Biological Forum – An International Journal **14(2a): 339-343(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Ethanol and Sucrose on Extending vase Life of Carnation Cut Flower cv. Bizet

Jasleen Kaur[1] and Thaneshwari[2*]
[1]M.Sc. Student, Department of Horticulture (Floriculture and Landscaping), School of Agriculture, Lovely Professional University, Phagwara (Punjab), India.
[2]Assistant Professor, Department of Horticulture (Floriculture and Landscaping), School of Agriculture, Lovely Professional University, Phagwara (Punjab), India.

(Corresponding author: Thaneshwari)*
(Received 24 April 2022, Accepted 15 June, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Carnation is an important cut flower having great economic importance in floricultural industry due to its excellent post-harvest quality parameters. Vase life is an important trait in carnation which increases its economic value. As carnation is susceptible to ethylene therefore in order to increase its vase life use of different pulsing solutions like ethanol and sucrose was done in a study conducted during 2021-2022 in order to find out the effect of different concentration of ethanol and sucrose as pulsing solution on vase life of carnation cv. 'Bizet' at Horticulture laboratory, Department of Horticulture, School of Agriculture, LPU, Punjab. In this experiment, seven pulsing solutions, *viz*; T_1: control (distilled water), T_2: 10% sucrose + 0% ethanol, T_3: 10% sucrose + 4% ethanol, T_4: 10% sucrose + 8% ethanol, T_5: 15% sucrose + 0% ethanol, T_6: 15% sucrose + 4% ethanol, T_7: 15% sucrose + 8% ethanol with 3 replications were evaluated incompletely randomized design. Maximum increase in flower stem weight (8.49g) and flower diameter (9.81 cm) was observed in treatment T_7 (*i.e.*, when pulsed with 15% sucrose + 8% ethanol) on 18th day of pulsing and was found to be statistically superior than all other treatment. Maximum amount of water uptake (37.50 ml) was observed in treatment T_7 on 20th day of pulsing. Maximum vase life (21.56 days) was also observed in treatment T_7 and was found to be statistically at par with treatment T_6 (21.12 days) *i.e.*, when treated with 15 % sucrose + 4% ethanol. In this experiment treatment 7th was found to be superior which increased the vase life of carnation.

Keywords: Carnation, Ethanol, Pulsing, Sucrose, Vase life.

INTRODUCTION

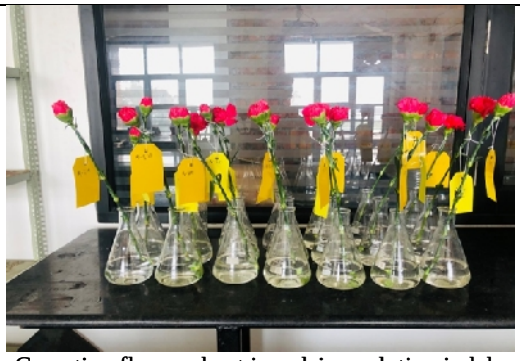
Dianthus caryophyllus commonly known as carnation belongs to family Caryophyllaceae. This flower is a symbol of passion and desire and it is the national flower of Spain. It is an important cut flower owing to its excellent keeping quality, ability to withstand long-distance transport, wide range of forms and ability to rehydrate after shipping therefore being preferred by flower growers of exporting countries as compared to other flowers (Nowak and Rudnicki 1990). However, carnation flower is susceptible to ethylene. Ethylene production is responsible for senescence in flowers and is an important signal for the onset of programmed cell death (PCD) of flowers (Sisler *et al*., 1983; Buanong *et al*., 2006). Various inhibitors of ethylene production play an important role in improving the vase life and delaying the PCD in cut carnation flowers (Van Staden, 1995; Zhou *et al*., 2005). Ethanol is an inhibitor of both ethylene synthesis and action which helps in inhibiting sensitivity to ethylene, inhibits ethylene action, and inhibits ethylene biosynthesis (Van Doorn, 2002; Hashemabadi*et al*., 2021). Sucrose provides energy, controls water balance, delays ethylene production thus reduces ethylene sensitivity and maintains flower freshness. Present experiment was conducted to in order to find out the effect of different concentration of sucrose and ethanol as a pulsing solution on vase life of carnation.

