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# Effect of post-harvest preservatives on vase life of chrysanthemum (*Dendranthema grandiflora.*) cv. Zembla.

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**Abstract**
An experiment was conducted during the winter season of 2022 at the Postgraduate Laboratory, Department of Horticulture, R.B.S College, Bichpuri, Agra, to investigate the effect of post-harvest preservatives on the vase life of chrysanthemum (*Dendranthema grandiflora*) cv. Zembla. The study was laid out in a completely randomized design (CRD) comprising nine treatments and three replications, making a total of 27 vases and 81 cut stems. The treatments included: distilled water (control), sucrose (4%), sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm), sucrose (2%) + citric acid (100 ppm), sucrose (2%) + NAA (100 ppm), sucrose (2%) + $GA_3$ (100 ppm), $Al_2(SO_4)_3$ (200 ppm) + NAA (100 ppm), citric acid (100 ppm) + $GA_3$ (100 ppm), and $Al_2(SO_4)_3$ (200 ppm) + citric acid (100 ppm) Among all treatments, sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) proved to be the most effective in enhancing post-harvest quality. Stems held in this solution recorded the largest flower head diameter (7.8 cm), minimum decline in fresh weight (10.1 g), highest solution uptake (218 mL), superior visual quality score (4.6), and the longest vase life (27 days). Moreover, this treatment delayed floret senescence initiation (22 days), complete senescence (29 days), and leaf yellowing initiation (18 days). Although all preservative combinations performed better than the control, sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) consistently outperformed the rest in maintaining freshness and extending vase life of cut chrysanthemum stems.

**Keywords:** Chrysanthemum, distilled water, sucrose, Aluminium Sulphate, NAA, GA3, citric acid, vase life

## Introduction

Chrysanthemum (*Dendranthema grandiflora*) sometimes called mums or chrysanths, belongs to family Asteraceae and are native to East Asia and north-eastern Europe. It is known as “glory of the east” and “queen of east”, as it is mainly cultivated in China and Japan. It is commonly known as guldaudi in Hindi belts of India. Chrysanthemum is one of the most popular ornamental crops in the world. The petals on chrysanthemums are technically called florets. There are two types of florets: disk florets and ray florets. Disk florets are found in the centre of the flower head and are botanically perfect, i.e., they contain both male and female parts. The best temperature for growing chrysanthemum is 20-28 °C for day and 15-20 °C for night. Chrysanthemum produces flowers from October to January depending upon the variety. Flowers are climacteric which makes them defenceless for huge post-harvest losses. Addition of preservatives to the holding solution.is recommended to prolong the vase life of cut flowers. All holding. solutions must contain sugars, acids, growth regulators and antimicrobials.

In recent years, the global demand for cut chrysanthemum flowers has shown a consistent upward trend. However, limited research has been conducted on the application of postharvest chemical treatments to enhance the shelf life and ornamental quality of cut chrysanthemum stems. Therefore, the present investigation was undertaken to identify an effective preservative treatment that could improve the quality parameters and vase longevity of cut chrysanthemum (*Dendranthema grandiflora*) cv. Zembla.

## Materials and Methods

The present experiment was conducted during the winter season of 2022 in the Postgraduate Laboratory, Department of Horticulture, R.B.S. College, Bichpuri, Agra.

Freshly opened cut flowers of chrysanthemum (*Dendranthema grandiflora*) cv. Zembla were harvested in the morning hours from the Horticultural Farm of R.B.S. College, Agra. Immediately after harvesting, the cut stems were placed in buckets containing clean water to prevent desiccation.

