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Effect of Different Vase Solutions on Vase Life of Gladiolus (*Gladiolus grandiflorus*)

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ABSTRACT

Gladiolus is a highly popular ornamental bulbous plant, admired for its stunning spikes that bloom sequentially from the base to the top. Despite its vast potential, the crop's contribution to the international market remains limited, possibly due to inadequate post-harvest management. Enhanced vase life can be achieved by using certain vase solutions to improve their spike life. The study was undertaken to evaluate the impact of floral preservative chemicals on the vase life of cut spikes of Gladiolus cv. Arka Amar. A laboratory experiment was carried out at the Department of Floriculture and Landscaping, College of Horticulture, Mysuru during November 2024, in a completely randomized design with two replications using T1-water (control), T2-sucrose 200ppm, T3-sucrose 200ppm+citric acid 200ppm, T4- sucrose 200ppm+citric acid 300ppm, T5-sucrose 200ppm+STS 200ppm, T6-sucrose 200ppm+STS 300ppm, T7-sucrose 200ppm+Al_2So_4 200ppm, T8-sucrose 200ppm+Al_2So_4 300ppm, T9- sucrose 200ppm+ GA_3 25ppm, T10- sucrose 200ppm+GA_3 35ppm. Results revealed that among the treatments studied, holding solution containing Sucrose 200ppm+ Al_2So_4 200ppm has improved days for basal floret opening (5d), vase life (11d), longer days for softening of lower floret in a spike (6days), more number of florets opened (10), maximum percentage of florets opening (88.15%), minimum transpiration loss and maximum water uptake followed by sucrose 200ppm with Ga_3 @ 25ppm. Thus, Al_2So_4 inhibit the microbial proliferation in the solution and sucrose in providing energy source for florets opening. Upon visual scoring on appearance (8.5) and freshness (8.0) were observed for same treatment combination.

Keywords: Gladiolus, Longevity, Preservative solution, Vase life.

INTRODUCTION

Gladiolus, commonly known as the Sword Lily is widely grown as a commercial cut flower worldwide. Its popularity stems from its striking spikes, adorned with elegant and delicate florets that bloom sequentially over time, contributing to its excellent keeping quality. However, the typical post-harvest life of gladiolus spikes is limited to just 6–7 d, which is insufficient for long-distance markets. Improper post-harvest handling further contributes to significant losses, with nearly 20–40% of cut flowers being wasted. Arka Amar is a high-yielding gladiolus variety distinguished by its orange-pink florets with a white blotch. It is commercially cultivated for cut flower production and is commonly used in floral arrangements, vase decorations, and bouquets (Bhattacharjee, 1999). The most desirable quality traits from a market perspective include flower shape, size, color and freshness. As a result, consumers strive to preserve these qualities to keep the flowers fresh for as long as possible.

Flower longevity is affected by both pre-harvest factors and post-harvest care and post-harvest factors (Sowjanya *et al*, 2021). Pre-harvest factors include the genetic makeup and growing conditions of the plant, while post-harvest factors involve various techniques to minimize losses. These techniques involve regulating water relations, respiration, and relative humidity, as well as utilizing growth regulators, preservative solutions, pre-cooling, and storage methods as well as proper packaging and transportation Gupta *et al* (2018). Among preservatives, sugars play crucial role in maintaining the quality of cut flowers by providing the necessary energy source of food to the detached flower and for various

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Table 1: Treatment details for enhancing the vase life of gladiolus var. Arka Amar.

Treatment	Treatment combinations
T1	Control (dd.Water)
T2	Sucrose 200ppm
T3	Sucrose 200ppm + Citric acid 200ppm
T4	Sucrose 200ppm + Citric acid 300ppm
T5	Sucrose 200ppm + STS 200m
T6	Sucrose 200ppm + STS 300ppm
T7	Sucrose 200ppm + Al_2SO_4 200ppm
T8	Sucrose 200ppm + Al_2SO_4 300ppm
T9	Sucrose 200ppm + GA_3 25ppm
T10	Sucrose 200ppm + GA_3 35ppm

biological and physiological process even after separation from the mother plant. It also serve as an energy source for respiration, metabolic process in cut flowers Srinivas and Lakshmi (2019). It involves the breakdown of sugars to produce energy (in the form of ATP) that fuels cellular activities such as, nutrient uptake, synthesis of essential compounds and maintenance of cell integrity. This helps to maintain the turgidity of the flower's tissues, especially the expanding corolla in flower development and opening (Halevy and Mayak, 1981). While the GA3 gibberllic acid, a plant growth regulator, extend the vase life by promoting their opening and delaying of senescence, keeping them fresh for longer time.

Aluminum sulfate (Al_2SO_4) inhibits the bacterial growth and stabilize petal colour due to antimicrobial properties. It also acts as a biocide in water to prevent the flowers from decaying quickly and prevents plugging of the conducting tissues (Sowjanya *et al*, 2019).

