly increasing the number of blooms per scape, larger flower diameter was maintained in this treatment. The total acetone extractable pigment content of the perianth tissue of scapes held in this treatment was almost doubled as compared to control. When $CoCl_2$ (0.2mM) was added to this test solution containing Soft Drink (25%) + Sucrose (0.15M), the effects were much more pronounced and the solution uptake was significantly promoted. The present results suggest that Soft Drink (Limca) in combination with Sucrose (0.15M) + CoCl2 (0.2mM) can serve as an effective vase solution for the enhancement of vase life and postharvest quality of the cut flowers of *Hemerocallis fulva.*

INTRODUCTION

Hemerocallis fulva cv. Royal Crown (day lily) has a considerable potential as cut flower because of its beautiful brick red and funnel-shaped flowers,. The flowers bloom during June - July (in Kashmir) and the flowering period lasts for 4 - 5 weeks. The individual flowers have a life span of just one day (12hrs), opening at 8 - 9a.m. in the morning and wilting by 8 - 9 p.m. in the evening of the same day (Stead and Van Doorn, 1994; Sultan and Farooq, 1996; Nitta et al., 2010). This ephemeral life span of individual flowers is amply compensated by the profusion and continuity with which the buds on scapes bloom into flowers. A scape generally produces 16 flowers during its life span of 3 – 4 weeks. The cut scapes in water last for only a few days because of the failure of immature buds to develop and open. Besides, the flowers which open are smaller in size and lighter in colour (Sultan et al., 2001; Arief et al., 2005). However, the preservative solutions containing sucrose and cobalt chloride or 8-Hydroxyquinoline citrate have been shown to mitigate these shortcomings (Sultan et al., 2001; Arif et al., 2002; Arief et al., 2005). Flowers are ethylene - insensitive and so ethylene inhibitors have a limited role in its post harvest handling (Lay -Yee et al., 1992).

Soft drinks have been found to be very effective vase solutions on some flowers such as rose cv. 'Mary de Vor' (Ahn, 1996), since they contain carbonated water, sucrose, citric acid and sodium citrate which are the known ingredients of effective vase solutions (Yildirim et al., 1995; Reddy et al., 1995; Lee et al., 1996). The objective of the present study was to examine the effects of the soft drink in combination with sucrose and $CoCl_2$ on the vase life and post harvest quality of cut scapes of *Hemerocallis fulva.*

MATERIALS AND METHODS

Hemerocallis fulva cv. Royal Crown growing in the University Botanical Garden was used in the study. The scapes were harvested at 0900 hrs. in the morning, one day before the anthesis of the first flower and immediately brought to the laboratory. In the laboratory, the basal few centimeters of the scapes were recut under water to a uniform length of 35 cm before transferring them to test solutions.

The scapes were held in the conical flasks containing 200 ml of the following test solutions: Soft Drink

**Email:* arifk11@yahoo.co.in

ISSN 2348-4330

(25%); Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM). The test solutions were made up in distilled water which when taken alone served as control. The test solutions were renewed after every three days to minimize the microbial growth. To prevent evaporation of the test solutions, the flasks were capped with polyethene which was held in position by rubber bands. The scapes were introduced into the holding solution through small holes made in the polyethylene. Three scapes were kept in each flask and there were three flasks (replicates) per treatment, including control. The experiment was repeated twice.

The effects of these treatments were evaluated by keeping the flowers in the laboratory at a temperature of 26.2 ± 2.4˚C under cool white florescent light with a mix of diffused natural light (12Wm-2) 12 hours a day and a RH of 60 ± 10%. Total acetone extractable pigments were determined by macerating one gram of perianth tissue of flowers produced on 7th day, in 25 ml of 80% acetone. The contents were filtered and the absorbance of the filtrate was immediately read at 465 nm in a Biochem Absorptiometer.

The results are presented in tabular form. The values are the means of three replicates in each treatment. The data has been analyzed statistically and significant differences were established on the basis of standard error and LSD at P=0.05, besides the Tukey's test.

