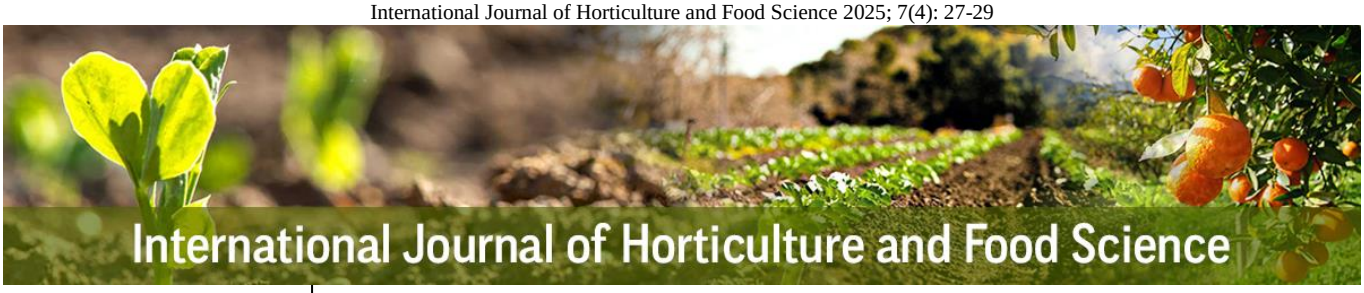

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Studies on post-harvest life of gladiolus under different vase solutions

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Abstract
A study was conducted to assess the post-harvest quality of gladiolus spikes under different vase solutions at the Horticulture Research Laboratory, Department of Horticulture at Kamla Nehru Institute of Physical & Social Sciences, Sultanpur, Uttar Pradesh, India, in the year 2025. The experiment was performed in Complete Randomized Design (CRD) with nine treatments replicated three times, T_1 (2% sucrose), T_2 (4% sucrose), T_3 (6% sucrose), T_4 (8% sucrose), T_5 (2% sucrose + citric acid @ 15ppm), T_6 (4% sucrose + citric acid @ 30ppm), T_7 (6% sucrose + citric acid @ 45ppm), T_8 (8% sucrose+ citric acid @ 60ppm), T_9 (distilled water). Among the treatments, the vase solution T_7 containing 6% sucrose + citric acid @ 45ppm demonstrated the highest absorption of vase solution, prolonged basal floret senescence and achieved the highest flower opening percentage, least fresh weight loss at 12 days, and longevity. This was followed by the treatment T_5 with 2% sucrose + citric acid @ 15ppm. The shortest vase life of spike was observed in treatment T_9, which consisted of distilled water. Based on these findings, the combination of 2% sucrose + citric acid @ 15ppm was identified as the most effective vase solution for extending the vase life of gladiolus.

Keywords: Gladiolus, post-harvest life, vase life, sucrose, citric acid

Introduction
Gladiolus (*Gladiolus grandiflorus L.*) is a prized ornamental bulbous plant, celebrated for its vibrant blooms and deep-rooted historical significance. It is widely recognized as a popular cut flower both globally and in India. The name 'Gladiolus' comes from the Latin word *gladius*, meaning 'sword,' which reflects the plant's distinctive, and sword-like foliage. Due to this characteristic, it is commonly known as the "Queen of Bulbous Flowers" or "Sword Lily." This plant belongs to the Iridaceae family and is native to regions of South Africa and Asia Minor. The vase life of cut flowers is a key determinant of their commercial value and is significantly influenced by cultural practices and post-harvest handling techniques. Studies suggest that 30-70% of a flower's potential longevity is predetermined at harvest, while approximately 20-40% of cut flowers are lost due to improper post-harvest handling. An ideal cut flower should retain its freshness, including color and fragrance, without compromising its quality grade for a reasonable duration. While the inherent quality is largely varietal, the shelf life is significantly influenced by the post-harvest environmental conditions. But work done so far to prolong the keeping quality of cut gladiolus is meager. Considering the above factors, an experiment was conducted to assess the vase life of Gladiolus cultivar 'Tiger Flame' under the agro-climatic conditions of Sultanpur.

