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Original Article

The vase life of two rose cultivars and the effects of different floral preservatives

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A B S T R A C T

The research was carried out in the horticulture department's laboratory at the Bangladesh Agricultural University in Mymensingh during 1st to 10th August, 2023. The major goal of this study was to use several preservation solutions to extend the vase life of two cut rose cultivars. In the postgraduate lab of the department of horticulture, the two-factor experiment was set up using a completely randomized design (CRD) with three replications. There were two cultivars: V_1=Lincoln (red color) and V_2= Brighton (yellow color), and five preservatives solutions were used to keep these blooms fresh *viz.*, T_0= water (control), T_1= lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3= aspirin solution (0.03%), and T_4= sugar solution (5%). The rose flowers were collected at half blooming stage from the landscaping section of Bangladesh Agricultural University, Mymensingh. Studies showed that there was a substantial difference between rose varieties in the parameters under study. Lincoln performed the highest total solution uptake(25.66ml) and maximum vase life (10 days) and gave lowest number of opened petals, number of dried petals, weight loss percent compared to Brighton. There was significant variation among the treatment effects in respect of number of opened petals, number of dried petals, weight loss (%), total solution uptake(ml) and vase life. With all the parameters, it was observed that treatment of sugar solution (5%) performance was the best among all the treatments. Lincoln gave the highest vase life when treated with 5% sugar solution.

Introduction

One of the most significant ornamental plants in the world is the rose (*Rosa hybrid* L.), and the most significant sector of the rose culture industry is the production of cut rose flowers (Bleeksma and Van Doorn, 2003; Mortazavi *et al*., 2007). The rose represents excellence, elegance, romance, and love. It is a member of the Rosaceae family and the 1400 cultivars and more than 150 different types that make up the genus Rosa (Synge, 1971). Roses are preferred over other kinds of flowers because they are often used as decorations and because of their delicate nature, beauty, allure, and perfume. This flower is valued highly economically and is employed in agro-based industries, particularly in cosmetics and fragrances. In addition, roses are essential in the production of numerous goods with significant medical and dietary value. However, the primary purpose of growing rose plants is to produce cut flowers, which heavily involves the floricultural industry (Butt, 2003). Although, because to poor water intake, low energy availability, and vulnerability to ethylene, fresh cut flowers are extremely perishable (Gerailoo & Ghasemnezhad, 2011). In terms of cut flower quality, longevity in the vase is the most crucial factor. Cut rose flowers typically only retain their beauty and charm for a short period of time. However, the majority of individuals want to take use of flowers for an extended period of time while maintaining their socioeconomic value (Tsegaw *et al*., 2011). Most cut flowers were stored in water in former times, but today's floral preservatives have been developed to extend the shelf life of cut flowers. Creating new techniques to increase the lifespan of the vase and flower beauty of rose plants is important and attracts a lot of interest globally. If flowers are kept in an appropriate floral preserver, they stay fresher for longer (Rubinatein, 2000). According to several studies (Marousky, 1969; Gilman and Steponkus, 1972; Parups and Chan, 1973; Kaltaler and Steponkus, 1976), several vase solutions, such as sucrose, prolong the life of cut roses in vases. Sucrose is a common ingredient in floral preservatives because it serves as a food source for respiratory substrate, slows down protein deterioration, and enhances cut flower water balance.

The overall vase life of carnations and Gladiola species is increased when flowers are treated with liquids containing sucrose (5–15%) (Mor *et al*., 1981). Citric acid is commonly available and inexpensive as an acidifier and can also destroy microorganisms in a solution. Citrus fruits (including lemons, limes, and oranges) contain it. Citric acid is abundant in lemon and lime juice. Citric acid concentrations in both lime and lemon juice extracts are 1.10 and 1.06 g/oz, respectively. Additionally, aspirin prolongs the vase life of freshly cut flowers by keeping bacteria out of the water and preventing them from harming the blooms. In aging rose petals, $CaCl_2$ treatment boosted ATPase activity, delayed the loss of membrane proteins and phospholipids, and improved bud opening, according to research by Torre *et al*. 2002. According to Chen *et al*. (2004), cut *Gerbera hybrida* flowers were immersed in $CaCl_2$ solution, which lengthened their flowering time. Few investigations on postharvest physiology have been done to extend the vase life of cut flowers (Halevy *et al*., 1981). There is no published information on any specific post-harvest procedures that could lengthen the storage life of rose cut flowers in Bangladesh. In order to determine the most efficient preservative that can improve and prolong vase life, this experiment was created to evaluate the effects of several preservatives on the vase life of roses.