RESULTS AND DISCUSSION

The average vase life of scapes in distilled water (controls) was 8.4 days (Table 1). Soft Drink (25%) in the holding solution enhanced vase life by 2.7 days, but the effect was not significant. However, when scapes were held in holding solutions containing Soft Drink (25%) in combination with either Sucrose (0.15M) or Sucrose (0.15M) + $CoCl_2$ (0.2mM), the vase life was significantly prolonged by nearly seven days.

When the scapes were placed in distilled water (controls), most of the buds (57%) failed to develop and abscised. Only a few buds (5.6) opened successfully. When scapes were held in Soft Drink (25%), significantly larger number of buds developed and opened compared to controls (Table 1). The effect was much more pronounced when scapes were held in holding solutions containing Soft Drink (25%) in combination with either Sucrose(0.15M) or Sucrose (0.15M) + $CoCl_2$ (0.2 mM).

Table 1: Effect of aerated Soft Drink (25%); Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM) in the holding solution on the vase life and number of blooms produced and buds aborted by the scapes of *Hemerocallis fulva*. (Figures in parentheses represent percentage of buds aborted).#

Treatments	Vase life scape^{-1} (days)	Number of blooms produced scape^{-1} Days after transfer							Number of buds aborted scape^{-1}
		3	6	9	12	15	18	21	
D.W. (Control)	8.4^{a}	2.0^{a}	3.8^{a}	5.3^{a}	5.6^{a}	5.6^{a}	5.6^{a}	5.6^{a}	7.3^{a} (56.6)
Soft Drink (25%)	11.1^{a}	1.8^{a}	3.9^{a}	5.4^{a}	6.6^{b}	7.9^{b}	7.9^{b}	7.9^{b}	4.6^{b} (36.8)
Soft Drink(25%)+ Sucrose(0.15M)	14.9^{b}	2.0^{a}	3.9^{a}	5.5^{a}	6.5^{a}	7.8^{b}	8.9^{b}	9.0^{b}	3.3^{c} (26.8)
Soft Drink(25%)+ Sucrose (0.15M)+ $CoCl_2$(0.2mM)	15.2^{b}	1.9^{a}	4.0^{a}	5.6^{a}	6.6^{b}	8.4^{b}	9.2^{b}	9.4^{b}	3.3^{c} (25.9)
LSD at P=0.05	3.0	0.3	1.0	1.0	0.9	1.1	2.0	2.1	1.0(6.0)

Values are the means of three replicates in each treatment. Superscript lower case letters 'a, b and c' indicate that the values having different letters differ significantly at 5% level of significance.

Compared to distilled water controls, the volume of holding solution absorbed by the scapes was lower when held in Soft Drink (25%), but higher when held in Soft Drink (25%) + Sucrose (0.15M) or Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM). However, the effect was significant only when $CoCl_2$ (0.2mM) was included in the holding solution (Table 2).

Table 2: Effect of an aerated Soft Drink (25%); Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM) in the holding solution on the volume of holding solution absorbed by the scapes of *Hemerocallis fulva*. #

Treatments	Volume of holding solution absorbed scape^{-1} (ml) Days after transfer				
	3	6	9	12	15
D.W.(Control)	10.0^{ab}	19.4^{ab}	27.1^{a}	32.5^{ab}	34.6^{ab}
Soft Drink (25%)	8.4^{a}	17.5^{a}	26.5^{a}	29.3^{a}	31.3^{a}
Soft Drink(25%)+ Sucrose(0.15M)	9.5^{a}	20.6^{b}	29.6^{a}	35.8^{b}	38.3^{b}
Soft Drink(25%)+ Sucrose(0.15M)+ $CoCl_2$(0.2mM)	11.6^{b}	29.5^{c}	37.8^{b}	43.5^{c}	48.5^{c}
LSD at P=0.05	1.9	2.4	3.5	4.7	4.9

Values are the means of three replicates in each treatment. Superscript lower case letters 'a, b and c' indicate that the values having different letters differ significantly at 5% level of significance.

Irrespective of the treatments, the diameter of flowers produced successively decreased with progressing time. However, a larger flower diameter was maintained in Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) +$CoCl_2$ (0.2mM). (Table 3).