MATERIAL AND METHODS

The experiment entitled "Effect of ethanol and sucrose on extending vase life of carnation cut flower" was conducted with completely randomized design consisting of 7 treatments and 3 replications in Horticulture laboratory, Department of horticulture, School of Agriculture, Lovely professional university, Punjab during 2021-2022. The cut stem of carnation cv. 'Bizet' was collected at paint brush stage and their stem was recut at 40cm height and the basal two pair of leaves was removed in laboratory and their initial weight was taken by using weighing balance. After which initial flower diameter was also recorded with the help of scale. Then these carnations cut flower stems were kept in solutions of ethanol and sucrose in an initial volume of 300ml for 24hrs where the concentrations were different for each treatment. The treatments were: T_1-control (distilled water), T_2-10%

sucrose + 0% ethanol, T_3-10% sucrose + 4% ethanol, T_4-10% sucrose + 8% ethanol, T_5-15% sucrose + 0% ethanol, T_6-15% sucrose + 4% ethanol, T_7-15% sucrose + 8% ethanol. After 24hrs the carnation stems were transferred to a uniform vase solution of 5% sucrose + citric acid 200ppm in an initial volume of 300ml. Any changes in the carnation stem were regularly evaluated at regular intervals. Parameters like flower weight (at an interval of 3 days), flower diameter (at an interval of 3 days), water uptake (at an interval of 5 days), bent neck, vase life, and petal color were taken into consideration and accordingly the results were obtained. The data generated was subjected to statistical analysis by using WASP (web Agri stat package) software by ICAR.

Carnation cv. Bizet harvested from field at "Paint brush stage".



Carnation flowers kept in pulsing solution in lab on 3rd day of pulsing.

RESULT AND DISCUSSION

A. Effect of different concentration of ethanol and sucrose as a pulsing solution on increase in carnation flower stem weight (gm)

Data presented in Table 1, revealed that maximum increase in flower stem weight was observed in treatment T_7 (8.49g on 18th day of pulsing), when pulsed with 15% sucrose + 8% ethanol which was found to be statistically superior to all other treatments and increase was seen gradually on consecutive days i.e., on 3rd, 6th, 9th, 12th, 15th, 18th, day after pulsing. Minimum increase in flower stem weight on 15th day of pulsing was observed in treatment T_1 (4.65g), when carnation was simply treated with distilled water. After which there was decrease in flower stem weight. While the increase in flower stem weight was found to statistically at par in treatment T_5 and T_6, when carnation was pulsed with 15% sucrose + 0% ethanol and 15% sucrose + 4% ethanol respectively; on 15th days after pulsing. It was observed that after 15th day of pulsing (in treatments T_1, T_2, T_3, T_4, T_5, T_6) and after 18th of pulsing (in treatment T_7) decrease in flower stem weight was there which may be due to vase life of carnation coming to an end.

Table 1: Effect of different concentration of ethanol and sucrose as a pulsing solution on increase in carnation flower stem weight.

Treatment	Pulsing solutions	Increase in flower stem weight on 3rd day of pulsing (gm)	Increase in flower stem weight on 6th day of pulsing (gm)	Increase in flower stem weight on 9th day of pulsing (gm)	Increase in flower stem weight on 12th day of pulsing (gm)	Increase in flower stem weight on 15th day of pulsing (gm)	Increase in flower stem weight on 18th day of pulsing (gm)	Increase in flower stem weight on 21st day of pulsing (gm)
T1	Control (distilled water)	0.25^{f}	1.60^{f}	2.12^{f}	3.66^{e}	4.65^{e}	3.16^{g}	3.50^{c}
T2	10% sucrose + 0% ethanol	1.18^{e}	2.28^{e}	3.33^{e}	4.21^{d}	5.45^{d}	4.68^{f}	3.10^{d}
T3	10% sucrose+ 4% ethanol	1.57^{d}	2.45^{e}	3.51^{d}	4.57^{d}	5.71^{d}	4.93^{e}	3.75^{c}
T4	10% sucrose+8%ethanol	2.27^{c}	3.29^{d}	4.59^{c}	5.22^{c}	6.25^{c}	5.28^{d}	3.66^{c}
T5	15% sucrose + 0% ethanol	2.57^{b}	3.60^{c}	4.75^{b}	5.12^{c}	6.60^{b}	5.43^{c}	5.40^{b}
T6	15%sucrose+ 4% ethanol	2.64^{b}	3.87^{b}	4.89^{b}	5.75^{b}	6.78^{b}	5.86^{b}	5.72^{b}
T7	15% sucrose+8% ethanol	3.29^{a}	4.82^{a}	5.37^{a}	6.18^{a}	7.62^{a}	8.49^{a}	7.36^{a}
CD(0.05)		0.09	0.26	0.14	0.41	0.46	0.11	0.34