Materials and Methods

Experimental location and period of the study

The goal of the current experiment was to find the optimal treatment combination for maintaining flowers for long-term preservation. It was carried out in the Laboratory of the Horticulture Department of Bangladesh Agricultural University, Mymensingh, from August 1 to August 10, 2023.

Experiment Frame Work

The experiment used two components: Factor A, two types of roses (V_1=Lincoln, which was red, and V_2=Brighton, which was yellow), and Factor B, five preservative solutions (T_0=water, which served as the control), T_1= lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3= aspirin solution (0.03%), and T_4= sugar solution (5%). Three replications of the two-factor experiment were used in the Completely Randomized Design (CRD) layout. The rose blooms were taken from the landscaping section of Bangladesh Agricultural University in Mymensingh while they were halfway through flowering.

Methods for preparing the preservative solutions

Control (Tap water)

Half bloomed roses were selected and placed in 15 vases containing Tap water and kept in laboratory at room temperature.

Lemon juice solution (5%)

One liter of water was infused with fifty milliliters of lemon juice to create the solution. 15 flowers of half bloomed roses were selected and placed in a lemon juice solution (200ml) and kept in laboratory at room temperature.

Sugar solution (5%)

Fifty-gram sugar was diluted in one liter of water. 15 flowers of half bloomed roses were selected and placed in 15 vases containing sugar solution (200 ml) and kept in laboratory at room temperature.

Aspirin solution (0.03%)

0.03 gm aspirin tablet was mixed with one liter of water to prepare solution. 15 flowers of half bloomed roses were selected and placed in 15 vases containing aspirin solution and kept in laboratory at room temperature.

$CaCl_2$ solution (0.05%)

To create the solution, 0.05 gram of calcium chloride was mixed in a liter of water. 15 flowers of half bloomed roses were selected and placed in 15 vases and kept in laboratory at room temperature.

Methods of studying different parameters

Number of opened petals

By counting every two days, it was possible to determine how many opened petals of a rose were affected by various preservatives.

Number of dried petals

By monitoring on two separate days, the amount of dried rose petals affected by various preservatives was determined.

Weight loss (%)

The weight loss of roses affected by various preservatives was calculated by counting every two days. Using the following formula, weight loss was calculated:

Percent weight loss (%WL) =$(\mathbf{IW}-\mathbf{FW})/\mathbf{IW}\times 100$

Where,

WL = Percent total weight loss

IW = Initial weight of flowers (g)

FW = Final weight of flowers (g)

Total solution uptake (ml)

The amount of solution that was still present 12 days after storing was used to compute the total solution absorption (ml). Evaporation of water was controlled by aluminum foil paper covering the top of pot.

Vase life

By tracking the number of days, it took to dry all the rose petals after harvest, researchers were able to determine how different preservatives affected the vase life of flowers.

Statistical analysis

The MSTAT computer application was used to statistically assess the data acquired from experiments on various parameters. The analysis of variance for each character was completed by the F variance test after the average values for all the variables were computed. The Least Significant Difference (LSD) test was used to determine the significance of the difference between two sets of averages at 1% levels of chance (Gomez and Gomez, 1984).

Results and Discussion

Number of opened petals

The number of opened petals of rose was influenced significantly because of distinct varieties. The maximum amount of opened petals (9.47) was obtained with Brighton rose(V_2). The Lincoln rose (V_1) was determined to have the fewest opened petals (8.60) (Table 1). Begum *et al*, 2020 discovered that flower opening of rose cvs. Lincoln and Tajmahal were increased significantly in different DAS that the opening of Lincoln was comparatively slower than Tajmahal.

Table 1. The impact of variation on rose petals opening at various DAS.