Table 3 : Effect of an aerated Soft Drink (25%); Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM) in the holding solution on the diameter of flowers, produced by the scapes of *Hemerocallis fulva*.#

Treatments	Diameter flower^{-1} (cm) Days after transfer					
	3	6	9	12	15	18
D.W.(Control)	10.8 ± 0.1	9.6 ± 0.0	9.5 ± 0.0	9.0 ± 0.0	-	-
Soft Drink (25%)	10.8 ± 0.0	10.0 ± 0.2	9.9 ± 0.1	9.4± 0.1	8.0 ± 0.0	-
Soft Drink(25%)+ Sucrose(0.15M)	10.8 ± 0.0	10.8 ± 0.0	10.5 ± 0.1	10.4 ± 0.0	8.2± 0.4	7.5 ± 0.0
Soft Drink(25%)+ Sucrose(0.15M)+ $CoCl_2$(0.2mM)	10.9 ± 0.0	10.8 ± 0.0	10.7 ± 0.0	10.4 ± 0.0	8.6 ± 0.2	8.5 ± 0.0

#Values are the means of three replicates in each treatment ± standard error.

The color of the flowers which opened later during the experiment was lighter in distilled water controls. However, fading colour of the successive blooms was mitigated when scapes were held in other treatments. The pigment content of perianth tissue, as measured by the absorbance of acetone extracts, was significantly enhanced when scapes were held in Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM) (Table 4).

Table 4: Effect of an aerated Soft Drink (25%); Soft Drink (25%) + Sucrose (0.15M) and Soft Drink (25%) + Sucrose (0.15M) + $CoCl_2$ (0.2mM) in the holding solution on the total acetone extractable pigments in the perianth tissue of the flowers of Hemerocallis fulva, produced on the 7th day of transfer of scapes to the holding solutions.#

Treatments	Absorbance at 465 nm
D.W. (Control)	0.24^a
Soft Drink (25%)	0.27^a
Soft Drink(25%)+Sucrose(0.15M)	0.40^b
Soft Drink(25%)+Sucrose(0.15M)+ $CoCl_2$(0.2mM)	0.42^b
LSD at P = 0.05	0.12

#Values are the means of three replicates in each treatment. Superscript lower case letters 'a, b and c' indicate that the values having different letters differ significantly at 5% level of significance.

When a floral scape is detached from the parent plant, the supply of carbohydrates and nutrients is cut off leading to its senescence (Van Staden, 1995). Thus, an exogenous supply of sugars becomes necessary for the restoration of carbohydrate level for the respiration and normal development of buds and flowers. Sucrose has been found to be very effective in delaying the senescence and improving the post harvest quality of most cut flowers, including *Hemerocallis fulva* (Halevy and Mayak,1979; Sultan et al., 2001; Arief et al., 2005). Besides water and sucrose, the other effective ingredients of vase solutions are biocides, mineral ions, ethylene inhibitors, growth regulators, organic acids, salts and antioxidants (Halevy and Mayak, 1981). In the present study, Soft Drink (Limca) in combination with Sucrose (0.15M) and $CoCl_2$ (0.2mM) in the vase solution has been found to be very effective in enhancing the vase life and post harvest quality of *Hemerocallis fulva*. Similar results with soft drinks have been observed in many flowers such as rose cv. 'Mary de Vor' (Ahn, 1996).

The effects may be attributed to the combined effects of sucrose and other ingredients of soft drink which include citric acid, sodium citrate, stabilizing and emulsifying agents and carbonated water. All these ingredients are well known for their efficacy as ingredients of vase solutions (Song et al., 1994; Reddy et al., 1995; Yildirim et al., 1995; Lee et al., 1996). The addition of $CoCl_2$ (0.2mM) to Soft Drink (25%) + Sucrose (0.15M) had more positive effect on the vase life and other postharvest characteristics. It may be attributed to the enhanced solution uptake in presence of $CoCl_2$ (Table 2). Our results are in true accordance with the well known promotory role of CoCl2 in solution uptake. Thus, the present study suggests that Soft Drink (Limca) in combination with Sucrose (0.15M) and $CoCl_2$ (0.2mM) can serve as an effective vase solution, especially for *Hemerocallis fulva*, as they contain most of the essential ingredients of vase solutions.

