# INFLUENCE OF PRESERVATIVE CHEMICALS AND GROWTH REGULATORS ON THE POST HARVEST PHYSICAL PARAMETERS OF GLADIOLUS SPIKES (*Gladiolus grandiflorus* L.) cv. AMERICAN BEAUTY

**[1]R. Sudhagar, [2]S. Sowmiya and [3]B. Pamela Elisheba**
[1]Assistant Professor, [2]PG Scholar, [3]Ph.D Scholar, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar – 608002, Tamil Nadu, India.

***Abstract:*** The present investigation on the "Influence of preservative chemicals and growth regulators on the post harvest physical parameters of gladiolus (*Gladiolus grandiflorus* L.) cv. American Beauty" was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar. The experiment was conducted in a Completely Randomized Design with 13 treatments in three replications. The treatments consisted of two preservative chemicals *viz*., 8-hydroxy quinoline sulphate @ 150, 300, 450 ppm and silver nitrate @ 25, 50, 75 ppm along with benzyl adenine (BA) @ 20, 40 and 60 ppm and gibberellic acid ($GA_3$) @ 10, 25 and 40 ppm and a control (distilled water) was also maintained. The results of the experiment revealed that the best treatment was $T_2$ (8-HQS 300 ppm + 4 % sucrose + BA 40 ppm) in terms of all the physical parameters *viz*., days taken for the basal floret to open in vase, longevity of florets, ornamental value and vase life. From the above results it has been concluded that the use of vase solution containing 8 HQS 300 ppm + sucrose 4 per cent + BA 40 ppm was found better for extending the vase life and maintaining quality of gladiolus cv. American Beauty.

***Index Terms***: 8-hydroxy quinoline sulphate, silver nitrate, sucrose, benzyl adenine, gibberellic acid.

## I. INTRODUCTION

Gladiolus is an important commercial flower crop having pivotal place as cut flower both in domestic as well as international market. It is relatively easy to grow and is ideal for bedding and exhibition purposes. The flowers are used in flower arrangements, in bouquets and for indoor decorations. Floral senescence is the major problem regarding the postharvest management of cut flowers. 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. Longer life of cut flowers makes sure that the middle men, retailers and final consumers will be satisfied and will return back to purchase more flowers. It is estimated that in India gladiolus is grown in about 1270 ha producing about 127 million cut spikes every year (Singh, 2006). It is a slender herbaceous perennial with sword shaped phyllode leaves, grown both for gardens and floral decorations. 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. Hence there is a need to develop handling techniques in such a way so as to improve opening of flowers in the first phase and to reduce the rate of senescence in the second phase for prolonged vase life of cut flowers. There are various techniques of post harvest handling of cut flowers. Floral preservatives have been used at all stages of flower handling and marketing to improve the flower quality, longevity and better consumer acceptability (Bhattacharjee, 1999). Several attempts were made to study the effect of different chemicals, sugars, including growth regulators to extend the vase life of cut flowers having economic value (Marousky, 1978; Halevy and Mayak, 1979). Hence keeping the above problems in view, the present work has been undertaken to study the influence of preservative chemicals and growth regulators on the post harvest physical parameters of gladiolus spikes (*Gladiolus grandiflorus* L.) cv. American Beauty to evaluate the post harvest quality and vase life.

## II. MATERIALS AND METHODS

The investigation on the "Influence of preservative chemicals and growth regulators on the post harvest physical parameters of gladiolus spikes (*Gladiolus grandiflorus* L.) cv. American Beauty." was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu. The study was taken up in a completely randomized design with thirteen treatments replicated thrice. The treatments included were $T_1$ (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 % + $GA_3$ 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) and $T_{13}$ - Control (Distilled water).

Gladiolus (*Gladiolus grandiflorus* L.) cv. American Beauty spikes were of good quality which were free from mechanical injury, diseases and insect injuries were obtained from a local wholesaler in Hosur. Distilled or de-ionised water was used to reduce experimental variability (Rule *et al.*, 1986), therefore all the solutions were prepared with distilled water and such freshly prepared solutions were used for the experimentation. According to Lemper (1981), cleaning the stems and

re-cutting the base before placing them in the solutions are essential. In each glass bottle one flower was placed and considered as one replication. The spikes were trimmed under water to 60 cm. The mouth of the bottles was sealed with aluminum foil, which effectively prevented the evaporation loss of aqueous test solutions. The observations of the flowers were recorded in alternate days.

