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Effect of Floral Preservatives and Growth Regulators on Post Harvest Life of Gladiolus (*Gladiolus grandiflorus* L.) *cv.* American Beauty

Y. Angel[1*] and A. Vignesh Kumar[1]

[1]Department of Horticulture, Kalasalingam School of Agriculture and Horticulture, Krishnankoil, Tamil Nadu, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

A Postharvest experiment was conducted to maximize the vase life of gladiolus using different preservative solution in department of Horticulture, Kalasalingam School of Agriculture and Horticulture. In this experiment the treatment consisted of two preservative chemicals and two growth regulators viz., 8-Hydroxy quinoline sulphate @ 300 ppm Silver nitrate @ 50 ppm, Benzyl adenine @ 20,40,60 ppm and Gibberlic acid @ 10,25,40 ppm along with sucrose @ 4 per cent with distilled water as control. The results of this experiment revealed that the maximum water uptake, transpirational loss of water, water balance, fresh weight change, percentage of opened florets, floret diameter, longevity of floret, vase life was recorded in T_2 (8-HQS @ 300 ppm + sucrose 4% + BA @ 40 ppm), when compared to control. Some parameters like optical density of vase solution, days taken for the basal floret to open in vase and the percentage of wilted florets were observed least in T_2 (8-HQS @ 300 ppm + sucrose 4% + BA @ 40 ppm). T5 (8-HQS @ 300 ppm + Sucrose 4% + BA @ 40 ppm) solution was found best to extend the vase life of gladiolus.

Keywords: Gladiolus; vase life; preservatives; growth regulators.

**Corresponding author: E-mail: angeljothy2018@gmail.com;*

1. INTRODUCTION

Flowers have always remained an integral part of human's life and they are very important in the Indian traditional way of life. The use of flowers in garden and homes are well documented through most of the recorded history. Gladiolus is an important commercial flower crop having pivotal place as cut flower both in domestic as well as international market. Gladiolus is very much liked for its majestic spikes containing attractive, elegant and delicate florets. It is relatively easy to grow and is ideal for bedding and exhibition [1]. Cut flowers in general are highly perishable commodities and vulnerable to large post-harvest losses. Once severed from the plant, they are deprived of their natural sources of water and nutrients and wilt rapidly. Upon detachment from plants, the cut flowers carry on all life processes at the expense of stored food in the form of carbohydrate, protein and fats for a few more days [2]. 8-HQS is the most effective germicide and has a strong inhibition effect against bacteria, yeast and fungi and xylem blocking. It may influence flower longevity by acidifying water, improving water balance and inhibiting alternative cyanide respiration [3]. After treatment with 6-BA in cut China rose, the water absorption capacity of cut flowers was higher than that of the control, so the water equilibrium in the stems was improved, the ex-osmosis of soluble substances in the petals increased and cut flower life was prolonged [4]. Senescence is the final stage of plant development that follows the physiological maturity consequently leading to the death of cell, organ or the whole plant [5]. Petal senescence is highly associated with physiological and genetically controlled processes that include membrane leakage, degradation of macromolecules and oxidative stress Seglie et al., [6]. Hence keeping the above problems in view, the present work "Effect of floral preservatives and growth regulators on post harvest life of gladiolus (*Gladiolus grandiflorus* L.) *cv.* American Beauty'' has been carried out to evaluate the post-harvest quality and vase life with the following objectives:

1. To study the effect of best combinations of floral preservatives and plant growth regulators on quality and vase life of gladiolus.

2. MATERIALS AND METHODS

Experiment was conducted at department of Horticulture, Kalasalingam School of Agriculture and Horticulture, during January 2021 to find out the appropriate preservative solution for extending the vase life of gladiolus. The variety used for the study was American Beauty with characters such as reddish pink florets with whitish throat and whitish blue anthers. Spikes were 70-75cm long; each with 10-12 florets (8-9cm in size).The shelf life of variety used was 3 days. The 60 gladiolus spikes were procured from Hosur southern flora flower farm. There are twelve chemical preservative solution which are used for extending the vase life and the treatment details are given below,

2.1 Treatment Details Chart

Using completely randomized design with three replications. Observations were recorded at 6th day of the treatment imposed on water uptake (g/s), transpirational Losses (g/s), opened florets (%), longevity of floret (Days), vase life (Days). For all the treatments one spikes/500ml glass bottles was used with 200 ml solution. The mean

