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

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***Abstract*:** The present investigation on the "Influence of preservative chemicals on the post harvest physiological and biochemical 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 sucrose 2 and 4 per cent and a control (distilled water) was also maintained. The results of the experiment revealed that the best treatment was $T_5$ (8-HQS 300 ppm + sucrose 4 per cent) in terms of all the physiological and biochemical parameters *viz.*, water uptake, transpirational loss of water, water balance, fresh weight change and optical density of vase solution. From the above results, it has been concluded that the use of vase solution containing 8-HQS 300 ppm + sucrose 4 per cent was found better for maintaining the quality of spikes of gladiolus cv. American Beauty.

***Index Terms*: 8-hydroxy quinoline sulphate, sucrose, distilled water**

## I. INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* L.) belonging to the family Iridaceae, is an important ornamental bulbous plant. It is a 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. 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. 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. Two set of factors regulate the keeping quality of cut flowers (i) Internal mechanism that includes a balance between water uptake and water loss, stem plugging, respiration rate and production of toxic substance like ethylene (ii) External factors that include environmental conditions and microbial attack on cut ends. 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). The maintenance of post-harvest quality of cut flowers is extremely important in order to reward the work spent to increase the production with the commercialization of the product. Hence keeping the above problems in view, the present work has been undertaken to study the influence of preservative chemicals on the post harvest physiological and biochemical parameters of gladiolus (*Gladiolus grandiflorus* L.) cv. American Beauty.

## II. MATERIALS AND METHODS

The investigation on "Influence of preservative chemicals on the post harvest physiological and biochemical parameters of gladiolus (*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 consisted of $T_1$ (8-HQS 150 ppm + sucrose 2 %); $T_2$ (8-HQS 300 ppm + sucrose 2 %); $T_3$ (8-HQS 450 ppm + sucrose 2 %); $T_4$ (8-HQS 150 ppm + sucrose 4 %); $T_5$ (8-HQS 300 ppm + sucrose 4 %); $T_6$ (8-HQS 450 ppm + sucrose 4 %); $T_7$ ($AgNO_3$ 25 ppm + sucrose 2 %); $T_8$ ($AgNO_3$ 50 ppm + sucrose 2 %); $T_9$ ($AgNO_3$ 75 ppm + sucrose 2 %); $T_{10}$ ($AgNO_3$ 25 ppm + sucrose 4 % ); $T_{11}$ ($AgNO_3$ 50 ppm + sucrose 4 %); $T_{12}$ ($AgNO_3$ 75 ppm + sucrose 4 %) and $T_{13}$ - Control (Distilled water).

Uniform gladiolus (*Gladiolus grandiflorus* L.) cv. American Beauty spikes free from mechanical injury, diseases and insect injuries were obtained from a local wholesale distributor in Hosur, were used for the experimentation. De-ionised or distilled 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. The spikes were trimmed under water to 60 cm. Lemper (1981) suggested that 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. After recording fresh weight, the individual flower spikes were placed randomly in the glass bottles containing 200 ml of aqueous test solutions of different treatments. The mouth of the bottles was sealed with aluminium foil, which effectively prevented the evaporation loss of aqueous test solutions. The weight of each container (bottle) and solution/distilled water with and without flower spikes were recorded once in two days, while recording weights re-cutting the base of floral stems (about 0.5 cm) was done under water. The observations of the flowers were recorded in alternate days. The physiological parameters like water uptake (WU), transpirational loss of water (TLW), water balance (WB) were observed and expressed as gram per flower (g/f) and fresh weight change (FWC) was recorded as percentage of initial weight. The biochemical parameter i.e., optical density (OD) of vase solution was measured at every alternate day using spectrophotometer at 480 nm.

## III. RESULTS AND DISCUSSION

The results of the experiment showed that the use of 8-HQS 300 ppm + sucrose 4 % markedly influenced the physiological and biochemical parameters of gladiolus *viz.*, water uptake (11.38 g/f), transpirational loss of water (10.43 g/f), water balance (5.95 g/f), fresh weight change (115.73 %) and optical density of vase solution (0.0210) on 2$^{nd}$ day of observation (Table 1- 3)**.**

### 3.1. Physiological parameters

#### 3.1.1. Water Uptake

In the present study, among the biocide and mineral salt treatments, gladiolus spikes held in the treatment 8-HQS 300 ppm + sucrose 4 % recorded highest water uptake, followed by $AgNO_3$ 50 ppm + sucrose 4 %, while the lowest water uptake was recorded in control. Water uptake decreased at each successive interval of observation from first day till the end of the vase life period. It may be due to its effective transportation within the floral stems and reduced stem blockage, which was supported by the findings of Marousky (1969) in cut roses. Further, stem blockage might be due to their specific germicidal property which was supported by the findings of Larsen and Frolich (1969) in cut carnations. The present results in gladiolus were in accordance with the findings of Anju *et al*. (2002) in cut gladiolus and Prashant (2006) in cut gerberas.