## III. RESULTS AND DISCUSSION

The results of the present study revealed that the use of 8-HQS 300 ppm + sucrose 4 per cent + BA 40 ppm markedly influenced the physical parameters of gladiolus *viz.*, percentage of opened florets, percentage of wilted florets, days taken for the basal floret to open in vase, floret diameter, longevity of florets, ornamental value and vase life (Table 1-3).

The percentage of opened florets differed significantly by the effect of different treatments till the end of the vase period. The maximum percentage of opened florets (93.26) was observed in $T_2$ (8-HQS 300 ppm + 4 % Sucrose + BA 40 ppm) whereas the minimum percentage of opened florets were recorded in control (85.97). A large amount of soluble carbohydrate is required for the flower bud opening, as substrates for cell walls and respiration as well as for their osmotic properties. Since the carbohydrates of the cut flowers are limited, the beneficial effects of exogenous sucrose ranged from increased flower bud or floret (in the case of inflorescences) opening (Kuiper *et al*., 1995) and delayed senescence of individual flowers or florets (Ichimura, 1997).

The percentage of wilted florets was found to be significantly influenced by all the treatments. The lowest percentage of wilted florets (49.65) was noted in $T_2$ (8-HQS 300 ppm + 4 % Sucrose + BA 40 ppm). In the treatment $T_{13}$ (control) the highest percentage of wilted florets (80.84) were observed on day 6.

Days to opening of basal flower of cut gladiolus was significantly affected till the end of vase life period. The flowers held in different concentrations of floral preservatives differed significantly with lowest number of days to opening of basal flower (0.58) was recorded in $T_2$ (8-HQS 300 ppm + 4 % Sucrose + BA 40 ppm). Among all the treatments, control recorded significantly highest number of days to opening of basal flower (1.52). Remaining other treatments differed significantly among themselves.

Floret diameter of gladiolus spikes was significantly affected till the end of the vase life period. The influence of the floral preservative treatments differed significantly with the maximum floret diameter (7.92 cm) recorded by gladiolus spikes held in $T_2$ (8-HQS 300 ppm + 4 % Sucrose + BA 40 ppm) while control ($T_{13}$) recorded the minimum floret diameter (6.15 cm). Significant differences in the longevity of florets were obtained influenced by the floral preservatives along with the combination of sucrose. Among the different treatments, $T_2$ (8-HQS 300 ppm + 4 % Sucrose + BA 40 ppm) recorded the maximum longevity of florets (3.12 days). The minimum longevity of florets (1.98 days) was observed in $T_{13}$ (control). Benzyladenine at low concentrations (25 mg $L^{-1}$) improves the vase life and floret opening of the tuberose cut stems, while high concentrations (100 mg $L^{-1}$) were ineffective (Hutchinson *et al.*, 2003). Benzyladenine has similiarly been reported to improve vase life and flower opening in alstroemeria (Muthui *et al.*, 2001) and Anthurium (Paull and Goo, 1985). The lack of positive effect on vase life and floret opening at higher BA concentrations could be due to increased ethylene production (Hutchinson *et al*., 2003) which may accelerate tuberose senescence.

The effect of treatments on the ornamental value was found to be highly significant. Among the various treatments, the highest ornamental value (8.67) was recorded in $T_2$ (8-HQS 300 ppm + 4 % Sucrose + BA 40 ppm). It was followed by treatment $T_5$ (8-HQS 300 ppm + 4 % Sucrose + $GA_3$ 25 ppm). The lowest ornamental value (2.11) was obtained in $T_{13}$ (control).

The vase life of cut gladiolus differed significantly recording highest vase life with all the concentrations of floral preservative treatments compared to control. The cut gladiolus held in different concentrations of floral preservative treatments differed significantly with highest vase life (10.54 days) recorded by flowers held in the treatment 8-HQS 300 ppm + 4 % Sucrose + BA 40 ppm while control recorded significantly lowest vase life (6.21 days) compared to the other treatments.

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 longer. Cytokinins and cytokinin-like compounds were reported to delay the ethylene climacteric in cut carnations by Apelbaum and Katchansky (1977). Further, it was proposed that cytokinins may be a natural anti-senescence factor flower petals (Eisinger, 1977) thereby increasing the vase life of cut carnations. The present results were in accordance with the findings of Setyadjit *et al.* (2004) who reported that the use of 6-benzylaminopurine 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.