Citric acid maintains the pH level and prevents the bacterial growth. STS (Silver thiosulphate), chemical compound used as preservative to extend vase life by acting as an ethylene antagonist, by inhibiting the ethylene production. Recognizing the critical role of extended vase life in the trade of cut flowers, the present study aims to maximize the longevity of gladiolus flower spikes through preservative vase solutions like Sucrose, citric acid, Al_2SO_4, STS and GA_3.

MATERIALS AND METHODS

A laboratory experiment was conducted in November 2024 at the Department of Floriculture and Landscaping, College of Horticulture, Mysuru, to identify the best preservative combination for extending the vase life of **Gladiolus var. Arka Amar.** Ten different preservative treatment combinations (Table 1) including water as control used in vase life experiment, performed in Completely Randomized Design with two replications. The spikes were harvested at its colour break stage and were kept in bucket of water immediately after harvesting. The cut flowers were positioned upright in the conical flask ensuring that the stems were dipped in vase solution (Plate 1). Prior to placement, the lower leaves were removed, leaving no leaves immersed in the vase solution. One gladiolus spike was taken for each treatment with two replications immersed in conical flask containing preservative solution of 200ml by giving a slant cut for the better absorption under ambient condition. The mouth of each conical flask was plugged with cotton to minimize evaporation losses during the experiment. Observations on days for basal floret opening, days for softening of first lower floret, initial spike weight (g), spike weight at peak florets bloomed stage (g), number of florets opened in a spike, percentage of florets opened in a spike, vase life (days), water uptake both on weight basis and volume basis, transpiration loss and overall quality of florets and spike by scoring at last day of vase life based on their colour and freshness. The cut spikes were monitored on daily basis until the end of freshness. The flowers along with the preservative solutions were initially weighed on alternate days. By calculating the consecutive difference in weights on each day, the water uptake was determined and expressed in grams per spike along with volume basis (ml). Spike longevity was measured by recording the number of days the florets remained fresh in the vase solution before exhibiting symptoms of bent neck (loss of spike strength) or advanced signs of withering. The vase life data for various parameters were analyzed statistically using sample means. An analysis of variance (ANOVA) table was prepared, and the critical

Table 2: Effect of different chemical preservatives on post harvest spike quality traits of gladiolus var. Arka Amar.

Treatment	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
T1	4.50	4.00	32.80	38.35	8.00	81.00	31.00	8.00	7.00	7.00
T2	5.00	4.50	35.95	39.70	8.50	85.50	52.50	8.50	8.00	8.00
T3	4.50	5.50	34.50	37.00	9.50	67.80	42.50	9.00	8.00	8.00
T4	4.50	5.50	38.40	41.00	9.00	79.50	65.00	10.00	8.00	7.00
T5	5.00	5.50	31.00	39.00	8.50	73.00	50.00	10.50	7.50	7.50
T6	5.00	5.50	40.50	45.70	9.00	69.00	55.00	10.00	7.00	8.00
T7	5.00	6.00	38.20	42.75	10.00	88.15	75.00	11.00	8.50	8.00
T8	5.50	5.00	35.75	41.60	7.50	73.20	52.50	10.50	8.00	7.00
T9	4.50	5.50	36.30	42.80	9.00	77.00	65.00	8.50	7.50	7.00
T10	5.00	5.00	35.30	40.15	9.00	77.00	55.00	10.50	7.00	8.00
S.E m(±)	0.47	0.47	1.09	1.44	0.63	1.42	3.18	0.59	6.00	8.00
CD@1%	2.13	2.13	4.90	6.45	2.83	6.37	14.24	2.65	7.00	7.50

Traits: X1: Basal floret opened, X2: Days for softening of first lower floret, X3: Initial Spike weight (g), X4: Spike weight at 5th day (g), X5: Number of Florets opened in a spike, X6: Percentage of florets opened in a spike, X7: Amount of water uptake (v/v ml), X8: Vase life (days), X9: Score of Freshness and Strength of Spike, X10: Overall acceptability appearance Score

Plate 1: Gladiolus spikes at 1st day and 5th day of vase life studies

difference at the 1% level was calculated to compare treatment means.

RESULTS AND DISCUSSION

As consumers pay much attention towards quality of gladiolus in the sense of flower colour, freshness, longevity and spike strength that is driving the market competition. Unfortunately, the flowers are losing freshness and quality due to high ethylene synthesis and microbial activity during storage condition, poor post-harvest handling and management practices. This can be overcome by proper use of preservative solutions like sucrose, citric acid, Al_2SO_4, STS and GA_3. The analysis of variance for the observed parameters indicated a significant effect (CD = 1%) of different preservatives on the quality parameters of gladiolus var. Arka Amar. Experimental results showed that all treatments significantly improved vase life compared to the control (Table 2). Early floret opening was observed in treatments T1, T3, T4, and T9 (4.5 days), followed by other treatments, which recorded floret opening at 5 d. Earlier softening of basal floret was observed in T1 (4 d) followed by T2 (4.5 d), T8 and T10 (5d each respectively). The maximum number of florets opened was recorded in treatment T7 (10 florets), followed by

Table 3: Effect of different chemical preservatives on water uptake (weight basis) by the spikes of gladiolus cv. Arka Amar.

