Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 2545-2548
Received: 13-10-2020
Accepted: 15-11-2020

Rohan Tomar
Department of Floriculture and Landscaping, College of Horticulture, VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand, India

Dr. Mamta Bohra
Department of Floriculture and Landscaping, College of Horticulture, VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand, India

Varun Chauhan
Department of Floriculture and Landscaping, College of Horticulture, VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand, India

Mohit Chaudhary
Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh, India

Corresponding Author:
Rohan Tomar
Department of Floriculture and Landscaping, College of Horticulture, VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand, India

Effect of pulsing solution for improving vase life of gerbera (*Gerbera jamesonii* Bolus ex. Hook) cv. Rucha

Rohan Tomar, Mamta Bohra, Varun Chauhan and Mohit Chaudhary

Abstract
The present experiment on effect of pulsing solution for improving vase life of gerbera was carried out during November, 2019 at Floriculture and Landscaping Laboratory, College of Horticulture, VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand. The experiment consists of ten treatments which were replicated three times in Completely Randomized Design. The results of investigation revealed that the treatment applied with 15% Sucrose + 300 ppm 8-HQC (T_7) recorded maximum amount of pulsing solution uptake (3.28 ml), per cent weight increase of cut stems after pulsing (10.09), vase life (12.91 days), per cent increase in flower diameter (14.32 cm), amount of distilled water consume (19.89 ml), minimum per cent decrease in weight of the cut stem (17.67), per cent stem bending (38.30) and minimum number of CFU (42.26×10^{-6}) for pulsing solution. The results show that sucrose could increase vase life in combination with 8-HQC.

Keywords: pulsing, holding, sucrose, 8-HQC, CFU, distilled water

Introduction
Gerbera (*Gerbera jamesonii* Bolus ex. Hook.) is ranked among the top ten commercial cut flowers in the world flower market. It belongs to the family Asteraceae and originated from South Africa and Asia. It is also known as Transvaal daisy, Barberton daisy and African daisy. The leaves are radical, petiolated, lanceolate, lobed, narrower at the base and wider at tip and are arranged in a rosette at the base. It is a light weight flower with long and slender flower stalk. The daisy like dazzling and magnificent flower is used for vase decoration and flower arrangement purpose. The flowers have hollow stem therefore it is highly prone to water stress. Beside this stem/scape bending is a major physiological disorder of this crop which causes reduction in vase life of flower. Balestra *et al*. (2005) [2] reported that blockage of xylem due to bacterial plugging is the main reason of stem break and bending. The postharvest longevity of cut flowers can often be improved by the use of different preservative solution (Prashanth, 2006) [15]. A preservative solution contains three components i.e. sucrose that provide carbohydrate to the flower, biocide which helps in killing the population of microbes and an acidifier which lower down the pH of vase solution which helps in improving vase life of flower. For improving the vase life of gerbera pulsing solutions plays an important role. Therefore, the work embodied in this paper aimed to increase flower vase life and other related characters of cut gerbera flowers.

Materials and Methods
The present investigation entitled "Effect of pulsing solution for improving vase life of gerbera (*Gerbera jamesonii* Bolus ex. Hook) cv. Rucha" was carried out under Floriculture laboratory, College of Horticulture, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal in 2019. The investigation was done for pulsing solution. The experiment consists of ten treatments *viz*., T_1 Control (distilled water); T_2 (10% Sucrose + 200 ppm 8HQC); T_3 (10% Sucrose + 250 ppm 8HQC); T_4 (10% Sucrose + 300 ppm 8HQC); T_5 (15% Sucrose + 200 ppm 8HQC); T_6 (15% Sucrose + 250 ppm 8HQC); T_7 (15% Sucrose + 300 ppm 8HQC); T_8 (20% Sucrose + 200 ppm 8HQC); T_9 (20% Sucrose + 250 ppm 8HQC); T_{10} (20% Sucrose + 300 ppm 8HQC). The experiment was laid out in Complete Randomized Design with three replications per treatment. Cut stems were placed for 6 hours in pulsing after that put in distilled water.