The flower stems were then trimmed to a uniform length of 40 cm, and the lower leaves were removed, retaining three to four pairs of upper leaves on each stem. Subsequently, the prepared stems were placed in 250 mL glass beakers containing various holding solutions as follows:

- Distilled water (control)
- Sucrose. (4%)
- Sucrose. (2%) + $Al_2(SO_4)_3$ (200 ppm)
- Sucrose (2%) + citric acid (100 ppm)
- Sucrose (2%) + NAA (100 ppm)
- Sucrose(2%) + $GA_3$ (100 ppm)
- $Al_2(SO_4)_3$ (200 ppm) + NAA (100 ppm)
- Citric acid (100 ppm) + $GA_3$ .(100 ppm)
- $Al_2(SO_4)_3$ (200 ppm) + citric acid (100 ppm)

The experiment was conducted out in a Completely Randomized Design. (CRD) with three replications, comprising nine treatments per replication. Each treatment consisted of three cut stems.

Observations were recorded on flower head diameter, change in fresh weight of the flower, amount of solution consumed, number of days to initiation of floret senescence, number of days to complete senescence, number of days to initiation of leaf yellowing, appearance score of cut flower. Stems, and vase life. The collected data were subjected to analysis of variance (ANOVA) for statistical interpretation.

**Results and Discussion**

The analysis of variance (ANOVA).revealed that the effect of different preservative treatments on all observed parameters was statistically significant at the 5% level of probability.

According to the mean comparisons presented in Table 1, the largest flower head diameter (7.9 cm) was recorded in the treatment sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm), while the smallest flower diameter (6.85 cm) was observed in the distilled water (control) treatment. The increase in flower diameter with $Al_2(SO_4)_3$ may be attributed to its role in reducing stomatal opening and consequently lowering respiration and transpiration losses, thus conserving carbohydrates essential for floral expansion.

Similar findings were also reported by Ichimura *et al.* (2005) [6], who emphasized that reduced respiration loss enhances flower longevity and size.

Data presented in Table 1 further indicate that the maximum loss in fresh weight (14.5 g) occurred in the control ($T_0$), whereas the minimum weight loss (9.9 g) was recorded in the sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) treatment ($T_2$). The improved fresh weight maintenance may be due to enhanced water absorption coupled with lower transpiration losses. Similar results were described by Halevy and Mayak (1981) [5], who stated that an increase in flower fresh weight occurs only when water uptake exceeds transpiration rate.

From the results shown in Table 1, the longest duration for initiation of leaf yellowing (18.06 days) was observed with sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm), while in the control treatment, leaf yellowing symptoms appeared much earlier, after only 11.3 days. The delayed yellowing in the $Al_2(SO_4)_3$-based treatment could be due to the antimicrobial action of aluminium sulphate, which helps prevent vascular blockage at the cut ends, thereby maintaining water balance and metabolic activity within the stem. These findings are in line with the observations of Karki *et al.* (2004) [7], Divya *et al.* (2004) [3], and Singh *et al.* (2004) [4], who also reported the beneficial effect of aluminium sulphate in prolonging the postharvest life of cut flowers.

Overall, the results indicate that sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) was the most effective treatment in maintaining flower freshness, reducing physiological losses, and delaying senescence of cut chrysanthemum stems, thereby significantly extending vase life compared to the control.

Comparison of means presented in Table 1 and Table 2 revealed that the cut stems placed in the solution containing Sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) ($T_2$) exhibited the longest duration for the initiation of floret senescence (21.8 days) as well as for complete senescence (29.06 days). In contrast, the control treatment recorded the earliest onset of floret senescence and complete senescence, which occurred at 13.2 days and 19.8 days, respectively. The present results are in agreement with the findings of Bala *et al.* (2008) [1], who also observed beneficial effects of sucrose and aluminium sulphate in extending vase life. Similarly, Patil (1995) [10] reported that sucrose application effectively delayed senescence in golden rod cut flowers, while Seyf *et al.* (2012) [12] found aluminium sulphate to be effective in prolonging vase life in cut roses.

The maximum solution uptake by the cut stems was recorded in treatment $T_2$ containing Sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm), with a value of 219 mL, whereas the minimum uptake was noted in the control treatment (104.5 mL). These findings are consistent with earlier reports by Halevy and Mayak (1981) [5], Singh *et al.* (2000) [13], Kumar *et al.* (2010) [9], Danaee *et al.* (2011) [2], and Gebremedhin *et al.* (2013) [4], who observed similar trends in different cut flower species.

