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Effect of Sucrose and Aluminium Sulphate on Vase Life of Cut Chrysanthemum (*Dendranthema grandiflora)* cv. Fireside Cushion

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was laid out in Completely Randomized design (CRD) with 10 treatments and each replicated thrice. The treatment T_7 'Sucrose 2% + Aluminium sulphate @ 200 ppm reported significantly better performance compared to other treatments, in terms of water uptake (6.79g/stem), flower diameter (6.00 cm), weight of spikes (42.50 g), spike length (11.50 cm), spike diameter (2.33 mm), total solution consumption (36.00 ml), vase life (15 days), gross returns (72 Rs/treatment) and net returns (27 Rs/treatment). The highest B:C ratio (1.80) was also found in the same treatment T_7 i.e., Sucrose 2 % + Aluminium sulphate @ 200 ppm and also attained maximum vase life among the treatments.

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1. INTRODUCTION

"Chrysanthemum is botanically called Dendranthema grandiflora commonly known as Gul-e- Daudi and it belongs to the family Asteraceae. Chrysanthemum is a herbaceous perennial plant growing to 50-150 cm tall with deeply lobed leaves and have fibrous root system. The chromosome number of chrysanthemum is (2n=18). It is known as Queen of flowers" [1]. "It is native to Northern hemisphere chiefly Europe and Asia. Many authorities claimed that it originated in china" [2]. It is a national flower of Japan and its name is derived from two Greek words "chrysos" and "anthos" meaning gold and flower, respectively [3]. "It is the most important commercial flower grown mainly for loose and cut flower production, which are used in floral arrangement and making garlands and bouquets. Chrysanthemum is a pot plant and is popular in white, yellow and different shades of pink" [4].

"The vase life is yardstick for the longevity of cut flower. Vase life of cut flower is mainly affected by two main factors i.e., ethylene, which accelerates the senescence of many flowers and microorganisms, especially fungi and bacteria that grow in the vase solution, block the stem and limit water uptake besides the production of chemical compound that cause vascular blockage and reducing vase life of cut flowers. The vase life differs among various species and cultivars of chrysanthemum, which is one of the most valuable characteristics determining its quality, customer satisfaction and the commercial value" [5]. "Sucrose has been found to be the most commonly used sugar in prolonging vase life of cut flower. The exogenous application of the sucrose supplies amends the cut flower with much needed substrates for respiration, and enables cut flowers harvested at the bud stage to open, which otherwise could not occur naturally and it acts as osmotically active molecule, there by leading to the promotion of subsequent water relations" [6].

"Aluminium sulphate has been recommended for maintaining the longevity of several cut flowers moreover it acts as antimicrobial agent in vase solutions. In chrysanthemum, aluminium sulphate treatment enhanced the vase life and improved the post-harvest visual quality of cut stems by retaining freshness in leaves. The higher concentrations of aluminium sulphate decreased chlorophyll content, fresh weight of stem and vase life in rose cultivar cherry brandy" [7]. The aim of the experiment is to study the effect of sucrose and aluminium sulphate on vase life of cut chrysanthemum and to estimate the economics of various treatments.

2. MATERIALS AND METHODS

The experiment was conducted during 2022, in Horticultural Post Harvest laboratory, Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.), which is located at 25°39' 42''N latitude, 81°67'56" E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the Yamuna River by the side of Prayagraj - Rewa road about 12 km from the city. The preservatives used during vase life are sucrose and aluminium sulphate. The experiment was laid out in Completely Randomized Design with ten treatments i.e., T_1-Control (Distilled water), T_2-(Sucrose 1%), T_3- (Sucrose 1% + Aluminium sulphate @100 ppm), T_4-(Sucrose 1% + Aluminium sulphate @ 200 ppm), T_5- (Sucrose 2%), T_6-(Sucrose 2% + Aluminium sulphate @ 100 ppm), T_7-(Sucrose 2% + Aluminium sulphate @ 200 ppm), T_8-(Sucrose 3%), T_9-(Sucrose 3% + Aluminium sulphate @ 100 ppm),T_{10}-(Sucrose 3% + Aluminium sulphate @ 200 ppm), each replicated thrice.

3. RESULTS AND DISCUSSION

1. Water uptake (g stem^{-1}) of cut chrysanthemum at 15 days during vase life

The maximum water uptake (g stem^{-1}) was observed with T_7-sucrose 2% + Aluminium sulphate 200 ppm(6.79 g stem^{-1}) whereas minimum was reported in T_1-control(3.30g stem^{-1}).

"Sucrose improves water absorption from the vase solution which maintain turgidity and freshness, whereas aluminum sulphate which act as a germicide there by encouraging water transport through cut stem by inhibiting the vascular blockage and delaying the increase in membrane permeability. That is why shelf life was found highest in the treatment T_7" Kaur et al. [8].

2. Water loss (g stem^{-1}) of cut chrysanthemum at 15 days during vase life

The maximum water loss (g stem^{-1}) was observed with T_7-sucrose 2% + Aluminium sulphate 200 ppm (3.80g stem^{-1}) whereas minimum was reported in T_1-control (6.35 g stem^{-1}).