Data Collected

Amount of pulsing solution uptake (ml/stem)

Amount of pulsing solution uptake was calculated by using the following formula.

Amount of pulsing solution uptake (ml) = Initial volume of solution (ml) – Final volume of the solution (ml) (after 6 hours pulsing duration).

Per cent weight increase of cut stems after pulsing (%)

Increase in weight of cut stems was worked out by recording the initial and final weight of stems at the time of pulsing them in preservative solutions.

$$\text{Per cent weight increase of cut stems after pulsing} = \frac{W_2 - W_1}{W_1} \times 100$$

W_1- Weight of cut stems before pulsing

W_2- Weight of cut stems after pulsing

Vase life (days)

Vase life was measured in days at the time of keeping the flowers in vase until the flowers show any of the following symptoms: stem bending or neck bending or 50% petal discolouration or wilting.

Percent increase in flower diameter

The equatorial diameter of flowers at two places was recorded and average of two values was calculated. Increase in flower diameter of cut stem was worked out by recording the initial and maximum flowers diameter attained by the stems.

$$\text{Per cent increase in flower diameter} = \frac{W_2 - W_1}{W_1} \times 100$$

W_1- Initial flower diameter of cut stems

W_2- Maximum flower diameter attained by cut stems

Amount of distilled water consumed (ml/stem)

Amount of distilled water consumed was calculated by using the formula:

Amount of distilled water consumed = Initial volume of distilled water (ml) – Final volume of the distilled water at the termination of vase life of cut stem (ml).

Per cent decrease in weight of the cut stem

Decrease in weight of stems was worked out by recording initial and final weight of cut stems recorded at the time of putting cut stems in distilled water and termination of vase life.

$$\text{Per cent decrease in weight of the cut stem} = \frac{W_1 - W_2}{W_1} \times 100$$

W_1- weight of cut stems at the time of putting them in distilled water

W_2- weight of cut stems at the time of vase life termination

Per cent stem bending (%)

It was measured by using formula

$$\text{Per cent stem bending} = \frac{\text{Number of cut stem showing bend neck}}{\text{Total number of cut stems used}} \times 100$$

Number of CFU (Bacterial count)

Dilution plate count technique was adopted to estimate the bacterial population. After completion of vase life, 1 ml solution from each replication of each treatment was taken. Afterwards, serial dilutions were made up to10^{-6} dilutions. Out of these, 3 dilutions (10^{-4}, 10^{-5} and 10^{-6}) were selected and plated on nutrient agar. Under each dilution, three plates were used and the number of colonies of bacteria was counted after 48 hours of incubation at 37 ° C and their mean value was recorded.

Results and Discussion

Effect of pulsing solution on vase life of gerbera cv. Rucha

The maximum amount of pulsing solution uptake (3.28 ± 0.11 ml) was noticed on T_7 and found statistically at par with T_4 (2.61 ± 0.33 ml), T_5 (2.79 ± 0.10 ml), T_6 (2.91 ± 0.23 ml) and T_8 (2.64 ± 0.14 ml). Marousky (1971) [14] reported that 8-HQC inhibit stem plugging by reducing the pH of the solution. It acts as a germicide which decreases the microbial growth in vascular bundles. Similar findings were reported by Silva De *et al.* (2013) [16], Vaidamitra (2017) [17] and Helaly (2019) [9] in gerbera, and Lakmali *et al.* (2016) [13] in gerbera and alstroemera.

The highest percent weight increase of cut stems (10.09 ± 0.41%) was observed from the flowers pulsed with T_7 and found statistically at par with T_6 (8.78 ± 0.62%). Besides this 8-HQC have profound effect to check deleterious microbial effect (Farnham *et al*., 1972) [7] and presence of sucrose act as anti-desiccant (Marousky, 1971) [14] which increase the weight of cut stem. Similar results have been reported by Lakmali *et al.* (2016) [13] in gerbera and alstroemera and Vaidamitra (2017) [17] in gerbera.