Variety	No. of petal open at different DAS				
	2	4	6	8	10
V_1	3.73	5.20	6.10	7.0	8.60
V_2	3.13	6.20	6.73	8.80	9.47
$LSD_{0.05}$	0.36	0.39	0.34	0.42	0.42
$LSD_{0.01}$	0.49	0.54	0.46	0.57	0.57
Level of significance	**	**	**	**	**

** = Significant at 1% level of probability; V_1 = Lincoln (red color), V_2 = Brighton (yellow color)

Postharvest treatments exerted significant effect on opening of petals of rose during storage. Overall opening of petals trended of increased with the progress of storage duration, the lowest number of opening of petals (8.00) was observed in 5% sugar solution and the highest number of opening petals (9.84) was observed in control (tap water) treatment at 10 days after storage (Table 2). Sugar is an osmotically active chemical that aids in maintaining the turgidity of the growing corolla and aids in the development of flowers and opening. Begum *et al*., 2020 noted that when the flower was stored in 2% sucrose with 50 ppm solution of $AgNO_3$ comparing to various preservatives in different DAS, the smallest opening of the bloom was recorded.

Table 2. Influence of various after-harvest procedures on the quantity of rose petals that open at various DAS.

Postharvest treatments	No. of petal open at different DAS				
	2	4	6	8	10
T_0	4.84	8.00	8.67	9.17	9.84
T_1	4.34	6.17	6.34	8.00	9.67
T_2	3.17	5.00	5.34	7.84	8.67
T_3	3.17	6.67	7.84	8.17	9.00
T_4	1.67	2.67	2.67	7.33	8.00
$LSD_{0.05}$	0.57	0.62	0.54	0.66	0.66
$LSD_{0.01}$	0.78	0.85	0.73	0.90	0.90
Level of significance	**	**	**	**	**

** = Acceptable at a 1% level of chance
T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

The quantity of opened petals was greatly impacted by the combined effects of several cultivars and postharvest treatments. The use of the pair of Brighton (V_2) with control (tap water) treated yielded the highest number of opened petals (10.00). The treatment combined with Lincoln (V_1) with 5% syrup produced the least number of exposed petals (7.33) (Table 5). The tendency of petal opening was slower at the initial part of storage but drastically changes in petal opening were observed during the 6-8th day after storage.

Number of dried petals

Significant effect was found in dried petals of rose by different varieties. The number of dried petals was lowest in case of Lincoln rose (V_1) (8.13) compared to Brighton rose (V_2) (10.80) (Table 3).

Table 3. Effectiveness of variation on rose petals' drying amount at various DAS.

Variety	No. of petal dried at different DAS				
	2	4	6	8	10
V_1	0.67	3.47	4.93	6.80	8.13
V_2	1.93	4.73	5.80	7.33	10.80
$LSD_{0.05}$	0.21	0.31	0.28	0.34	0.37
$LSD_{0.01}$	0.29	0.42	0.38	0.46	0.50
Level of significance	**	**	**	**	**

** = Significant at 1% level of probability
V_1 = Lincoln (red color), V_2 = Brighton (yellow color)

The present investigation's postharvest procedures had a substantial impact on the dried rose petals. The minimum number of dried petals (5.00) was observed in 5% sugar solution at 10 DAS and the maximum number of dried petals (8.56) was observed in control solution (Table 4). Since sugars are the primary food supply for flowers and are necessary to power all hormonal and physiological processes once flowers separate from their mother plants, they play a significant role in maintaining the high standards of cut flowers.

Table 4. Effect of different postharvest treatments on the quantity of dried petals of rose at different DAS.

Postharvest treatments	No. of petal dried at different DAS				
	2	4	6	8	10
T_0	2.34	6.67	8.17	4.84	8.56
T_1	0.67	3.67	4.84	6.34	7.50
T_2	1.67	3.67	5.17	6.67	7.17
T_3	1.67	4.00	5.00	5.33	6.67
T_4	0.17	2.50	3.67	4.67	5.00
$LSD_{0.05}$	0.33	0.49	0.44	0.54	0.58
$LSD_{0.01}$	0.45	0.67	0.60	0.73	0.79
Level of significance	**	**	**	**	**

** = Significant at the level of 1%.
T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

On dried rose petals, the cumulative impact of various types and postharvest treatments was discovered. Lincoln(V_1) showed the lowest number of dried petals (4.67) with the treatment combination of 5% sugar solution(T_4). When compared with the control (T_0) treated 10 DAS, the Brighton rose (V_2) was shown to have a maximum amount of dried out petals (8.67) (Table 5).

Table 5. The combined impact of rose cultivars and various postharvest therapies on the quantity of opened and desiccated petals at various DAS.