Sucrose promoted bud opening much faster in treatment T_7 as compared to when they were kept in control *i.e.*, distilled water. Sucrose helped in supplying of substrates for respiration and provided energy thus increasing flower metabolism which helps in increasing vase life and helping cut flowers harvested at bud stage to open, which otherwise would not occur naturally (Pun and Ichimura 2003; Ichimura *et al.*, 2022). Maximum increase in flower stem weight as seen in treatment T_7 and gradual increase in flower stem weight from treatment T_1 to treatment T_7 may be due to maximum water uptake and maintenance of water balance. Sucrose also contributed to increase in flower stem weight as it helped in providing energy to cut stem. Ethanol helped in decreasing ethylene production as it acts an antimicrobial agent thus helping in inhibiting any microbial growth and preventing bacterial plugging of water conducting tissues and therefore there is maximum increase in fresh flower weight in treatment T_7 having more concentration of ethanol as compare to other treatments. Citric acid on the other hand also helped in increasing water conductance in xylem of cut carnation thus increasing fresh flower stem weight and improving vase life.

Carnation flowers weighed by keeping on electronic weighing balance to measure the effect of pulsing solution on flower weight of carnation.

B. Effect of different concentration of ethanol and sucrose as a pulsing solution on increase in flower diameter (cm)

Data presented in Table 2, revealed that maximum increase in flower diameter was observed in treatment T_7 (9.81 cm on 18th day of pulsing), when pulsed with 15% sucrose + 8% ethanol which was found to be statistically superior to all other treatments and increase was seen gradually on consecutive days *i.e.*, on 3rd, 6th, 9th, 12th, 15th day after pulsing. Minimum increase in flower diameter was observed in treatment T_1 (5.16cm on 15th day of pulsing), when carnation was simply kept in distilled water. After which there was decrease in flower diameter. While the increase in flower diameter was found to statistically at par in treatment T_3 and T_2, when carnation was pulsed with 10% sucrose + 4% ethanol and 10% sucrose + 0% ethanol respectively; on 6th and 9th days after pulsing. It was observed that after 15th day of pulsing (in treatments T_1, T_2, T_3, T_4, T_5, T_6) and after 18th of pulsing (in treatment T_7) decrease in flower diameter was there which may be due to vase life of carnation coming to an end.

Presence of sucrose and carbohydrates help in opening of flower bud which otherwise could not open naturally (Pun and Ichimura 2003). Essential substrate are provided by sucrose for respiration, structural material and carbon skeletons for opening of bud and thus increasing flower diameter gradually (Mayak *et al.*, 1973; Krause *et al.*, 2021). Sucrose promotes cell expansion and petals markedly mark outwards (Norikoshi *et al.*, 2016) as compared to control treatment where no sucrose was present. On the other hand presence of ethanol and citric acid helped in reducing any microbial activity and ethylene production which might be helpful in enhancing flower opening and flower diameter. Germicides and sucrose together in right concentrations can be helpful in enhancing flower opening and diameter as seen *Antirrhinum* (Asrar, 2012) and *Rose* (Norikoshi *et al*., 2016).

Table 2: Effect of different concentration of ethanol and sucrose as pulsing solution on increase in carnation flower diameter (cm).