The maximum vase life (12.91 ± 0.44 days) was recorded from the flowers pulsed with T_7 followed by T_6 (11.24 ± 0.14 days). Joshi (2012) [12] reported that sucrose helps in increasing the level of moisture retention, increase osmotic potential of cytoplasm and reduce transpiration losses. The use of 8-HQ reduce stem blockage in sterile tissues (Halevy and Mayank, 1981) [8] and citric acid act as acidifier which inhibits the growth of microorganisms (Dole and Wilkins, 1999). The result is corroborated with the findings of Chandrakant (2012) [3], De *et al*. (1996) [5] in gerbera crop and Jain *et al*. (2017) [10] in gladiolus.

The maximum percent increase in flower diameter (14.32 ± 0.48%) was recorded in T_7 followed by T_6 (12.69 ± 0.32%). More uptake of solution helped in more opening of disc florets and enlargement of ray florets contributing to increased flower size. The above results were corroborated with the finding of Chandrakant (2012) [3] and Vaidamitra (2017) [17] in gerbera.

The maximum amount of distilled water consumed (19.89 ± 0.20 ml) was recorded in T_7 and found statistically at par with T_5 (18.87 ± 0.35 ml) and T_6 (19.16 ± 0.64 ml). The increase amount of distilled water consumed in these treatments might be due to sucrose which supplies carbohydrate to the tissues and decrease the H_2O potential and thus improving the water uptake. Use of 8-HQC in pulsing helps in inhibiting stem plugging thereby conductivity of stem for solution uptake (Marousky, 1972). The results are in conformity with the findings of Vaidamitra (2017) [17] and Helaly (2019) [9] in gerbera.

The minimum percent decrease in weight of the cut stem (17.67 ± 0.77%) was recorded in T_7 and found statistically at par with T_5 (18.68 ± 0.57%) and T_6 (18.89 ± 0.12%). Daan *et al*. (1995) reported that combination of sucrose and 8HQC markedly inhibit senescence. The reduction in increase in percent weight of cut stem under T_1 might be due to decrease water uptake and increase water loss. The above results are

also corroborated with the findings of Jain *et al.* (2017) [10] in gladiolus and Vaidamitra (2017) [17] in gerbera.

The minimum stem bending [38.30 ± 1.30 (38.21 ± 0.76)%] was observed in the cut stems when pulsed with T_7 followed by T_6 [43.11 ± 1.39 (41.02 ± 0.80)%]. Minimum stem bending might be due to minimum bacterial count was recorded under this treatment which causes elimination of vascular blockage in xylem and enhanced solution uptake. Similar results were reported by Javad *et al.* (2011) [11] and Vaidamitra (2017) [17] in gerbera.

The minimum number of bacteria (42.26 ± 0.63 CFU/ml) was recorded in T_7 followed by T_5 (47.66 ± 1.20 CFU/ml). This might be due to antimicrobial activity of 8-HQC which reduces the pH of solution. Similar findings were also found by Amith (2010) [1], Divya (2013) [6] and Vaidamitra (2017) [17] in gerbera.

Table 1: Effect of pulsing treatments on amount of pulsing solution uptake (ml), per cent weight increase of cut stems after pulsing, vase life (days) and cent increase in flower diameter of gerbera cv. Rucha