Chart 1. Treatment details

T_1	8-HQS @ 300 ppm + sucrose 4 % + BA @ 20 ppm
T_2	8-HQS @ 300 ppm + sucrose 4 % + BA @ 40 ppm
T_3	8-HQS @ 300 ppm + sucrose 4 % + BA @ 60 ppm
T_4	8-HQS @ 300 ppm + sucrose 4 % + GA3 @10 ppm
T_5	8-HQS @ 300 ppm + sucrose 4 % + GA_3 @ 25 ppm
T_6	8-HQS @ 300 ppm + sucrose 4 % + GA_3 @ 40 ppm
T_7	$AgNO_3$ @ 50 ppm + sucrose 4 % + BA @ 20 ppm
T_8	$AgNO_3$ @ 50 ppm + sucrose 4 % + BA @ 40 ppm
T_9	$AgNO_3$ @ 50 ppm + sucrose 4 % + BA @ 60 ppm
T_{10}	$AgNO_3$ @ 50 ppm + sucrose 4 % + GA_3 @10 ppm
T_{11}	$AgNO_3$ @ 50 ppm + sucrose 4 % + GA_3 @ 25 ppm
T_{12}	$AgNO_3$50 ppm + sucrose 4 % + GA_3 @ 40 ppm
T_{13}	Control (Distilled water)

temperature recorded during the study period was 28.6˚C and 85 percent relative humidity. The experiment flowers were held in the laboratory at ambient room temperature 28.6˚C and 85 percent relative humidity (RH) coupled with 40 W cool white fluorescent tubes, with 12 hours photoperiod.

3. RESULTS AND DISCUSSION

3.1 Water Uptake (g/s)

The spikes held in different concentrations of floral preservatives differed significantly with highest WU (12.39 g/s) was recorded in T_2 (8-HQS @ 300 ppm + 4 % sucrose + BA @ 40 ppm) on day 2, followed by T_5 (8-HQS @ 300 ppm + 4 % sucrose + GA_3 @ 25 ppm) with a WU of (12.11 g/s Table 1). Among all the treatments, control recorded significantly lowest WU (8.89 g/s) on day 2. Similar results were obtained on day 6. The maximum WU was observed in gladiolus spikes held in T_2 (8-HQS @ 300 ppm + 4 % sucrose + BA @ 40 ppm) due to BA increased the water absorption capacity of gladiolus spikes and improved the water equilibrium in the stems by increasing the ex-osmosis of soluble substances in the petals and thereby prolonged the vase life. This was supported by the finding that BA delayed the decrease in water content which is associated with senescence of gerbera flowers by Van Meeteren [7]. Chen and Chen [4] in cut China rose also supported the present results.

3.2 Transpirational Loss of water

The gladiolus spikes held in different concentrations of preservatives differed significantly with the highest TLW (11.32) spikes recorded inT_2 (8-HQS @ 300 ppm + 4 % sucrose + BA @ 40 ppm) on day 2, followed by T_5 (8-HQS @ 300 ppm + 4 % sucrose + GA_3 @ 25 ppm) (11.08). Control (T_{13}) recorded significantly lowest TLW (8.65) on day 2 when compared to the other treatments. Similar results were recorded on day 6 (Table 1).Higher TLW by gladiolus spikes held in 8-HQS @ 300 ppm + sucrose 4 % + BA @ 40 ppm might be due to higher water uptake to avoid temporary water stress [8]. Minimum TLW was observed in control due to reduced water uptake, thereby the quantity of water retained in the flowers was meagre which led to wilting of cut flowers. The present results were in accordance with the findings of Balakrishna et al. [9] in cut tuberose.

3.3 Days to Opening of Basal Floret in Vase

The flowers held in different concentrations of floral preservatives and growth regulators differed significantly with the lowest number of days to opening of basal flower (0.56 days) recorded in T_2 (8-HQS @ 300 ppm + 4 % Sucrose + BA @ 40 ppm), followed by T_5 (8-HQS @ 300 ppm + 4 % Sucrose + GA_3 @ 25 ppm) recording (0.76 days) . Among all the treatments, control recorded significantly highest number of days to opening of basal floret (1.50). The results were similar to the findings of [10] in Asiatic lily cv. Cordelia.

3.4 Opened Florets

The maximum percentage of opened florets (93.24 %) was observed in T2 (8-HQS @ 300 ppm + 4 % Sucrose + BA @ 40 ppm) on day 8, followed by T5 (8-HQS @ 300 ppm + 4 % Sucrose + GA_3 @ 25 ppm) (92.66 %), whereas the minimum percentage of opened florets (85.85 %) were recorded in (control treatment) on day 8 (Table 2). It may be due to Benzyl adenine at low concentrations (25 mg L^{-1}), improves vase life and florets opening of the tuberose cut stems, while high concentrations (100 mg L^{-1}) were ineffective [11]. Benzyl adenine has similarly been reported to improve the vase life and flower opening in Alstroemeria [12,13].

3.5 Longevity of Florets

Among the different treatments, T_2 (8-HQS @ 300 ppm + 4 % sucrose + BA @ 40 ppm) recorded the maximum longevity of florets (3.11 days), followed by T_5 (8-HQS @ 300 ppm + 4 % sucrose + GA_3 @ 25 ppm) with a longevity of 3.00 days. The minimum longevity of florets (1.97) was observed in (control treatment) (Table 2). Longevity of floret is an important parameter which also contributes to the post harvest life of gladiolus spikes. Setyadjit et al. [14] reported that the use of 6-benzyl amino purine in vase solutions was effective in increasing the longevity of harvested Grivellea ‘Sylvia’ inflorescences by suppressing the senescence parameters of relative fresh weight, flower discoloration and flower wilting.