Treatment	1st day	3rd day	5th day	7th day	10th day
T1	570.65	561.45	559.05	554.50	491.50
T2	503.90	555.30	554.55	550.60	485.85
T3	566.50	591.20	488.45	484.40	480.95
T4	567.90	561.25	559.35	555.80	553.25
T5	554.30	543.45	541.05	520.70	532.85
T6	524.80	497.80	511.75	503.90	551.50
T7	555.60	512.90	509.35	522.00	525.60
T8	561.65	534.55	550.50	542.95	544.25
T9	554.50	549.45	547.00	538.30	542.95
T10	494.85	486.10	479.70	527.20	474.25
S.E m(±)	1.15	2.85	2.57	2.48	2.23
CD@1%	5.14	12.77	11.51	11.09	9.99

Table 4: Effect of different chemical preservatives on transpiration loss by the spikes of gladiolus cv. Arka Amar.

Treatment	1st day	3rd day	5th day	7th day	10th day
T1	621.60	609.15	597.55	586.50	584.90
T2	551.15	540.95	529.50	519.90	518.50
T3	559.50	547.01	536.30	562.50	519.80
T4	619.75	610.10	595.35	582.10	585.10
T5	586.55	574.60	571.15	537.50	539.35
T6	577.20	545.30	532.90	548.20	518.10
T7	584.45	531.80	517.85	559.50	556.40
T8	580.65	564.10	553.05	568.15	538.90
T9	609.25	591.75	584.60	576.90	572.05
T10	599.10	559.85	580.60	576.55	547.50
S.E m(±)	2.31	2.35	2.62	2.16	3.07
CD@1%	10.34	10.54	11.75	9.67	13.76

T3 (9.5), T9 and T10 (9 each respectively), whereas the minimum was recorded in control (8). The highest floret opening percentage was observed in treatment T7 (88.15%), followed by T2 (85.50%) and T9 and T10 (77% each). These findings align with the studies of Nasrin *et al* (2008) on gladiolus and Talukdar and Barooah (2010) on tuberose. The effect of Al_2SO_4 in promoting the maximum number of open florets and the highest percentage of floret opening was attributed to its antimicrobial properties, which helped prevent vascular blockage and finally increasing water uptake and more number of florets opening.

Similar results were found by Sharma *et al*. (2017) in gladiolus and by Selvaraj *et al* (2014) in tuberose. Treatment T7, sucrose 200ppm with Al_2SO_4 200 ppm observed maximum vase life (11 days), followed by T8, T10, T5 (10.5d each) as compared to control (8d). The extended vase life of spike may be probably due to effect of $A1_2SO_4$ property of inhibiting microbial growth thus enhancing better absorption and longer freshness. The results of this study align with the findings of previous researchers, including Abadi *et al* (2013) in gerbera and Selvaraj *et al* (2014) in tuberose.

From the period of first day to last day of vase life studies, at last day maximum solution uptake (30g and75ml) was reported in the treatment T7 (Table 3) with sucrose 200ppm + Al_2SO_4 200 ppm (weight basis and volume basis) followed by T4 and T9 (65ml each respectively). Similarly minimum transpiration loss (Table 4) was found in T7 (28.05g) followed by T2 (31.25g) and T4 (37.65g), while high loss in T6 (59.10g). Variation in solution uptake might be due to disturbance in transpiration pool, bacterial and fungal

growth. The germicidal action of Al_2SO_4 at 200 ppm prevented stem blockage, allowing better water flow through the stems. Sucrose enhanced water uptake, likely due to the accumulation of translocated sugars in the flowers, which increased osmotic potential. This improved the spikes' ability to absorb water while reducing transpiration loss by minimizing stomatal opening, thereby maintaining flower turgidity (Nair *et al*, 2003).

The findings of this study were consistent with those of Kumar and Awasthi (2012), Choudhary *et al* (2011) in gladiolus, and Mishra and Khanal (2019) in gladiolus. The highest score (8.5) for appearance and freshness was recorded in treatment T7 (sucrose 200 ppm + Al_2SO_4 200 ppm) (Table 2). This may be attributed to the combined effect of sucrose and aluminum sulfate, which resulted in a lower percentage of wilting and improved physiological characteristics compared to other treatments (Sarje *et al,* 2024). Both acts as anti-microbial and energy source. Similar results were observed in gladiolus by Verma and Fatmi (2022), Bajwa *et al* (2016) in rose, Mishra and Khanal (2019) in gladiolus.

CONCLUSION

From the present investigation the holding solution containing T7- Sucrose 200ppm + Al_2SO_4 200ppm resulted in extending of gladiolus var. Arka Amar keeping quality in sense of vase life (11d), maximum percentage of florets opening (88.15%), minimum transpiration loss (28.05g) and maximum water uptake (30g and75ml).

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