Treatment codes	Treatments	Amount of pulsing solution uptake (ml) ± S.E(m)	Per cent weight increase of cut stems after pulsing ± S.E(m)	Vase life (days) ± S.E(m)	Per cent increase in flower diameter ± S.E(m)
T_1	Control (Distilled Water)	1.23 ± 0.12	5.14 ± 0.17	8.16 ± 0.22	4.57 ± 0.18
T_2	10% Sucrose + 200ppm 8-HQC	2.50* ± 0.38	7.64*± 0.38	10.11* ± 0.26	10.26*± 0.12
T_3	10% Sucrose + 250ppm 8-HQC	2.54* ± 0.32	7.64*± 0.66	10.08*± 0.44	9.44*± 0.18
T_4	10% Sucrose + 300ppm 8-HQC	2.61* ± 0.33	8.02*± 0.39	11.00*± 0.28	10.95*± 0.38
T_5	15% Sucrose + 200ppm 8-HQC	2.79*± 0.10	8.68*± 0.62	11.18*± 0.30	11.08*± 0.40
T_6	15% Sucrose + 250ppm 8-HQC	2.91* ± 0.23	8.78*± 0.62	11.24*± 0.14	12.69*± 0.32
T_7	15% Sucrose + 300ppm 8-HQC	3.28*± 0.11	10.09*± 0.41	12.91*± 0.44	14.32*± 0.48
T_8	20% Sucrose + 200ppm 8-HQC	2.64*± 0.14	8.03*± 0.23	11.08*± 0.10	10.37*± 0.07
T_9	20% Sucrose + 250ppm 8-HQC	2.43*± 0.15	7.15*± 0.16	9.83*± 0.68	9.01*± 0.20
T_{10}	20% Sucrose + 300ppm 8-HQC	2.01* ± 0.34	7.01*± 0.42	9.25*± 0.14	8.69*± 0.42
SE (d)		0.35	0.63	0.49	0.43
C.D. (0.05)		0.74	1.32	1.03	0.92

* Significant at 5% level of significance as compared to control

Table 2: Effect of pulsing treatments on per amount of distilled water consumed (ml), per cent decrease in weight of the cut stem, per cent stem bending and number of CFU (Bacterial count) of Gerbera cv. Rucha

Treatments code	Treatments details	Amount of distilled water consumed (ml) ± S.E(m)	Per cent decrease in weight of the cut stem ± S.E(m)	Percent stem bending and transformation angular value ± S.E(m)	Number of CFU (Bacterial count) 10^{-6} ± S.E(m)
T_1	Control (Distilled Water)	13.19 ± 0.41	22.97 ± 0.38	73.37 ±1.87 (58.94 ±1.21)	85.00 ± 0.57
T_2	10% Sucrose + 200ppm 8-HQC	17.54*± 0.94	19.72*± 0.26	55.81* ± 1.01 (48.32 ±0.58)	56.33* ± 0.88
T_3	10% Sucrose + 250ppm 8-HQC	16.96*± 1.00	19.74*± 0.53	54.78* ± 1.52 (47.72 ± 0.87)	52.33* ± 0.88
T_4	10% Sucrose + 300ppm 8-HQC	17.58*± 0.53	19.22*± 0.24	51.59* ± 1.29 (45.89 ± 0.73)	49.66* ± 0.88
T_5	15% Sucrose + 200ppm 8-HQC	18.87*± 0.35	18.68*± 0.57	45.86* ± 1.17 (42.60 ± 0.67)	47.66* ± 1.20
T_6	15% Sucrose + 250ppm 8-HQC	19.16*± 0.64	18.89*± 0.12	43.11* ± 1.39 (41.02 ± 0.80)	47.00* ± 1.15
T_7	15% Sucrose + 300ppm 8-HQC	19.89*± 0.20	17.67*± 0.77	38.30* ± 1.30 (38.21 ± 0.76)	42.26* ± 0.63
T_8	20% Sucrose + 200ppm 8-HQC	18.64*± 0.23	18.98*± 0.11	51.15* ± 1.18 (45.64 ± 0.67)	50.33* ± 1.20
T_9	20% Sucrose + 250ppm 8-HQC	15.17*± 0.62	20.52*± 0.28	64.81* ± 1.54 (53.60 ± 0.92)	61.33* ± 0.88
T_{10}	20% Sucrose + 300ppm 8-HQC	14.98*± 0.54	20.69*± 0.36	66.67* ±1.12 (54.72 ± 0.68)	61.48* ± 0.51
S.E (d)		0.51	0.58	1.92 (1.14)	1.29
$C.D_{(0.005)}$		1.07	1.23	4.04 (2.41)	2.71

* Significant at 5% level of significance as compared to control

Conclusion

The results of present investigation revealed that gerbera cv. Rucha pulsed with 15% Sucrose + 300 ppm 8-HQC for 6 hrs and found significantly effective in improving vase life of flower and could satisfactorily be recommended for enhancing vase life of gerbera.