3.6 Vase Life

The gladiolus spikes held in different vase solutions differed significantly with highest vase life (11.54 days) recorded by flowers held in the

treatment T_2 (8-HQS @ 300 ppm + 4 % sucrose + BA @ 40 ppm), followed by T_5 (8-HQS @ 300 ppm + 4 % sucrose + GA_3 @ 25 ppm) (11.19 days), while control (T_{13}) recorded significantly lowest vase life (6.21 days) compared to the other treatments (Table 2). The increased vase life period by gladiolus spikes in 8 HQS @ 300 ppm + sucrose 4% +BA @ 40 ppm might be due to better water relations, delay in protein degradation, maintenance membrane integrity, leading to delay in petal senescence. Among the preservative chemicals along with growth regulators, gladiolus spikes held in 8-HQS @ 300 ppm + sucrose 4 % + BA @ 40 ppm registered the highest vase life while the lowest was recorded in control. Among the plant growth regulators, BA was found most effective in maintaining the membrane integrity thereby maintaining cellular integrity which delay flower petal senescence and maintain its freshness for longer period. Cytokinins and cytokinin-like compounds were reported to delay the ethylene in climacteric cut carnation by Jones and Hill [15], cut rose by Mor et al. [16] and cut carnation by Cook et al. [17]. Further, it was proposed that cytokinins may be a natural anti-senescence factor in flower petals [18] thereby increasing the vase life of cut carnation.

Table 1. Effect of gladiolus flowers to different floral preservatives and growth regulators used and data recorded on 8th day of the experiment

Treatments	Water uptake (g/s)				Transpirational loss of water (g/s)			
	2nd day	4th day	6th day	8th day	2nd day	4th day	6th day	8th day
T_1	10.23	7.77	6.82	4.04	9.66	8.08	7.63	5.38
T_2	12.39	10.11	9.01	6.38	11.32	9.39	9.01	7.18
T_3	11.72	8.90	7.81	4.63	10.83	9.06	8.56	6.04
T_4	9.97	8.37	7.12	4.06	9.50	8.77	8.26	5.54
T_5	12.11	9.34	8.38	6.04	11.08	9.18	8.82	7.02
T_6	10.97	8.88	6.48	4.80	10.26	9.23	8.38	6.08
T_7	9.62	7.86	6.09	3.78	9.19	8.26	7.50	5.44
T_8	11.46	9.63	8.19	4.67	10.65	9.83	9.26	6.21
T_9	10.73	8.28	7.43	5.35	10.05	8.33	8.00	6.37
T_{10}	9.46	7.66	5.58	3.63	9.02	8.11	7.36	5.21
T_{11}	11.22	9.17	7.11	4.41	10.41	8.65	7.60	6.09
T_{12}	10.52	8.58	7.65	5.42	9.84	8.78	8.30	6.18
T_{13}	8.89	5.45	3.39	2.56	8.65	6.51	5.19	4.49
SED	0.14	0.18	0.22	0.15	0.10	0.12	0.16	0.10
CD (P=0.05)	0.28	0.38	0.46	0.31	0.22	0.27	0.33	0.22

Table 2. Effect of gladiolus flowers to different floral preservatives and growth regulators used and data recorded on 8th day of the experiment

Treatments	Days to opening of basal floret in vase (days)	Opened florets (%)	Longevity of florets (days)	Vase life (days)
T_1	1.21	88.24	2.50	8.78
T_2	0.56	93.24	3.11	11.54
T_3	0.84	91.91	2.91	10.82
T_4	1.29	87.60	2.46	8.54
T_5	0.76	92.66	3.00	11.19
T_6	1.01	90.12	2.78	9.87
T_7	1.35	87.06	2.67	8.13
T_8	0.89	91.40	2.87	10.61
T_9	1.08	89.44	2.67	9.45
T_{10}	1.43	86.33	2.15	7.74
T_{11}	0.95	90.76	2.87	10.24
T_{12}	1.17	88.93	2.59	9.11
T_{13}	1.50	85.85	1.97	7.21
SED	0.03	0.31	0.03	0.16
CD (P=0.05)	0.07	0.65	0.06	0.33

4. CONCLUSION

In this study treatment combination T_5 (8-HQS @ 300 ppm + 4% Sucrose + BA @ 40 ppm) positively influenced the cut flowers in vase solution by providing food and also minimised the antimicrobial activity in the holding solution, as a result increase the water uptake, transpirational loss, percentage of opened florets, longevity of florets and increased vase life of gladiolus flower.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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