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# Pulsing Effect of Sucrose and Sodium Hypochlorite on Vase Life of Cut Chrysanthemum cv Arcticqueen Flower

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## ABSTRACT

An experiment was executed to investigate the role of different concentrations of sucrose and sodium hypochlorite as pulsing solution on post harvest storage life and other characteristics of cut chrysanthemum cv Arctic queen flower after harvest. The experiment was framed as Completely Randomized design with factorial concept with three levels of sucrose (5, 10, 20 %) and with 50 ppm NaOCl with 3 replications. The output of the experiment revealed that flower weight (8.26 g), water uptake (13.76 g), fresh weight change (123.76g), and maximum vase life (10.23 days) was achieved in 10% sucrose for 4 hrs pulsing treatment.

**Keywords** Chrysanthemum, Sucrose, Sodium hypochlorite, Fresh weight, Vase life.

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## INTRODUCTION

Cut flowers are important and valuable products of horticulture with regards to handling of cut flowers, the freshness, attractive color of flowers and more fresh stage of flowers when kept in vase for decoration are important to fetch a good market returns. For maintaining the quality of cut flowers to extend the duration of freshness of flower life usage of chemicals are considered important for having good acceptance of the products in the market. The important reason of deterioration of cut flowers is loss of water from the flower and also might be due to blockage of xylem vessels by microorganisms which can accumulate in the vase solution. From long time chemicals as biocides are used to make the flower holding solution medium as acidic so the bacterial multiplication is reduced.(Nowak and Rudnicki 1990).The post harvest life of cut flowers can be extended by use of optimum environment (Larson 1992), like sucrose solution, sodium hypochlorite (Muriithi and Ouma 2011) and silver thiosulphate (Gollnour and Iveill 2002). The postharvest life of cut flowers with good market demand can be improved by the use of chemicals and sugars (Prashanth 2006). In the preservative solutions to control harmful bacteria and help to prevent bacterial multiplication bactericides are added (Halevy and Mayak 1981).

Loss of water from petals, wilting, ethylene production and vascular blockage by air and microorganisms are considered as few reasons for short storage life of cut flowers (Elgimabi and Ahmed 2009). Cut flowers vase life is mainly affected by two factors, ethylene which hastens the senescence of many flowers and microorganisms which blocks the conducting tissues and reduces the vase life of cut flower (Zencirkiran 2005). Sucrose, acidifier, an inhibitor of microorganisms is used as floral preservative and for an anti ethylene action (Tehranifar *et al.* 2013). In the world floriculture market chrysanthemum is in second position after rose (Kafi and Ghahsareh 2009). Pulsing treatment and keeping cut flowers in holding solution is important methods for extending the cut flower vase life.