Treatment	Pulsing solutions	Increase in flower diameter on 3rd day of pulsing (cm)	Increase in flower diameter on 6th day of pulsing (cm)	Increase in flower diameter on 9th day of pulsing (cm)	Increase in flower diameter on 12th day of pulsing (cm)	Increase in flower diameter on 15th day of pulsing (cm)	Increase in flower diameter on 18th day of pulsing (cm)	Increase in flower diameter on 21st day of pulsing (cm)
T1	Control(distilled water)	0.35^{g}	2.56^{f}	3.54^{f}	4.55^{g}	5.16^{g}	4.23^{g}	4.23^{g}
T2	10% sucrose + 0 ethanol	1.36^{f}	3.40^{e}	4.27^{e}	5.21^{f}	6.18^{f}	5.20^{f}	5.20^{f}
T3	10% sucrose+ 4% ethanol	1.63^{e}	3.58^{e}	4.43^{e}	5.49^{e}	6.39^{e}	5.45^{e}	5.45^{e}
T4	10% sucrose+8% ethanol	1.82^{d}	3.81^{d}	4.63^{d}	5.66^{d}	6.86^{d}	5.68^{d}	5.68^{d}
T5	15% sucrose+ 0 ethanol	2.16^{c}	4.14^{c}	5.26^{c}	6.31^{c}	7.49^{c}	6.10^{c}	6.10^{c}
T6	15% sucrose+ 4% ethanol	2.45^{b}	4.47^{b}	5.63^{b}	6.59^{b}	7.86^{b}	6.71^{b}	6.71^{b}
T7	15% sucrose+8% ethanol	3.63^{a}	4.73^{a}	6.62^{a}	7.20^{a}	8.25^{a}	9.81^{a}	8.67^{a}
CD(0.05)		0.15	0.19	0.18	0.10	0.15	0.21	0.22

C. Effect of different concentration of ethanol and sucrose as pulsing solution on amount of water uptake (ml) by carnation flower cut stem

Data presented in Table 3, revealed that maximum amount of water uptake was observed in treatment T_7 (37.50 ml on 20th day of pulsing), when pulsed with 15% sucrose + 8% ethanol which was found to be statistically superior to all other treatments and increase was seen gradually on consecutive days *i.e.*, 5th, 10th, 15th and 20th days after pulsing. Minimum amount of water uptake was observed in treatment T_1 (1.06 ml on 5th day of pulsing and 33.16 ml on 20th day of pulsing), when carnation was simply kept in distilled water. While the amount of water uptake was found to be statistically at par in treatment T_7 and T_6, when carnation was pulsed with 15% sucrose + 8% ethanol and 15% sucrose + 4% ethanol respectively; on 15th days after pulsing.

Sucrose helps in maintaining the water balance, turgidity (Chaudhary and Khanal 2018) and helps in absorbing more water by lowering of osmotic potential of flower tissues thus improving the amount of water uptake (Wani *et al*., 2009). On the other hand, ethanol and citric acid acted as successful germicide inhibiting vascular blockage caused by various micro-organisms and thus avoiding any proliferation of bacteria and improving water uptake. It was observed that after 20th day of pulsing there was gradual decline in amount of water uptake which may be due to proliferation of microbes, air embolism of cut stems and plant reaction to wounding (Tsegaw *et al*., 2011).

Table 3: Effect of different concentration of ethanol and sucrose as pulsing solution on amount of water uptake (ml) by carnation flower cut stem.

Treatment	Pulsing solutions	Amount of water uptake on 5thday of pulsing (ml)	Amount of water uptake on 10thday of pulsing (ml)	Amount of water uptake on 15th day of pulsing (ml)	Amount of water uptake on 20thday of pulsing (ml)
T1	Control(distilled water)	1.06^{g}	13.40^{g}	21.30^{e}	33.16^{g}
T2	10%sucrose + 0ethanol	2.36^{f}	13.80^{f}	21.83^{d}	34.30^{f}
T3	10%sucrose+ 4%ethanol	3.16^{e}	14.40^{e}	23.46^{d}	34.60^{e}
T4	10%sucrose+8%ethanol	3.40^{d}	15.06^{d}	24.43^{c}	35.40^{d}
T5	15%sucrose+ 0 ethanol	3.56^{c}	15.40^{c}	25.16^{b}	36.30^{c}
T6	15%sucrose+ 4%ethanol	3.80^{b}	15.73^{b}	25.60^{a}	36.80^{b}
T7	15%sucrose+8%ethanol	4.13^{a}	16.73^{a}	26.00^{a}	37.50^{a}
CD(0.05)		0.15	0.24	0.67	0.19