8-HQS, $AgNO_3$ and sodium hypochlorite are antimicrobial in nature thereby improved flower quality and vase life by improving water relations, further sucrose in the vase solution increased the pool of dry matter and respirable substrate (Halevy and Mayak, 1979). It has been reported that the main effect of applied sugars in extending cut flower vase life was to maintain mitochondrial structure and functions (Kaltaler and Steponkus, 1976). Applied sugars also inhibit ethylene production in cut flowers and improve the water balance by regulation of stomatal activity (Dilley and Carpenter, 1975).

Further, Abdel Khader and Rogers (1986) in cut flowers and Krishnappa and Reddy (2004) in cut carnations reported that longevity can be increased by using a preservative solution containing an antimicrobial agent, an acidifying agent, and sucrose which supported the present results.

From the above results it can be concluded that the use of vase solution containing 8-HQS 300 ppm + sucrose 4 per cent + BA 40 ppm was found better for extending the vase life and maintaining quality of Gladiolus cv. American Beauty.

**Table 1. Influence of floral preservatives and growth regulators on percentage of opened florets (%) of gladiolus cv. American Beauty**

| Treatments | Percentage of opened florets (%) | | | |
|---|---|---|---|---|
| | 2nd day | 4th day | 6th day | 8th day |
| $T_1$ - 8- HQS 300 ppm+4% Sucrose+BA 20ppm | 17.65 | 37.74 | 80.27 | 88.26 |
| $T_2$ – 8- HQS 300 ppm+4% Sucrose+BA 40ppm | 29.43 | 50.32 | 85.73 | 93.26 |
| $T_3$ - 8- HQS 300 ppm+4% Sucrose+BA 60ppm | 27.05 | 47.25 | 84.36 | 91.93 |
| $T_4$ - 8- HQS 300 ppm+4% Sucrose+$GA_3$ 20ppm | 16.28 | 34.96 | 79.58 | 87.62 |
| $T_5$ - 8- HQS 300 ppm+4% Sucrose + $GA_3$ 25ppm | 28.30 | 48.67 | 85.19 | 92.68 |
| $T_6$ - 8- HQS 300 ppm+4% Sucrose+ $GA_3$ 50ppm | 22.48 | 42.67 | 82.18 | 90.14 |
| $T_7$ - $AgNO_3$ 25 ppm+2% Sucrose+BA 20ppm | 25.56 | 33.38 | 78.74 | 87.08 |
| $T_8$ - $AgNO_3$ 50 ppm+2% Sucrose+BA 40ppm | 25.56 | 46.18 | 83.73 | 91.42 |
| $T_9$ - $AgNO_3$ 75 ppm+2% Sucrose+BA 60ppm | 20.76 | 41.19 | 81.47 | 89.46 |
| $T_{10}$ - $AgNO_3$ 25 ppm+4% Sucrose+$GA_3$ 10ppm | 13.63 | 31.52 | 78.13 | 86.35 |
| $T_{11}$ - $AgNO_3$ 50 ppm+4% Sucrose+ $GA_3$ 25ppm | 23.97 | 44.32 | 83.05 | 90.78 |
| $T_{12}$ - $AgNO_3$ 50 ppm+4% Sucrose+ $GA_3$ 50ppm | 19.27 | 39.26 | 80.54 | 88.95 |
| $T_{13}$ - Control (distilled water) | 12.15 | 29.84 | 77.26 | 85.97 |
| SED | 0.49 | 0.56 | 0.22 | 0.19 |
| CD (P= 0.05) | 0.98 | 1.12 | 0.43 | 0.37 |

**Table 2. Influence of floral preservatives and growth regulators on percentage of wilted florets (%) of gladiolus cv. American beauty**