Treatment combinations	No. of petals open at different DAS					No. of petals dried at different DAS				
	2	4	6	8	10	2	4	6	8	10
V_1T_0	2.00	3.00	3.00	7.33	8.67	1.67	2.33	4.00	5.67	7.00
V_1T_1	4.67	7.33	7.67	8.33	9.57	0.33	3.33	4.67	5.67	6.33
V_1T_2	3.33	5.00	5.67	8.00	9.67	0.67	3.00	5.00	5.89	6.00
V_1T_3	3.67	7.33	8.00	8.67	9.33	0.67	4.00	4.00	5.33	6.68
V_1T_4	1.33	2.33	3.33	5.33	7.33	0.00	1.67	3.00	4.33	4.67
V_2T_0	5.00	8.33	8.67	9.67	10.00	3.00	8.00	8.33	0.00	8.67
V_2T_1	4.00	5.00	5.00	7.67	9.67	1.00	4.00	5.00	7.00	7.67
V_2T_2	3.00	5.00	5.00	7.67	7.67	2.67	4.33	5.33	5.33	6.33
V_2T_3	2.67	6.00	7.67	7.67	8.67	2.67	4.00	6.00	4.33	6.67
V_2T_4	4.67	7.67	8.67	8.67	9.67	0.33	3.33	4.33	5.00	5.33
$LSD_{0.05}$	0.81	0.88	0.76	0.93	0.93	0.47	0.70	0.62	0.76	0.82
$LSD_{0.01}$	1.10	1.20	1.04	1.27	1.27	0.64	0.95	0.85	1.04	1.12
Level of significance	**	**	**	**	**	**	**	**	**	**

** = Significant at 1% level

V_1 = Lincoln (red color), V_2 = Brighton (yellow color)

T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

Percent weight loss of rose

Due to using of various kinds, the changes in the proportion of weight reduction of rose blossoms were found to be significant. At 10 days after storage (DAS), the weight loss of rose flowers was maximum (74.53%), which occurred from (V_2) Brighton (yellow color), while it was lowest (61.11%) in (V_1) Lincoln (red color) (Figure 1). Post-harvest treatments had a considerable impact on rose weight loss. T_4 treatment resulted in the least amount of weight reduction (56.39%) while T_0 treatment resulted in the greatest degree of decreased weight (74.01%) (Figure 2). This might be explained by how sucrose delays the aging of petals and flower withering (Halevy and Mayok, 1979). According to Sudaria *et al.* (2017), the amount of flower weight loss decreased when sugar at a concentration of 4% was added to preservation solutions containing 8-HQS.

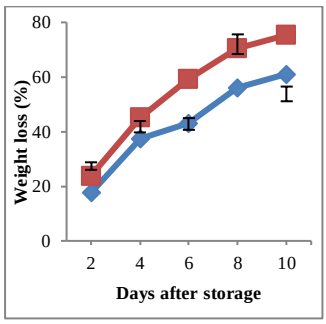

Figure 1: The primary influence of variety on the weight loss percentage of roses at various storage-related days. LSD is represented by vertical bars with a one percent (%) of significance. V_1 = Lincoln (red color), V_2 = Brighton (yellow color)

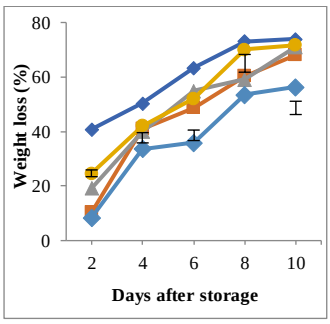

Figure 2: The impacts of various postharvest interventions on weight loss percentage at various days after storage (DAS). Vertical bars represent LSD at 1% level of significance. T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

Regarding the proportion of reduced weight of roses, the combined impacts of species and following harvest remedies were found to be substantial. According to the findings, V_2T_0 gave the most weight loss of roses (78.57%) whereas V_1T_4 experienced the least weight loss of roses (44.44%).

Table 6. Interactions of variety and various postharvest procedures combined on rose weight loss percentage at various DAS

Treatment combination	Percent loss of weight at different DAS				
	2	4	6	8	10
V_1T_0	37.30	47.22	50.00	69.44	69.45
V_1T_1	9.72	36.11	47.62	50.00	58.33
V_1T_2	13.33	33.33	41.67	50.00	66.67
V_1T_3	19.44	39.88	44.44	66.67	66.67
V_1T_4	8.33	31.11	31.11	44.44	44.44
V_2T_0	44.44	53.33	76.67	76.67	78.57
V_2T_1	11.11	46.03	50.00	70.71	77.78
V_2T_2	25.12	46.67	68.33	68.33	75.48
V_2T_3	30.00	44.44	59.72	73.61	76.67
V_2T_4	8.67	36.11	40.71	62.70	68.33
$LSD_{0.05}$	2.24	3.42	3.50	5.90	4.42
$LSD_{0.01}$	3.06	4.67	4.78	8.05	6.02
Level of significance	**	**	**	**	**