D. Effect of different concentration of ethanol and sucrose as pulsing solution on vase life of carnation

Data presented in Table 4, revealed that maximum vase life was observed in treatment T_7 (21.56 days), when pulsed with 15% sucrose + 8% ethanol which was found to be statistically at par with T_6 (21.12 days) when treated with 15 % sucrose + 4% ethanol. Minimum vase life was observed in treatment T_1 (18.60 days), when carnation was simply kept in distilled water. Treatment T_7 had the longer vase life which was justified from the fact that ethanol was effective in increasing the vase life of carnation by inhibiting ethylene biosynthesis in carnation flowers (Wu *et al*., 1992). On the other hand, both ethanol and citric acid helps in controlling microorganism's activity thus preventing any vascular blockage, maintaining better water absorption, preventing any water stress and wilting of petals therefore increasing vase life. Also, once the vascular blockage is avoided by the use of ethanol, sucrose then facilitates higher intake of water and accumulation of total soluble sugars in petal cells by enhancing osmotic driving force for uptake of solution, thus increasing vase life. These findings were supported by studies of Nagarajuna *et al*. (2002); Hutchinson *et al*. (2003) in tuberose and Nijasure *et al*. (2004) in gladiolus.

Table 4: Effect of ethanol and sucrose as pulsing solution vase life of carnation flower.

Treatment	Pulsing solutions	Vase life (days)
T1	Control(distilled water)	18.60^{f}
T2	10% sucrose + 0 ethanol	19.22^{e}
T3	10% sucrose+ 4% ethanol	19.50^{d}
T4	10% sucrose + 8% ethanol	19.67^{c}
T5	15% sucrose + 0 ethanol	20.55^{b}
T6	15% sucrose + 4% ethanol	21.12^{a}
T7	15% sucrose + 8% ethanol	21.56^{a}
CD(0.05)		0.46

CONCLUSION

In accordance with the above results, it can be concluded that pulsing of carnation cv. 'Bizet' with ethanol and sucrose for 24 hours in solution comprising of 15 % sucrose + 8% ethanol improved all post-harvest parameters and can be recommended for increasing vase life of carnation. The combination of sucrose and ethanol was found to be effective pulsing solution for carnation cv. Bizet because it tremendously increased vase life and helped in preserving flower freshness and color during transportation besides improving all other quality parameters. Future course of action in improving vase life of carnation cv. Bizet can be carried out by focusing on the use of silver nanoparticle, essential oils and germicide as it was recently reported

that Carbon nanotubes in the holding solution stimulate flower opening and prolong vase life in carnation (Ahmadi-Majd *et al*., 2022).

Author contributions: Both the authors (Jasleenkaur and Thaneshwari) wrote, reviewed, and approved the final version of the manuscript equally.

Acknowledgement. I want to thank my university lab, my guide and parents for extending support in exhibition of the research work.

Conflicts of Interest. None.

REFERENCES

Ahmadi-Majd, M., Mousavi-Fard, S., Rezaei Nejad, A., & Fanourakis, D. (2022). Carbon nanotubes in the holding solution stimulate flower opening and prolong vase life in carnation. *Chemical and Biological Technologies in Agriculture, 9*(1): 1-22.

Asrar, A. W. A. (2012). Effects of some preservative solutions on vase life and keeping quality of snapdragon (*Antirrhinum majus* L.) cut flowers. *Journal of the Saudi Society of Agricultural Sciences, 11*(1): 29-35.

Buanong, M., Mibus, H., Sisler, E. C., & Serek, M. (2005). Efficacy of new inhibitors of ethylene perception in improvement of display quality of miniature potted roses (*Rosa hybrid* L.). *Plant growth regulation, 47*(1): 29-38.

Chaudhary, G., & Khanal, A. (2018). Effects of different concentrations of sucrose on vase life of rose (*Rosa sps. cv. Dutch Hybrid*). *Journal of the Institute of Agriculture and Animal Science, 35*(1): 183-190.

Hashemabadi, D., AbediniAboksari, H., Hedayat Rad, D., & Kaviani, B. (2021). Herbal extracts and alcohol increase vase life of *Dianthus caryophyllus* L. cv 'Yellow Candy'. *Revista Chapingo*. *Seriehorticultura*, *27*(3): 135-155.