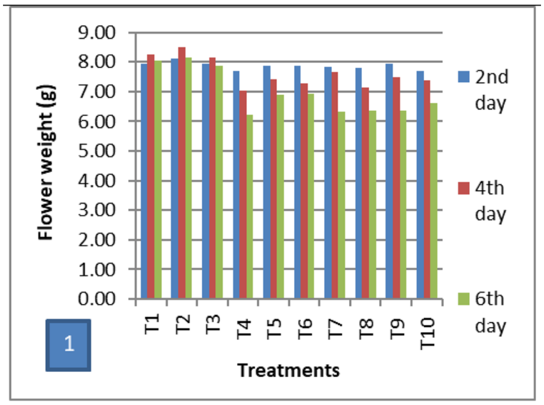
## MATERIALS AND METHODS

The present work was done in the Department of Floriculture and Landscape Architecture Laboratory, College of Horticulture, Rajendranagar, Hyderabad. Flowers of chrysanthemum (*Dendranthema grandiflora* L.) cultivar 'Arctic queen' were obtained from commercial farm. Chrysanthemum cv Arctic queen is a spray type flower. The cut stems after transportation unpacked immediately, graded to uniform length and quality in order to maintain homogeneity within the replications. The flowers were kept in pulsing solution of sucrose alone at 5, 10 and 20 % for 4 hrs and in combination with sodium hypochlorite at 50 ppm for 2 hrs and 4 hrs at room temperature, flowers in distilled water are treated as control. After completion of pulsing, flowers were kept in distilled water for the remaining part of the experimental period to evaluate their vase life. All the measurements were taken at 2 days interval. Vase life was calculated by recording how many days the flowers remained in good condition without spoilage in each replication during storage, from the begining of the experiment until the flower exhibited petal wilting / abscission / petals lost their turgidity (Abadi *et al.* 2013). The weight of container + solution (without flower) recorded once in two days and the difference was taken to measure the water uptake within that particular duration of period and represented as gram per flower. The container weight + holding solution + flowers recorded once in two days and the difference was taken to measure the transpirational loss of water within that particular duration of period and represented as gram per flower. The container weight + solution + flower and the container weight + solution recorded once in two days and the difference was taken to measure the fresh weight change of flower during that particular period (Venkatarayappa *et al.* 1981). Relative water content (RWC) was determined by Wheatherly method (1958). One gram of fresh petals was taken and they were placed in water for 4 hrs. After soaking, the weight was measured as turgid weight. Then the petals were kept in hot air oven at 80$^{o}$C till the same weight was noted and this weight has been taken as dry weight. For determining PLW the initial weight and final weight of flowers was recorded and then the total loss of physiological weight was then calculated by taking the difference of the final weight of flowers from initial weight. Total soluble solids of cut flower stalks were measured alternate days using a digital refractrometer (Atago, Japan, Model: DR-A1). Vase life was determined when 50 % of flowers in a treatment become dull. The statistical analysis was carried out as per the procedure given by Panse and Sukhatme (1985). Results were analyzed using analysis of variance (ANOVA) and F-test. To compare the treatments during vase life least significant difference (LSD or CD) was used.

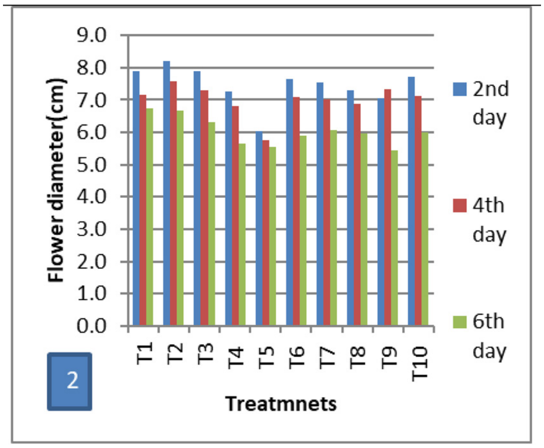
## RESULTS AND DISCUSSION

**Flower weight (g):** Significantly highest flower fresh weight was observed with $T_2$ (8.26 g), then by $T_1$(8.08 g), $T_3$ (7.99 g) during vase life period of cut chrysanthemum flower (Graph 1). Significant differences were observed in flower fresh weight. The flower fresh weight decreased from day 2 (7.87 g) to day 6 (6.98 g) at each interval of observation.

The data in confirms that pulsing with sucrose 10% for 4 hrs ($T_2$) increased the FW of flowers as it helped to enhance the water uptake, sucrose serves as a source of substrate for respiration. In other treatments sodium hypochlorite might have prevented the multiplication of microbes in xylem vessels but has