Material and Methods
The experiment was conducted at the Horticulture Research Laboratory, Department of Horticulture at Kamla Nehru Institute of Physical and Social Sciences, (Faridpur) Sultanpur, Uttar Pradesh, India, during February-March 2025, which is situated at about 8-kilometer distance from district head quarter of Sultanpur in the North-East direction. The study followed a Completely Randomized Block Design (CRD) with three replications. Nine different treatments were applied based on their availability and practicality for commercial flower vase use. The treatments included T_1 (2 percent sucrose), T_2 (4 percent sucrose), T_3 (6 percent sucrose), T_4 (8 percent sucrose), T_5 (2 percent sucrose + citric acid @ 15ppm), T_6 (4 percent sucrose + citric acid @ 30ppm), T_7 (6 percent sucrose + citric acid @ 45ppm), T_8 (8 percent sucrose + citric acid @ 60ppm), and T_9 (distilled water). Vase solutions kept at room temperature (24-27°C) during the period of experiment.

The fresh weight of cut gladiolus spikes was recorded before treatment. Subsequently, their weight was measured at periodic intervals after treatment, and the percentage of weight loss was calculated. Data were collected on post-harvest parameters i.e., total number of florets, opening of florets (%), Initial Spike weight (g), spike weight (g) at 2nd, 4th, 6th, 8th, 10th and 12th day, absorption of vase solution (ml) at 2nd, 4th, 6th, 8th, 10th and 12th day, drooping of florets (%) and vase life of the spike.

Results and Discussion

Data were collected on post-harvest quality parameters i.e., total number of florets, opening of florets (%), Initial Spike weight (g), spike weight (g) at 2nd, 4th, 6th, 8th, 10th and 12th day, absorption of vase solution (ml) at 2nd, 4th, 6th, 8th, 10th and 12th day, drooping of florets (%) at 2nd, 4th, 6th, 8th, 10th and 12th day and vase life of the spike. The data pertaining to above parameters are displayed in Table 1 and Table 2 The total number of florets varied significantly among treatments. The maximum floret opening 15.07% was found in T_5 (2% sucrose + citric acid @ 15ppm) at 2nd day and at 12th day 96.67% was observed in T_7 (6% sucrose + citric acid @ 45ppm). The maximum gradual decrease in spike weight 24.00g was recorded at 12th day in T9 (Distilled Water), and the minimum spike weight at 12th day 32.00g was found in T_5 (2% sucrose + citric acid @15ppm) displayed in (Table-1). The absorption of vase solution by cut gladiolus spikes showed a steady decline until the end of the vase life. Among the different floral preservative treatments, the highest absorption 23.67ml of vase solution at 12th day was found in T_3 (Sucrose 6%) and the lowest absorption 12.00 ml at 12th day was recorded in T_9 (distilled water), respectively. The maximum floret drooping 31.7% on the 6th day was observed in the treatment T_7 (sucrose 6% +45ppm citric acid) and at 12th day 82.37% in T_1 (2% sucrose). The minimum drooping of florets 10.6% at 6th day and at 12th day 67.50% was observed in treatment T_5 (2% sucrose + citric acid @ 15ppm). The vase life of cut gladiolus spike is a crucial factor in determining their commercial and aesthetic value. The longevity of gladiolus in a vase depends on various factors, including harvest stage, water uptake, microbial growth, and preservative treatments. Sucrose + Citric (4-6%) is commonly used to enhance the opening of florets and provide an energy source for prolonged vase life. The maximum vase life of 15.33 day was observed in T_5 (2% sucrose + citric acid @15ppm) and the minimum vase life of 11.67 days was recorded in T9 (distilled water) displayed in (Table-2). Sucrose supplies the necessary energy for growth and promotes faster bud opening, consistent with the findings reported by Silva (2003). Sucrose significantly enhanced the keeping quality by maintaining the fresh weight of the spike and minimizing physiological weight loss, likely due to improved water retention. Similar findings were reported by Divya *et al*. (2004).