#### 3.1.2 Transpirational loss of water

Water deficit has direct effect on turgor of cut flowers, which accelerates wilting and senescence (Halevy and Mayak, 1974). Among the preservative chemicals, gladiolus spikes held in 8-HQS 300 ppm + sucrose 4 % recorded highest transpirational loss of water. The biocide 8-HQS 300 ppm along with sucrose 4 % not only increased water uptake of gladiolus spikes effectively but also increased transpirational loss of water.

Higher transpirational loss of water by gladiolus spikes held in 8-HQS 300 ppm + sucrose 4 % might be due to higher water uptake to avoid temporary water stress (Halevy and Mayak, 1981) and thus led to increase the membrane viscosity (Faragher, 1986). Minimum TLW was observed in control due to reduced water uptake, thereby the quantity of water retained in the flowers was meager which led to wilting of cut flowers. The present results were in accordance with the findings of Rekha *et al*. (2001) in cut gladiolus spikes.

#### 3.1.3. Water balance

Gladiolus spikes held in 8-HQS 300 ppm + sucrose 4 % recorded highest water balance. Miller (1962) reported that when 8-HQS compounds were used in the vase solutions as antimicrobial agents, it also resulted in stomatal closure in carnation flowers by maintaining better water relations. The results of present investigation with mineral salts confirm an earlier hypothesis that adequate moisture level can be maintained in cut roses by either maintaining higher water uptake or water retention or both (Marousky, 1969). The present results are in confirmation with the results of Borochov *et al*. (1976) in cut roses.

Further, certain non-toxic mineral salts can increase the osmotic concentration and the pressure potential of the petal cells, thus improving their water balance and promoting longevity as reported by Mayak *et al*. (1985) in cut carnations.

#### 3.1.4. Fresh weight change

The gladiolus spikes recorded gradual increase, reaching peak on the 4$^{th}$ day and subsequent decrease in fresh weight, which was in accordance with the results of Rogers (1973) in cut flowers and Balakrishna *et al*. (1989) in cut tuberoses. Manjusha *et al*. (2002) reported similar results in cut gerbera cv. Sath Baba that fresh weight reached a peak on the 4$^{th}$ day of the experiment and then declined thereafter. Further, similar results were reported by Amariutei *et al.* (1995) in *Gerbera jamesonii* cv. Red Marleen.

Among the biocide and mineral salt treatments along with sucrose, highest fresh weight change was recorded by 8-HQS 300 ppm + sucrose 4 % and the spikes held in control recorded lowest FWC. Flowers held in 8-HQS 300 ppm along with sucrose influenced cut flower longevity by increasing water uptake, maintained normal levels of transpirational loss of water, improved water balance, thereby increased the fresh weight of the flowers. Prashant (2006) in cut gerberas also reported that combination of 8-HQS + sucrose increased cut flower longevity by increasing the water uptake and maintaining higher fresh weight.

### 3.2. Biochemical parameters

#### 3.2.1. Optical density

Cultivar held in 8-HQS 300 ppm + sucrose 4 % recorded the lowest OD while spikes held in control recorded highest OD suggesting that the use of biocide along with sucrose effectively controlled microbial growth in cultivars with firm scapes compared to cultivars with slender scapes and heavier capitulum. The fact that 8-HQS is a useful agent for precipitating many minor elements (Cu, Mn, Fe, Zn), suggested that it acts bacteriostatically and fungistatically by precipitating one or several of these elements so that the microorganisms cannot use them (Zentmyer, 1943). Maximum OD in control might be as a result of vascular plugging, indicated by more turbidity in the vase solution.