ABBREVIATIONS

D.W.: (Distilled water),
Suc.: (Sucrose)
8-HQC: 8-Hydroxyquinoline citrate

REFERENCES

Ahn,G.Y. 1996. Effect of post harvest pretreatment, recutting stems in water and carbonated soft drink treatment on vase life and flower quality of cut rose 'Mary de Vor'. J. Kor. Soc. Hort. Sci., 37: 719-725.

Arief, Z.M., I. Tahir, S. Farooq & S.M. Sultan. 2005. Sucrose and 8-HQC prolongs the vase life and improves the quality of cut scapes of Hemerocallis fulva L. cv. Royal Crown. In: Book of Extended Abstracts. Int. Conf. Postharvest Tech. & Quality Mgt in Arid Tropics (Ed. Opara, L.U.), Jan. 31 - Feb.2, 2005, Sultan Qaboos University, Sultanate of Oman. pp. 109-113.

Arif, M., Tahir, I., Sultan, S M. and Farooq, S. 2002. Enhancement of Vase Life of Cut Scapes of Garden Iris (Iris germanica L.) with Sucrose and Cobalt Chloride. J. of Indian Botanical Society, 81:.353-354.

Halevy,A.H. and Mayak,S. 1979. Senescence and post harvest physiology of cut flowers- 1. Hortic. Rev., 1: 204-236.

Halevy,A.H. and Mayak,S. 1981. Senescence and postharvest physiology of cut flowers- 2. Hortic. Rev., 3: 59-143.

Lay-Yee,M., Stead,A.D. and Reid,M.S. 1992. Flower senescence in day lily (Hemerocallis). Physiol. Plant., 86 : 308-314 .

Lee,J.S., Song,C.Y., Wang,H.J., Kim,Y.A., Ko,J.Y., Choi,J.K. and Kwack,B.H.1996. Effect of post harvest treatment and preservative solutions on flower quality and vase life of cut chrysanthemums. J. Kor. Soc. Hort. Sci., 37: 136-140.

Nitta, K., Yasumoto, A. A., and Yahara, T. 2010. Variation of flower opening and closing times in F1and F2 hybrids of daylily (Hemerocallis fulva; Hemerocallidaceae) and nightlily (H. citrina). American Journal of Botany, 97:261-267.

Reddy,B.S., Singh,K. and Singh,A. 1995. Effect of sucrose, citric acid and 8¬-hydroxyquinoline sulphate on the post harvest physiology of tuberose cv. Single. Advances in Agricultural Research in India, 3: 161-167.

Song,C.Y., Bang,C.S., Huh,K.Y., Lee,D.W. and Lee,J.S., 1994. Effect of post harvest pre-treatment and preservative solutions on the vase life of cut eustoma. J. Kor. Soc. Hort. Sci., 35: 487-492.

Stead,A.D. and Van Doorn,W.G. 1994. Strategies of flower senescence- a review. In: Society for Experimental Biology Seminar Series 55: Molecular and Cellular Aspects of Plant Reproduction"(Eds. R.J.Scott and A.D. Stead). Cambridge University Press, Cambridge. pp. 215-237.

Sultan, S.M. and Farooq,S. 1996. Some physiological changes associated with the development and senescence in flowers of day lily (Hemerocallis fulva L.). Plant Physiol. and Biochem., 23:205 - 208.

Sultan,S.M., Inayatullah Tahir and Farooq,S. 2001. Effect of sucrose and cobalt chloride in the holding solution on the vase life and flower quality of cut scapes of Hemerocallis fulva L. cv. Royal Crown. J. Plant Biol., 28: 127 - 130.

Van Staden,J.1995. Harmonal control of carnation flower senescence. Acta Hort., 405: 232-239.

Yildirim,T.B., Hatipoglu,A., Zager,B. and Gulgun,B. 1995. Research on the effects of the preservative chemicals used for extending the vase life of some cut flowers. Ege Universitesi Zirat Fakultesi Dergisi, 32 : 175-182.