Hutchinson, M. J., Chebet, D. K., & Emongor, V. E. (2003). Effect of accel, sucrose and silver thiosulphate on the water relations and post-harvest physiology of cut tuberose flowers. *African Crop Science Journal, 11*(4): 279-287.

Ichimura, K., Takada, M., & Ogawa, K. (2022). Effects of treatments with nigerosylmaltooligosaccharide, glucose and sucrose on the vase life of cut snapdragon flowers. *Scientia Horticulturae*, *291*, 110565.

Krause, M. R., Santos, M. N. D. S., Moreira, K. F., Tolentino, M. M., &Mapeli, A. M. (2021). Extension of the vase life of Liliumpumilum cut flowers by pulsing solution containing sucrose, citric acid and silver thiosulfate. *Ornamental Horticulture*, *27*, 344-350.

Mayak, S., Bravdo, B., Gvilli, A., & Halevy, A. H. (1973). Improvement of opening of cut gladioli flowers by pretreatment with high sugar concentrations. *Scientia Horticulturae, 1*(4): 357-365.

Nagaraju, H. T., Narayanagowda, J. V., & Nagaraja, G. S. (2002). Effect of pulsing with sucrose on vase life of tuberose. In Floriculture research trend in India. Proceedings of the national symposium on Indian floriculture in the new millennium, Lal-Bagh, Bangalore, 25-27 February, 2002. *Indian Society of Ornamental Horticulture*, (pp.346-347).

Nijasure, S. N., Ranpise, S. A., & Gondhali, B. V. (2004). Post harvest life of gladiolus cv. American Beauty as influenced by floral preservatives. *Journal of Ornamental Horticulture, 7*(3&4): 381-385.

Nowak, J. (1990). Postharvest handling and storage of cut flowers, florist greens, and potted plants (No., 04; SB442. 5, N6.).

Norikoshi, R., Shibata, T., Niki, T., & Ichimura, K. (2016). Sucrose treatment enlarges petal cell size and increases vacuolar sugar concentrations in cut rose flowers. *Postharvest Biology and Technology, 116:* 59-65.

PUN, U. K., & Ichimura, K. (2003). Role of sugars in senescence and biosynthesis of ethylene in cut flowers. *Japan Agricultural Research Quarterly: JARQ, 37*(4): 219-224.

Sisler, E. C., Reid, M. S., & Fujino, D. W. (1983). Investigation of the mode of action of ethylene in carnation senescence. *In II International Symposium on Carnation Culture 141* (pp. 229-234).

Tsegaw, T., Tilahun, S., & Humphries, G. (2011). Influence of pulsing biocides and preservative solution treatment on the vase life of cut rose (*Rosa hybrida* L.) varieties. *Ethiopian Journal of Applied Science and Technology, 2*(2): 1-15.

Van Doorn, W. G. (2002). Effect of ethylene on flower abscission: a survey. *Annals of botany*, *89*(6), 689-693.

Van Staden, J. (1995). Hormonal control of carnation flower senescence. *In VI International Symposium on Postharvest Physiology of Ornamental Plants 405* (pp. 232-239).

Wani, S. A., Siddique, M. A. A., Khan, F. U., Qadri, Z. A., Khan, F. A., Dar, Q. A. H., & Ali, S. (2009). Effect of pulsing treatments for enhancing shelf-life of cut Asiatic lilium cv. Elite. *Journal of Horticultural Sciences, 4*(2): 138-142.

Wu, M. J., Zacarias, L., Saltveit, M. E., & Reid, M. S. (1992). Alcohols and carnation senescence. *Hort Science, 27*(2): 136-138.

Zhou, Y., Wang, C. Y., Ge, H., Hoeberichts, F. A., & Visser, P. B. (2005). Programmed cell death in relation to petal senescence in ornamental plants. *Journal of Integrative Plant Biology*, *47*(6): 641-650.

How to cite this article: Jasleen Kaur and Thaneshwari (2022). Effect of Ethanol and Sucrose on Extending vase Life of Carnation Cut Flower cv. Bizet. *Biological Forum – An International Journal*, *14*(2a): 339-343.