** = Significant at 1% probability level

V_1 = Lincoln (red color),V_2 = Brighton (yellow color)

T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

Total solution uptake by rose

Significant variation was observed in total solution uptake by different varieties of rose. The higher total solution uptake was in Lincoln rose (V_1) (25.66 ml) and the lower solution uptake was in Brighton (V_2) (25.00 ml) (Figure 3). Begum *et al.* (2020) also noted that Lincoln (13.23 g) had a higher solution uptake than Tajmahal (12.30 g) at the last day of storage (17 DAS).

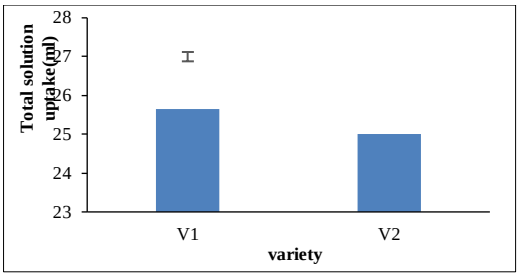

Figure 3: Principal impacts of variation on overall solution uptake at various days after storage (DAS). Vertical bar indicates significantly LSD value at 1% level. V_1 = Lincoln (red color), V_2 = Brighton (yellow color)

Significant variation was observed in total solution uptake in rose by different treatments. The total solution uptake is higher in 5% sugar solution (27.33 ml) and lower in control solution (22.33ml) (Figure 4). Sucrose aids in preserving turgidity and water balance. In his experiment, Rogers, 1973, discovered that adding sucrose to the holding solution may have boosted the holding solution's absorption. Begum *et al.* 2020 also observed the similar findings.

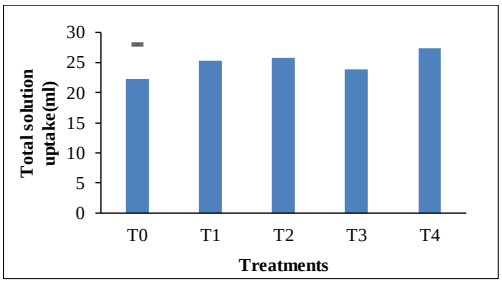

Figure 4: Different postharvest treatments' main effects on total solution uptake at various days after storage (DAS) are shown in the table below. LSD is represented by vertical bars with a 1% level of importance. T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

The combination effect of various types and treatments had a substantial impact on the overall solution absorption. Results showed that the highest total solution uptake (30.00ml) was observed in V_1T_4 and the lowest percentage of total solution uptake (21.00ml) was observed in V_2T_0 (Figure 5).

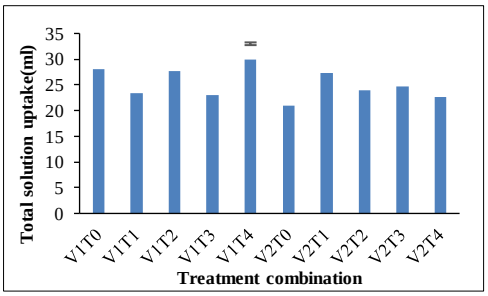

Figure 1: The interaction effect of variety and postharvest treatments on total solution uptake by rose. The vertical bar displays the LSD with a 1% degree of probability. V_1 = Lincoln (red color), V_2 = Brighton (yellow color);T_0 = Control, T_1 = Lemon juice solution (5%), T_2 = $CaCl_2$ solution (0.05%) ,T_3 = Aspirin solution (0.03%) , T_4 = Sugar solution (5%)

Vase life of rose

Different varietals have a considerable impact on rose longevity in the vase. Lincoln rose (V_1) showed the maximum vase life was (9.89 days) whereas Brighton (V_2) showed lowest vase life (9.00 days) (Figure. 6). Begum *et al.* 2020 observed in her experiment that cut rose cv. Lincoln performed better vase life than Tajmahal.