| Treatments | Percentage of wilted florets (%) | | | |
|---|---|---|---|---|
| | 2nd day | 4th day | 6th day | 8th day |
| $T_1$ - 8- HQS 300 ppm+4% Sucrose+BA 20ppm | - | 26.25 | 44.27 | 72.45 |
| $T_2$ - 8- HQS 300 ppm+4% Sucrose+BA 40ppm | - | 11.26 | 25.84 | 49.65 |
| $T_3$ - 8- HQS 300 ppm+4% Sucrose+BA 60ppm | - | 16.04 | 30.76 | 59.57 |
| $T_4$ - 8- HQS 300 ppm+4% Sucrose+$GA_3$ 20ppm | - | 27.72 | 46.54 | 74.83 |
| $T_5$ - 8- HQS 300 ppm+4% Sucrose + $GA_3$ 25ppm | - | 14.15 | 27.84 | 56.32 |
| $T_6$ - 8- HQS 300 ppm+4% Sucrose+ $GA_3$ 50ppm | - | 20.94 | 37.82 | 66.28 |
| $T_7$ - $AgNO_3$ 25 ppm+2% Sucrose+BA 20ppm | - | 29.67 | 48.63 | 76.72 |
| $T_8$ - $AgNO_3$ 50 ppm+2% Sucrose+BA 40ppm | - | 17.58 | 33.47 | 61.82 |
| $T_9$ - $AgNO_3$ 75 ppm+2% Sucrose+BA 60ppm | - | 22.68 | 39.87 | 68.45 |
| $T_{10}$ - $AgNO_3$ 25 ppm+4% Sucrose+$GA_3$ 10ppm | - | 31.16 | 50.58 | 78.96 |
| $T_{11}$ - $AgNO_3$ 50 ppm+4% Sucrose+ $GA_3$ 25ppm | - | 19.37 | 35.31 | 64.37 |
| $T_{12}$ - $AgNO_3$ 50 ppm+4% Sucrose+ $GA_3$ 50ppm | - | 24.53 | 41.76 | 70.38 |
| $T_{13}$ - Control (distilled water) | - | 32.73 | 52.76 | 80.84 |
| SED | - | 0.67 | 0.96 | 0.89 |
| CD (P= 0.05) | - | 1.35 | 1.92 | 1.79 |

**Table 3. Influence of floral preservatives and growth regulators on floret diameter (cm), longevity of florets (days), ornamental value and vase life (days) of gladiolus cv. American Beauty**

| Treatment | Days taken for the basal floret to open (days) | Floret diameter (cm) | Longevity of florets (days) | Ornam-ental value | Vase life (days) |
|---|---|---|---|---|---|
| $T_1$ - 8- HQS 300 ppm+4% Sucrose+BA 20ppm | 1.23 | 6.80 | 2.51 | 3.95 | 7.78 |
| $T_2$ - 8- HQS 300 ppm+4% Sucrose+BA 40ppm | 0.58 | 7.92 | 3.12 | 8.67 | 10.54 |
| $T_3$ - 8- HQS 300 ppm+4% Sucrose+BA 60ppm | 0.86 | 7.65 | 2.92 | 7.38 | 9.82 |
| $T_4$ -8- HQS 300 ppm+4% Sucrose+$GA_3$ 20ppm | 1.31 | 6.73 | 2.47 | 3.28 | 7.54 |
| $T_5$- 8- HQS 300 ppm+4% Sucrose+$GA_3$ 25ppm | 0.78 | 7.77 | 3.01 | 8.03 | 10.19 |
| $T_6$ - 8- HQS 300 ppm+4% Sucrose+$GA_3$ 50ppm | 1.03 | 7.21 | 2.79 | 5.69 | 8.87 |
| $T_7$ - $AgNO_3$ 25 ppm+2% Sucrose+BA 20ppm | 1.37 | 6.60 | 2.68 | 2.67 | 7.13 |
| $T_8$ - $AgNO_3$ 50 ppm+2% Sucrose+BA 40ppm | 0.91 | 7.48 | 2.88 | 6.99 | 9.61 |
| $T_9$ - $AgNO_3$ 75 ppm+2% Sucrose+BA 60ppm | 1.10 | 7.07 | 2.68 | 5.08 | 8.45 |
| $T_{10}$ - $AgNO_3$ 25 ppm+4% Sucrose+$GA_3$ 10ppm | 1.45 | 6.47 | 2.16 | 2.28 | 6.74 |
| $T_{11}$ - $AgNO_3$ 50 ppm+4% Sucrose+$GA_3$ 25ppm | 0.97 | 7.39 | 2.88 | 6.34 | 9.24 |
| $T_{12}$ - $AgNO_3$ 50 ppm+4% Sucrose+$GA_3$ 50ppm | 1.19 | 6.91 | 2.60 | 4.37 | 8.11 |

| | | | | | |
|---|---|---|---|---|---|
| $T_{13}$ - Control (distilled water) | 1.52 | 6.15 | 1.98 | 2.11 | 6.21 |
| SED | 0.03 | 0.05 | 0.03 | 0.24 | 0.14 |
| CD (P= 0.05) | 0.05 | 0.09 | 0.07 | 0.47 | 0.28 |

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