The data in Table 2 further revealed that stems held in Sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) solution recorded the longest vase life of 27.18 *days*, whereas the shortest vase life (17.3 days) was observed in the control where stems were kept in distilled water without preservatives. Comparable results were also documented by Koley (2013) [8], who reported that the combined use of sucrose and aluminium sulphate effectively prolonged vase life in cut flowers of golden rod and bird of paradise, respectively.

**Table 1:** Effect of preservatives on flower head diameter (cm), change in fresh weight, days to initiation of leaf yellowing and initiation of floret senescence

| S. No. | Treatments | Notations | Flower head diameter (cm) | Change in fresh weight (g) | Days to initiation of leaf yellowing | Initiation of floret senescence |
|---|---|---|---|---|---|---|
| 1. | Distilled water (Control) | $T_0$ | 6.85 | 14.56 | 11.30 | 13.20 |
| 2. | Sucrose (4%) | $T_1$ | 7.63 | 10.43 | 15.43 | 18.73 |
| 3. | Sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) | $T_2$ | 7.90 | 9.90 | 18.06 | 21.86 |
| 4. | Sucrose (2%) + Citric acid (100 ppm) | $T_3$ | 7.78 | 10.13 | 17.20 | 20.06 |
| 5. | Sucrose (2%) + NAA (100 ppm) | $T_4$ | 7.45 | 10.66 | 14.93 | 18.30 |
| 6. | Sucrose (2%) + $GA_3$ (100 ppm) | $T_5$ | 7.41 | 11.90 | 13.96 | 17.30 |
| 7. | $Al_2(SO_4)_3$ (200 ppm) + NAA (100 ppm) | $T_6$ | 7.27 | 13.50 | 12.06 | 15.30 |
| 8. | Citric acid (100 ppm) + $GA_3$ (100 ppm) | $T_7$ | 7.09 | 14.13 | 11.86 | 14.30 |
| 9. | $Al_2(SO_4)_3$ (200 ppm) + Citric acid (100 ppm) | $T_8$ | 7.36 | 12.93 | 13.73 | 16.53 |
| | CD at 5% | | 0.103* | 1.724* | 0.675* | 0.968* |

*Significant at 5% level of significance

**Table 2:** Effect of preservatives on days to complete senescence, solution uptake (mL), appearance of cut flower stem and vase life (days)

| S. No. | Treatments | Notations. | Days to complete senescence. | Solution uptake (mL). | Appearance of cut flower stem. | Vase life (days). |
|---|---|---|---|---|---|---|
| 1. | Distilled water (Control) | $T_0$ | 19.86 | 104.56 | 3.91 | 17.30 |
| 2. | Sucrose (4%) | $T_1$ | 25.63 | 163.76 | 4.49 | 22.73 |
| 3. | Sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) | $T_2$ | 29.06 | 219 | 4.62 | 27.18 |
| 4. | Sucrose (2%) + Citric acid (100 ppm) | $T_3$ | 26.96 | 173.23 | 4.57 | 24.20 |
| 5. | Sucrose (2%) + NAA (100 ppm) | $T_4$ | 24.40 | 150.86 | 4.44 | 21.54 |
| 6. | Sucrose (2%) + $GA_3$ (100 ppm) | $T_5$ | 23.60 | 136.06 | 4.34 | 21.09 |
| 7. | $Al_2(SO_4)_3$ (200 ppm) + NAA (100 ppm) | $T_6$ | 21.86 | 116.63 | 4.18 | 18.87 |
| 8. | Citric acid (100 ppm) + $GA_3$ (100 ppm) | $T_7$ | 21.40 | 111.23 | 4.03 | 18.10 |
| 9. | $Al_2(SO_4)_3$ (200 ppm) + Citric acid (100 ppm) | $T_8$ | 22.63 | 124.46 | 4.29 | 19.64 |
| | CD at 5% | | 0.908* | 2.149* | 0.135* | 0.723* |