Table 1: different Treatment Total Number of Florets, Opening of florets (%) in days, Initial Spike weight (g) and Spike weight (g) in day

Treatments	Treatment details	Total number of florets	Opening of Florets (%) in days						Initial Spike weight (g)	Spike weight (g) in days					
			2nd	4th	6th	8th	10th	12th		2nd	4th	6th	8th	10th	12th
T_1	Sucrose 2%	12.33	8.84	21.79	35.14	64.86	81.84	88.88	55.00	55.33	53.00	50.33	45.00	39.00	30.67
T_2	Sucrose 4%	12.33	13.46	21.58	37.82	62.18	83.76	94.66	53.33	54.00	52.00	48.67	42.00	36.00	28.00
T_3	Sucrose 6%	9.33	12.55	30.04	44.20	72.81	88.87	92.21	52.00	53.33	51.33	48.67	43.00	37.00	28.67
T_4	Sucrose 8%	10.00	9.70	26.13	49.97	73.81	90.24	93.94	50.67	52.00	50.00	47.33	42.00	35.67	26.67
T_5	Sucrose 2% + Citric Acid 15 ppm	9.33	15.07	29.00	42.93	75.17	89.77	92.80	53.00	54.33	53.33	51.33	46.00	40.33	32.00
T_6	Sucrose 4% + Citric Acid 30 ppm	12.67	10.47	23.93	47.44	70.94	86.75	92.31	51.33	51.67	49.67	47.67	44.00	36.00	27.00
T_7	Sucrose 6% + Citric Acid 45 ppm	9.33	10.00	25.00	53.33	75.00	93.33	96.67	52.00	53.00	51.00	47.67	41.67	35.33	26.67
T_8	Sucrose 8% + Citric Acid 60 ppm	8.00	9.53	41.91	62.86	88.57	91.91	91.91	50.00	51.00	49.00	47.00	41.33	34.00	26.33
T_9	Distilled Water	9.00	7.04	26.11	52.69	75.09	81.24	88.78	53.67	52.00	49.67	46.67	40.33	33.33	24.00
	C.D.	2.31	N/A	N/A	14.61	N/A	N/A	N/A	2.47	1.76	1.66	1.60	1.53	1.66	2.05
	SE(m)	0.77	5.15	4.75	4.88	4.81	3.32	3.90	0.82	0.59	0.56	0.53	0.51	0.56	0.69

Table 2: Absorption of vase solution (ml), Drooping of Florets (%) in days and vase life in day

Treatments	Treatment details	Absorption of vase solution(ml)						Drooping of Florets (%)				Vase Life in Day
		2nd	4th	6th	8th	10th	12th	6th	8th	10th	12th	
T_1	Sucrose 2%	8.67	10.67	13.33	18.33	20.33	23.00	21.1	35.73	61.24	82.37	12.67
T_2	Sucrose 4%	6.67	8.67	10.67	16.00	18.00	21.33	16.5	32.69	56.84	72.86	12.33
T_3	Sucrose 6%	8.00	9.67	12.67	17.67	20.33	23.67	21.9	39.44	64.72	76.15	12.00
T_4	Sucrose 8%	4.00	6.00	9.00	13.00	16.00	18.33	23.1	36.50	72.76	79.87	12.00
T_5	Sucrose 2% + Citric Acid 15 ppm	3.33	5.33	8.33	12.33	14.33	17.00	10.6	26.95	48.74	67.50	15.33
T_6	Sucrose 4% + Citric Acid 30 ppm	7.67	9.67	13.67	17.67	19.67	21.67	16.0	29.27	50.43	79.06	13.33
T_7	Sucrose 6% + Citric Acid 45 ppm	6.67	9.67	13.00	17.33	20.33	21.67	31.7	49.17	65.00	82.50	14.00
T_8	Sucrose 8% + Citric Acid 60 ppm	4.33	6.33	14.00	19.00	20.67	23.33	24.3	46.67	62.86	75.71	14.00
T_9	Distilled Water	2.33	4.33	7.00	10.00	11.00	12.00	22.8	38.15	67.22	81.76	11.67
	C.D.	1.45	1.37	1.79	1.88	2.08	2.08	N/A	N/A	N/A	N/A	1.49
	SE(m)	0.48	0.46	0.60	0.63	0.69	0.69	5.6	6.73	6.43	3.77	0.50

Conclusion

The present study concludes that the most effective treatment for extending the vase life of gladiolus spikes was T_5 (2% sucrose + citric acid @15ppm). This treatment resulted in significant better postharvest performance regarding total florets opened, floret opening percentage, absorption of total vase solution and prolonged vase life.

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