**Graph 1.** Flower weight (g).



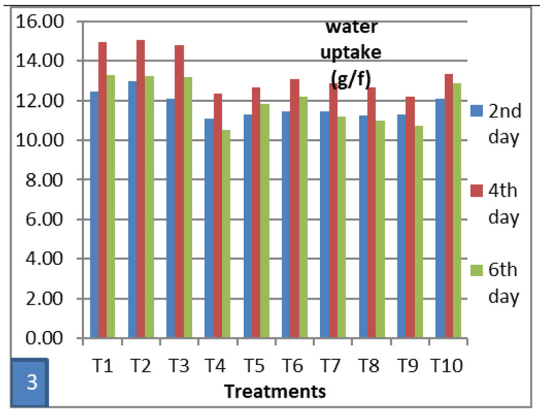

**Graph 2.** Flower diameter (cm).

not improved the water uptake by the cut chrysanthemum flower cv Arcitc queen, which might be the reason for reduced flower weight and diameter in most of the combinations in which sodium hypochlorite was added. Ichimura and Hiraya (1999) reported that sucrose extends the vase life of florets harvested at a bud stage. Cut flowers to which sugar added increases the availability of respirable substrates (Da Silva 2003), postponed the onset of hydrolysis of structural cell components (Donoghue *et al.* 2002), reduced ethylene production and sensitivity (Pun *et al.* 2005). Treatment with sucrose along with chemicals extends the vase life of cut Eustoma flowers. This might be due to supply of carbohydrates along with inhibition of vascular occlusion. In conclusions the work had reconfirmed the role of chemical treatments along with sucrose pulsing extended the vase life of chrysanthemum flowers.

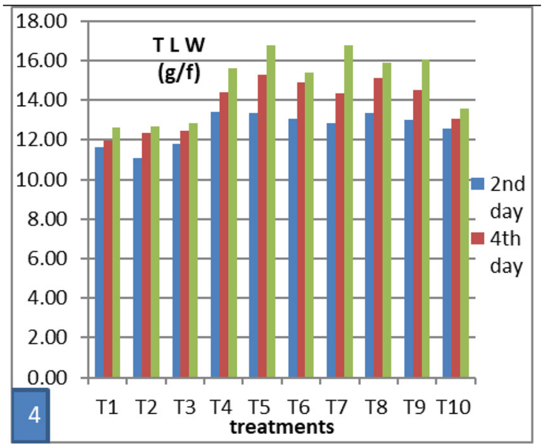
**Flower diameter (cm):** The cut chrysanthemum flowers under different treatments differed significantly for flower diameter (cm) (Graph 2). $T_2$ has cataloged the highest flower diameter (7.5 cm) which was on good as with $T_1$(7.3 cm) and $T_3$(7.2 cm).With days of vase life period significant difference in noted in flower diameter. The chrysanthemum flower diameter significantly decreased from day 2 (7.6 cm) to day 6 (6.1cm) at each internal of observation.

The observations confirm that pulsing of cut chrysanthemum cv Arctic queen with 10% sucrose for 4 hrs, recorded highest flower diameter, this can be due to better water relations and also probable use of sucrose as carbohydrate source, when the natural carbohydrates are depleted sucrose can be used as a substance of respiration.

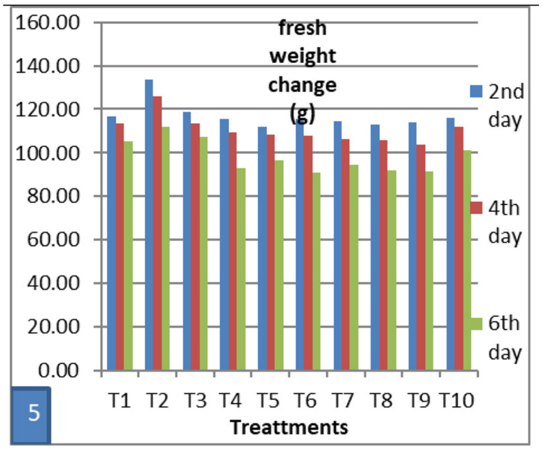
**Water uptake-WU(g):** Significant differences were noted for WU in imposed treatments (Graph 3). Significantly elevated WU (13.76 g) was observed with $T_2$ which was equable with $T_1$ (13.56 g) and the low WU was cataloged with $T_4$(11.32 g) and all remaining treatments recorded the intermediate values. The cut chrysanthemum flowers differed momentously for water uptake with days of study period. The water uptake increased from day 2 (11.74 g) to day 4 (13.39