References

1. Amith R. Effect of chemical floral preservatives on the vase life of cut flowers of gerbera cultivars. Thesis, M.Sc. Department of Horticulture, University of Agricultural Sciences, GKVK campus, Bengaluru 2010.
2. Balestra GM, Agostini R, Bellincontro A, Mencarelli F, Varvaro L. Bacterial populations related to gerbera (*Gerbera jamesonii* L.) stem break. Phytopathologia Mediterranea 2005;44:291-299.
3. Chandrakant JA. Post-harvest study on gerbera (*Gerbera jamesonii*) cv. Stanza. Thesis, Ph.D. Department of Horticulture, Navsari Agriculture University, Navsari 2012.
4. Daan K, Ribot S, Helen S, Van R, Nollie M. The effect of sucrose on the flower bud opening of Madelon cut rose. Scientia Horticulturae 1995;60:325-326.
5. De LC, Bhattacharjee SK, Misra RL. Post-harvest life of pulsed gladiolus spikes as affected by different chemicals. Journal of Ornamental Horticulture 1996;4:8-12.
6. Divya HS. Effect of holding solutions on the vase life of cut gerbera (*Gerbera jamesonii* Bolus ex. Hook). Thesis, M.Sc. University of Agricultural Sciences GKVK, Bengaluru 2013.
7. Farnham DS, Barr C, Halevy AH. The value of using chemical solution for carnation conditioning and bud opening 1972;150(1380):17-18, 52-54.
8. Halevy AH, Mayak S. Senescence and post-harvest physiology of cut flowers. Horticultural Reviews 1981;1:204-236.

9. Helaly AAE. Improving gerbera cut flowers by using pulsing and holding solutions under cold storage periods treatments. Journal of Plant Production 2019;10(3):241-246.
10. Jain R, Kumar P, Swaroop K, Pinder R. Standardization of pulsing treatments for improving the vase life of gladiolus (*Gladiolus grandiflorus* L.). Chemical Science Review and Letters 2017;6(21):484-488.
11. Javad NDM, Ahmad K, Mostata A, Roya K. Post-harvest evaluation of vase life, stem bending and screening of cultivars of cut gerbera (*Gerbera jamesonii* Bolus ex. Hook f.) flowers. African Journal of Biotechnology 2011;10(4):560-566.
12. Joshi AC. Post-harvest study on gerbera (*Gerbera jamesonii*) cv. Stanza. Thesis, M.Sc. Department of Horticulture, N.M. College of Agriculture, Gujarat Agricultural University, Navsari 2012.
13. Lakmali HHDI, Balasooriya BLS, Ratnayake K. Postharvest longevity of cut gerbera and alstroemeria as affected by citric acid pulse and vase solutions. Journal of Food and Agriculture 2016;9:39-49.
14. Marousky FJ. Inhibition of vascular blockage and increased moisture retention in cut rose induced by modifying pH, 8-Hydroxyquinoline citrate and Sucrose. Journal of the American Society for Horticultural Science 1971;96:38-41.
15. Prashanth P. Studies on the role of physiological and biochemical components with floral preservatives on the vase life of cut gerbera (*Gerbera jamesonii*) cv. Yanara. Thesis, Ph.D. Acharya N G Ranga Agricultural University, College of Agriculture, Rajendranagar, Hyderabad 2006.
16. Silva De WANT, Kirthisinghe JP, Alwis LMHR. Extending the vase life of gerbera (*Gerbera hybrida*) cut flowers using chemical preservative solutions. Tropical Agricultural Research 2013;24(4):375-379.
17. Vaidamitra SV. Studies on post-harvest handling of gerbera (*Gerbera jamesonii* Bolus ex. Hook). Thesis, M.Sc. Dr. Y. S. Parmar University of Horticulture and Forestry, Solan 2017.