***Significant at 5% level of significance

## Conclusion
The study demonstrated that preservative treatments significantly influenced all postharvest parameters of cut chrysanthemum stems. Among the treatments, sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) proved most effective, resulting in the largest flower head diameter, highest solution uptake, lowest fresh weight loss, delayed leaf yellowing, and longest vase life. These effects are attributed to improved water balance, reduced transpiration, and prevention of microbial blockage. The combination effectively delayed senescence and maintained freshness compared to the control. Overall, sucrose (2%) + $Al_2(SO_4)_3$ (200 ppm) was found to be the best preservative solution for extending vase life and enhancing postharvest quality of cut chrysanthemums.

## References

1. Bala M, Kumar R, Singh K. Effect of pulsing and holding solutions on keeping quality of cut flowers of rose (*Rosa* spp.). J Ornam Hort. 2008;11(1):54-57.
2. Danaee E, Mostofi Y, Moradi P. Effect of $GA_3$ and BA on postharvest quality and vase life of gerbera (*Gerbera jamesonii* cv. Good Timing) cut flowers. Hort Environ Biotechnol. 2011;52(2):140-144.
3. Divya BC, Vijayakumar M, Jawaharlal M, Sathiyamurthy VA, Srinivasan M. Effect of holding solutions on vase life of the cut rose (*R. hybrida*) cv. First Red. In: Abstracts of National Symposium on Recent Trends and Future Strategies in Ornamental Horticulture. Indian Soc Ornam Hort. 2004. p.132. University of Agricultural Sciences, Dharwad, India.
4. Gebremedhin H, Tesfaye B, Mohammed A, Tesfaye D. Influence of preservative solutions on vase life and postharvest characteristics of rose (*Rosa hybrida*) cut flowers. Int J Biotechnol Mol Biol Res. 2013;4(8):111-118.
5. Halevy AH, Mayak S. Senescence and postharvest physiology of cut flowers (Part II). Hort Rev. 1981;3:59-143.
6. Ichimura K, Kishimoto M, Norikoshi R, Kawabata Y, Yamada K. Soluble carbohydrates and variation in vase life of cut rose cultivars ‘Delilah’ and ‘Sonia’. J Hortic Sci Biotechnol. 2005;80(3):280-286.
7. Karki K, Kumar S, Srivastava R, Jauhari S. Effect of floral preservatives on vase life of cut rose flowers. Postharvest Biol Technol. 2004;15(1):33-40.
8. Koley T. Studies on postharvest handling of bird of paradise (*Strelitzia reginae*). [MSc thesis]. Nauni, India: Dr Yashwant Singh Parmar University of Horticulture and Forestry; 2013.
9. Kumar S, Kumar A, Chandra S. Effect of floral preservatives on vase life of gladiolus (*Gladiolus grandiflorus* L.). Asian J Hort. 2010;5(1):44-48.
10. Patil SR. Effect of growth substances and chemicals on growth, development and shelf life of golden rod (*Solidago canadensis* L.). [MSc thesis]. Dharwad, India: University of Agricultural Sciences; 1995.
11. Sediqy A. Studies on the postharvest life of golden rod (*Solidago canadensis* L.). [MSc thesis]. Bangalore, India: University of Agricultural Sciences; 2010.
12. Seyf M, Khalighi A, Mostofi Y, Naderi R. Study on the effect of aluminium sulphate treatment on postharvest life of the cut rose ‘Boeing’ (*Rosa hybrida* cv. Boeing). J Hort For Biotechnol. 2012;16(3):128-132.
13. Singh K, Arora JS. Effect of harvesting stages, sucrose, BAP and $GA_3$ on bud opening and vase life of tuberose. J Ornam Hort. 2000;3(2):111-113.

14. Singh K, Singh PJ, Ramesh Kumar. Effect of pulsing and vase treatments on keeping quality of cut roses. In: Abstracts of National Symposium on Recent Trends and Future Strategies in Ornamental Horticulture. Indian Soc Ornam Hort. 2004. p.132. University of Agricultural Sciences, Dharwad, India.