**Graph 3.** Water uptake (g/f).




**Graph 4.** TLW (g/f).

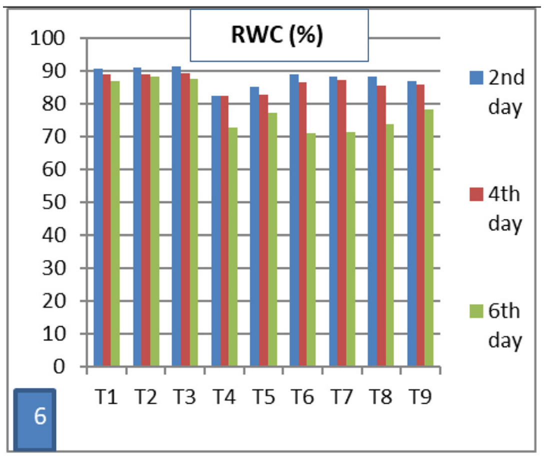



**Graph 5.** Fresh weight change (g).

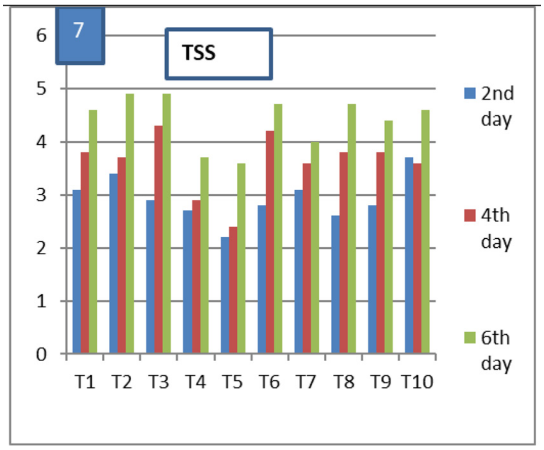
g) and decreased from day 4(13.39 g) to day 6 (12.01 g). One of the greatest problems in postharvest flower physiology is the blockage of the conducting systems might be due to air or bacterial growth or the plant reactions to the actual cut .Even after the removal of flower stems from the mother plant, to the wounded area few enzymes are mobilized and chemical are released to try to seal the wound (loub and Vandoom 2004).

**Transpiration loss of water (g/f):** The cut chrysanthemum flowers under different pulsing treatments differed significantly for TLW (Graph 4). The highest TLW was inscribed with $T_5$(15.12 g/f) which were on par with $T_8$(14.80 g/f). There were compelling differences in TLW during vase life period. The TLW momentously increased from day 2 (12.61 g/f) to day 6 (14.83 g/f). Cogently highest loss of water by transpiration was noted on day 6 (14.83 g/f).The interaction effect of TLW between days and treatments was significant. Squat value was cataloged with $T_2$ (11.10 g/f) and the remaining treatments recorded the intermediate values. On day 4 lowest TLW was filed with $T_1$(11.99 g/f) which were on line with $T_2$(12.32 g/f). On day 6, lowest TLW filed with $T_1$(12.64 g/f) which was aligned with$T_2$ (12.69 g/f), $T_3$ (12.85 g/f) and all other remaining interactions recorded intermediate values. In the presented study observations confirm that the pulsing with 10% sucrose recorded lowest TLW and controlled TLW, perhaps this may be due to elevated water uptake to avoid water stress and thus led to increase the membrane viscosity.

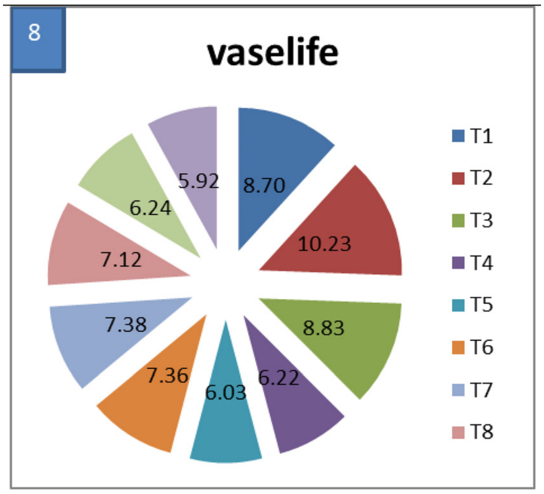
**Fresh weight change (g):** The cut chrysanthemum flowers held in unlike pulsing solutions discrete significantly (Graph 5). The highest change in fresh weight was observed with $T_2$(123.76 g) and the least FWC was observed with $T_9$(103.14 g) and remaining treatments recorded mid values. The FWC of chrysanthemum flowers gradually decreased at each successive interval of observation from day 2 (117.00 g) to day 6 (98.40 g).