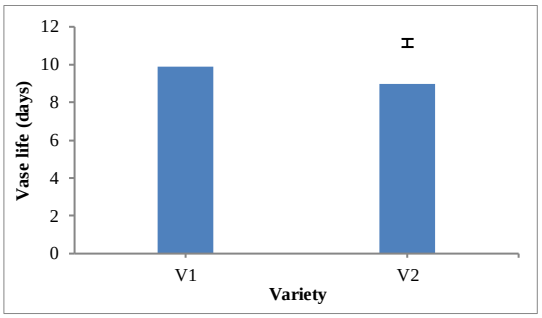

Figure 6: The principal impacts of diversity on vase life at various (DAS). At a 1% level of statistical significance, vertical bar shows LSD. V_1 = Lincoln (red color),V_2 = Brighton (yellow color)

Different preservatives had a substantial impact on the vase life of roses. In a 5% sugar solution, the longest vase life was obtained (9.96 days), and the shortest vase life was reported (6.9 days) in the untreated treatment (Figure 7). The longer vase life may be a result of the sucrose in the vase solution having an impact on the water balance in the cut rose flowers. Similar to this, adding 6% sucrose to a preservative solution greatly extended the shelf lifespans of gerbera (*Gerbera jamesanii* cv. Dune) flowers (Mousa *et al.*, 2009). Begum *et al.* 2020 that flowers preserved in 2% sucrose with 50 ppm or 100 ppm $AgNO_3$ exhibited a longer vase life than flowers preserved with alternative preservatives. On the rose cultivar Black Magic, identical results have been published by Hajizadeh *et al.* (2012).

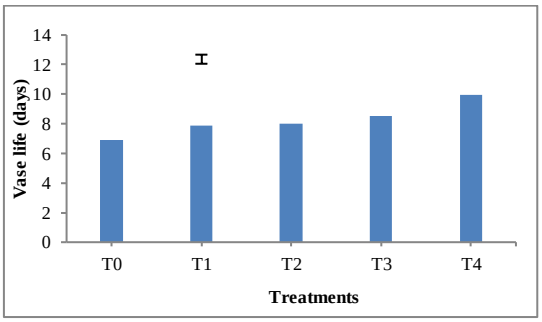

Figure 7: The primary outcomes of various post-harvest procedures on vase life at various DAS. LSD is represented by vertical bars with a 1% level of significance. T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

The combined effect on vase life of rose cultivar was also significant due to different varieties and postharvest treatments. The greatest length of vase life (10.00 days) and minimum vase life (7.00 days) were found in V_1T_4 and V_2T_0, respectively (Figure 8). The germicides keep hazardous microorganisms under control and avoid clogging the conducting tissues, while the carbohydrates provide a respiratory substrate.

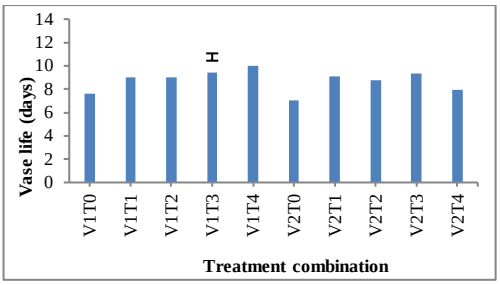

Figure 8: combined effects of various postharvest treatments and cultivars on vase life at various storage time points. Vertical bar: 1% degree of significance for LSD. V_1 = Lincoln (red color), V_2 = Brighton (yellow color); T_0 = (Control, tap water), T_1 = lemon juice solution (5%), T_2= $CaCl_2$ solution (0.05%), T_3 = aspirin solution (0.03%), T_4 = sugar solution (5%)

Conclusion

The current study examined the effects of varieties and different preservative solutions to increase the vase life of two cut rose cultivars. It was carried out in the Department of Horticulture's laboratory at Bangladesh Agricultural University, Mymensingh, Bangladesh. Based on the findings of this experiment, it was found that various treatments behaved considerably in terms of lengthening the vase life of cut rose flowers. Most treatments significantly differed in their ability to prolong the vase life of cut rose flowers. The experimental result revealed that, combining 5% sugar solutions treatment with Lincoln rose variety was shown the best performance to extend vase life. Therefore, the combined application of 5% sugar solutions along with Lincoln rose variety was found to be better in respect of rose cut flower. To increase the bloom quality and extend the life in the vase of roses and other cut flowers, additional research may be done to determine the effectiveness of other compounds at different concentrations.

Conflict of interest

There is no contradiction of interest because the research was conducted and written by the authors alone.

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