The spikes held in distilled water were found to have undergone water stress earlier resulting from vascular plugging of the conducting tissue. The present results were in accordance with the findings of Rogers (1973) in cut flowers. Lee and Kim (1994) further reported that ethephon also increased anthocyanin optical density in cut roses. Moreover, addition of biocides to the preservative solutions reduced the flower deterioration rate and improved the post-harvest quality of cultivars of cut gerbera which was in accordance with the findings of Humaid (2005) in cultivars 'Rose Supreme' and 'Nova Lux' of cut gladiolus. From the above results, it can be concluded that the use of vase solution containing 8-HQS 300 ppm + sucrose 4 per cent found better for maintaining the quality spikes of gladiolus cv. American Beauty.

**Table 1. Influence of floral preservatives on post harvest water uptake (g/f) and transpirational loss of water (g/f) of gladiolus cv. American Beauty**

| T. No. | Treatment details | Water uptake (g/f) | | | Transpirational loss of water (g/f) | | |
|---|---|---|---|---|---|---|---|
| | | 2nd day | 4th day | 6th day | 2nd day | 4th day | 6th day |
| $T_1$ | 8- HQS 150 ppm+2% Sucrose | 8.98 | 6.82 | 5.99 | 8.64 | 7.23 | 6.83 |
| $T_2$ | 8- HQS 300 ppm+2% Sucrose | 9.62 | 7.42 | 6.66 | 9.11 | 7.56 | 7.26 |
| $T_3$ | 8- HQS 450 ppm+2% Sucrose | 8.37 | 7.13 | 5.94 | 8.21 | 7.63 | 6.72 |
| $T_4$ | 8- HQS 150 ppm+4% Sucrose | 10.73 | 8.15 | 7.16 | 9.96 | 8.34 | 7.88 |
| $T_5$ | 8- HQS 300 ppm+4% Sucrose | 11.38 | 9.29 | 8.28 | 10.43 | 8.65 | 8.31 |
| $T_6$ | 8- HQS 450 ppm+4% Sucrose | 10.46 | 8.79 | 7.48 | 9.77 | 9.02 | 8.51 |
| $T_7$ | $AgNO_3$ 25 ppm+2% Sucrose | 8.11 | 6.63 | 5.34 | 8.02 | 7.21 | 6.55 |
| $T_8$ | $AgNO_3$ 50 ppm+2% Sucrose | 9.36 | 7.64 | 6.81 | 8.87 | 7.91 | 7.48 |
| $T_9$ | $AgNO_3$ 75 ppm+2% Sucrose | 8.62 | 7.24 | 6.17 | 8.43 | 7.79 | 7.34 |
| $T_{10}$ | $AgNO_3$ 25 ppm+4% Sucrose | 10.20 | 8.33 | 6.47 | 9.52 | 7.92 | 6.95 |
| $T_{11}$ | $AgNO_3$ 50 ppm+4% Sucrose | 11.12 | 8.58 | 7.70 | 10.20 | 8.46 | 8.12 |
| $T_{12}$ | $AgNO_3$ 75 ppm+4% Sucrose | 9.91 | 8.02 | 6.24 | 9.36 | 8.41 | 7.14 |
| $T_{13}$ | Control (distilled water) | 7.86 | 5.66 | 4.65 | 7.78 | 6.99 | 6.35 |
| | SED | 0.11 | 0.19 | 0.24 | 0.11 | 0.05 | 0.08 |
| | CD (P=0.05) | 0.23 | 0.39 | 0.47 | 0.21 | 0.10 | 0.16 |