**Graph 6.** RWC (%).




**Graph 7.** TSS.




**Graph 8.** Vase life

**Relative water content of petals (RWC):** The chrysanthemum flowers held in different pulsing solutions differed significantly in RWC of petals (Graph 6). Significantly highest RWC of petals was observed with treatment $T_2$ (89.38 %) which was on line with $T_3$ (89.24 %). The low value of RWC was filed with treatment $T_4$ (79.06 %) and remaining treatments recorded the intermediate values. These compelling differences in RWC during days of vase life. The RWC of petals was gradually decreased from day 2 (88.15 %) to day 6 (78.98 %).

**Total soluble solids (TSS) - °Brix:** The cut chrysanthemum flowers under different treatments differed significantly on TSS of flowers petals (Graph 7). Momentously high TSS content of petals was noted with treatment $T_2$ (4.0) and $T_3$ (4.0) which was also on line with $T_6$ (3.9), $T_1$(3.8), $T_8$ (3.7), $T_9$ (3.6) and $T_7$ (3.6). The lowest TSS of petals was filed with treatment $T_5$ (2.7) which was aligned with $T_4$ (3.1). There were compelling differences observed in TSS of flowers petals during vase life period. The TSS of

**Table 1.** Correlation and regression of parameters.

| | FW | FD | WU | TLW | RWC | FWC | TSS | VL |
|---|---|---|---|---|---|---|---|---|
| FW | 1 | .700** | .546** | -.855** | .825** | .855** | -.303 | .553** |
| FD | .700** | 1 | .342 | -.781** | .799** | .840** | -.301 | .517** |
| WU | .546** | .342 | 1 | -.476** | .504** | . 431* | .327 | .679** |
| TLW | -.855** | -.781** | -.476** | 1 | -.852** | -.859** | .198 | -.659** |
| RWC | .825** | .799** | .504** | -.852** | 1 | .854** | -.275 | .519** |
| FWC | .855** | .840** | .431* | -.859** | .854** | 1 | -.457* | .550** |
| CHL | .590** | .747** | .207 | -.645** | .704** | .750** | -.448* | .323 |
| TSS | -.303 | -.301 | .327 | .198 | -.275 | -.457* | 1 | .388* |
| pH | .165 | .102 | -.339 | .075 | -.004 | .173 | -.695** | -.364* |
| OD | -.482** | -.557** | .011 | .444* | -.436* | -.618** | .721** | .118 |
| EL | -.581** | -.684** | -.459* | .679** | -.684** | -.574** | -.135 | -.686** |
| ACC | . 580** | .490** | .679** | -.716** | .564** | .523** | .347 | .925** |
| VL | .553** | .517** | .679** | -.659** | .519** | .550** | .388* | 1 |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

flowers petals increased gradually from day 2 (2.9) to day 4 (4.4).

**Vase life (Days):** The vase life of cut chrysanthemums held in various vase solutions differed significantly (Graph 8). The highest vase life was noted with $T_2$(10.23 days) which was cogently highest over others followed by $T_1$(8.7 days), $T_3$ (8.83 days), the least vase life was noted with $T_{10}$ (5.92 days) and other treatments recorded the mid values for vase life. Pulsing with sucrose 10% concentration exhibited highest vase life may be due to better water relations by providing food as sucrose for metabolic activities like transpiration and respiration which is in line with Li *et al.* (2003), Kumar and Bhatttacharjee (2004) in cut rose, Hongyi and Jinzhi (2005) in cut lilies and Ichimura *et al*. (2005) in cut rose, further sucrose in the solution might have increased the pool and respirable substrate.

**Correlation and regression:** Data on different parameters viz., flower weight (FW), flower diameter (FD), water uptake (WU), transpiration loss of water (TLW), relative water content (RWC), fresh weight change (FWC), total soluble solids (TSS), and vase life (VL) were recorded. The vase life showed significant positive correlation (Table 1) with flower weight (0.553), flower diameter (0.517), water uptake (0.679), relative water content (0.519) and fresh weight change (0.550) at 1% level of significance and TSS is significantly positively correlated with vase life at 5 % level of significance, whereas the TLW (-0.659) significantly negatively correlated with the vase life at 1% level of significance.

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