**Table 2. Influence of floral preservatives on post harvest water balance (g/f) of gladiolus cv. American Beauty**

| T. No. | Treatment details | Water balance (g/f) | | |
|---|---|---|---|---|
| | | 2nd day | 4th day | 6th day |
| $T_1$ | 8- HQS 150 ppm+2% Sucrose | 5.34 (0.34) | 4.59 (-0.41) | 4.16 (-0.84) |
| $T_2$ | 8- HQS 300 ppm+2% Sucrose | 5.51 (0.51) | 4.87 (-0.13) | 4.41 (-0.59) |
| $T_3$ | 8- HQS 450 ppm+2% Sucrose | 5.16 (0.16) | 4.50 (-0.50) | 4.22 (-0.78) |
| $T_4$ | 8- HQS 150 ppm+4% Sucrose | 5.77 (0.77) | 4.82 (-0.18) | 4.28 (-0.72) |
| $T_5$ | 8- HQS 300 ppm+4% Sucrose | 5.95 (0.95) | 5.63 (0.63) | 4.97 (-0.03) |
| $T_6$ | 8- HQS 450 ppm+4% Sucrose | 5.69 (0.69) | 4.77 (-0.23) | 3.98 (-1.02) |
| $T_7$ | $AgNO_3$ 25 ppm+2% Sucrose | 5.09 (0.09) | 4.42 (-0.58) | 3.80 (-1.20) |
| $T_8$ | $AgNO_3$ 50 ppm+2% Sucrose | 5.49 (0.49) | 4.73 (-0.27) | 4.33 (-0.67) |
| $T_9$ | $AgNO_3$ 75 ppm+2% Sucrose | 5.19 (0.19) | 4.46 (-0.54) | 3.83 (-1.17) |
| $T_{10}$ | $AgNO_3$ 25 ppm+4% Sucrose | 5.68 (0.68) | 5.42 (0.42) | 4.52 (-0.48) |
| $T_{11}$ | $AgNO_3$ 50 ppm+4% Sucrose | 5.92 (0.92) | 5.12 (0.12) | 4.58 (-0.42) |
| $T_{12}$ | $AgNO_3$ 75 ppm+4% Sucrose | 5.55 (0.55) | 4.61 (-0.39) | 4.10 (-0.90) |
| $T_{13}$ | Control (distilled water) | 5.08 (0.08) | 3.67 (-1.33) | 3.30 (-1.70) |
| | SED | 0.01 | 0.12 | 0.14 |
| | CD (P=0.05) | 0.03 | 0.25 | 0.28 |

Figures in the parenthesis represent original values. The data was analysed statistically after uniform addition of a base value 5.0.

**Table 3. Influence of floral preservatives on post harvest fresh weight change (%) of flowers and optical density of gladiolus cv. American Beauty**

| T. No. | Treatment days | Fresh weight change (%) | | | Optical density | | |
|---|---|---|---|---|---|---|---|
| | | 2nd day | 4th day | 6th day | 2nd day | 4th day | 6th day |
| $T_1$ | 8- HQS 150 ppm+2% Sucrose | 105.71 | 107.32 | 97.54 | 0.0329 | 0.1490 | 0.2236 |
| $T_2$ | 8- HQS 300 ppm+2% Sucrose | 106.57 | 112.93 | 102.55 | 0.0298 | 0.1350 | 0.2025 |
| $T_3$ | 8- HQS 450 ppm+2% Sucrose | 104.76 | 108.17 | 99.94 | 0.0356 | 0.1613 | 0.2419 |
| $T_4$ | 8- HQS 150 ppm+4% Sucrose | 108.31 | 104.84 | 105.09 | 0.0241 | 0.1092 | 0.1638 |
| $T_5$ | 8- HQS 300 ppm+4% Sucrose | 109.21 | 115.73 | 99.03 | 0.0210 | 0.0953 | 0.1095 |
| $T_6$ | 8- HQS 450 ppm+4% Sucrose | 107.82 | 112.38 | 87.75 | 0.0256 | 0.1160 | 0.1739 |
| $T_7$ | $AgNO_3$ 25 ppm+2% Sucrose | 104.34 | 108.20 | 101.10 | 0.0373 | 0.1690 | 0.2534 |
| $T_8$ | $AgNO_3$ 50 ppm+2% Sucrose | 106.18 | 112.80 | 96.73 | 0.0311 | 0.1409 | 0.2113 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_9$ | $AgNO_3$ 75 ppm+2% Sucrose | 105.32 | 109.77 | 86.85 | 0.0343 | 0.1554 | 0.2331 |
| $T_{10}$ | $AgNO_3$ 25 ppm+4% Sucrose | 107.36 | 110.86 | 103.53 | 0.0269 | 0.1219 | 0.1828 |
| $T_{11}$ | $AgNO_3$ 50 ppm+4% Sucrose | 108.73 | 115.51 | 90.02 | 0.0226 | 0.1024 | 0.1388 |
| $T_{12}$ | $AgNO_3$ 75 ppm+4% Sucrose | 107.04 | 111.00 | 82.03 | 0.0285 | 0.1291 | 0.1937 |
| $T_{13}$ | Control (distilled water) | 103.93 | 106.48 | 82.03 | 0.0387 | 0.2228 | 0.2934 |
| | SED | 0.19 | 0.11 | 1.12 | 0.0006 | 0.0029 | 0.0011 |
| | CD (P=0.05) | 0.39 | 0.21 | 0.23 | 0.0012 | 0.0059 | 0.0022 |

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