"It is cleared from above results that different concentrations of sucrose and aluminium sulphate effective in water uptake and enhancing vase life and decreasing water loss when these solutions were used singly. But in combination their solutions were found more effective in maintaining an increased pattern of water uptake and decreasing water loss by transpiration" Kaur et al. [8].

3. Water loss/Water uptake ratio(g stem^{-1}) of cut Chrysanthemum at 15 days during vase life

The minimum Water loss/Water uptake ratio (g stem^{-1}) was observed with T_7-sucrose 2% + Aluminium sulphate 200 ppm (0.56 g stem^{-1}) whereas maximum was reported in T_1-control (1.93 g stem^{-1}).

This result is in agreement with the findings of [9] in cut hippeastrum flower. Solutions of sucrose and aluminium sulphate alone and in combination were found effective in maintaining a decrease in the ratio of transpiration loss and water uptake.

4. Flower Diameter (cm) of cut Chrysanthemum at 15 days during vase life

The maximum Flower Diameter (cm) was observed with T_7-sucrose 2% + Aluminium sulphate 200ppm (6.00 g stem^{-1}) whereas minimum was reported in T_1-control (4.40 g stem^{-1}).

The findings are closely confirmed with the findings of Farahat et al. [10] and Butt [11]. The increase in flower diameter might be due to the uptake more water by the cut stem which helps in maintain the physiological process and turgidity of flowers for long time as resulted by using of $AgNO_3$ and Al_2SO_4 in different concentration.

5. Weight of spikes (g) of cut Chrysanthemum at 15 days during vase life

The maximum Weight of spikes (g) was observed with T_7-sucrose 2% + Aluminium sulphate 200 ppm (42.50 g) whereas minimum was reported in T_1-control (30.00 g).

Aluminium sulphate act as an antimicrobial agent in vase solution [12] by inhibiting of bacterial vessel blockage. It is the agreement with result of Eustoma flowers that Aluminium sulphate had increased fresh weight of spikes [13].

6. Spike length (cm) of cut Chrysanthemum at 15 days during vase life

he maximum Spike length (cm) was observed with T_7-sucrose 2% + Aluminium sulphate 200 ppm (11.50 cm) whereas minimum was reported in T_1-control (6.00 cm).

7. Spike diameter (mm) of cut Chrysanthemum at 15 days during vase life

The maximum Spike diameter (mm) was observed with T_7-sucrose 2% + Aluminium sulphate 200 ppm (2.33 mm) whereas minimum was reported in T_1-control (1.17 mm).

8. Total solution consumption (ml) of cut chrysanthemum at 15 days during vase life

The maximum Total solution consumption (ml) was observed with T_7-sucrose 2% + Aluminium sulphate 200 ppm (36.00 ml) whereas minimum was reported in T_1-control (30.40 ml).

"This might be due to antimicrobial property of Aluminium sulphate which acidified the vase solution and reduced microbial growth" [14]. "Previous studies have also reported that antimicrobial compound like Aluminium control microbial and ensure water uptake and delay senescence of cut flower" [13].

9. Vase life (days) of cut chrysanthemum at 15 days during vase life

The maximum vase life was observed with T_7-sucrose 2% + aluminium sulphate 200 ppm (15.00 days) whereas minimum was reported in T_1-control (8.00 days).

This is an accordance with the findings of study are further supported by Ichimura [15] in cut roses. Singh and Sharma [16] in gladiolus spike, Jowkar et al. [17] reported that "aluminum

Table 1. Effect of sucrose and Aluminium sulphate on cut Chrysanthemum at 15 days during vase life

Notation	Treatments	Water uptake (g/stem)	Water loss (g/stem)	Water loss/Water uptakeratio (g/stem)	Flower Diameter (cm)	Weight of spikes (g)	Spike length (cm)	Spike diameter (mm)	Total solution consumption (ml)	Vase life (Days)
T_1	Control (Distilled water)	3.30	6.35	1.93	4.40	30.00	6.00	1.17	30.40	8.00
T_2	Sucrose 1%	3.72	6.30	1.69	5.23	34.50	6.67	1.33	31.60	10.00
T_3	Sucrose 1% + Aluminium sulphate @100 ppm	4.56	5.41	1.20	5.50	36.50	7.83	1.50	32.00	11.00
T_4	Sucrose 1% + Aluminium sulphate @ 200 ppm	4.95	5.15	1.05	5.00	37.00	8.70	1.83	32.50	12.00
T_5	Sucrose 2%	4.22	6.00	1.42	5.20	36.00	8.67	1.67	33.00	12.00
T_6	Sucrose 2% + Aluminium sulphate @ 100 ppm	6.52	4.86	0.74	5.80	40.00	11.00	2.17	35.67	14.00
T_7	Sucrose 2% + Aluminium sulphate @ 200 ppm	6.79	3.80	0.56	6.00	42.50	11.50	2.33	36.00	15.00
T_8	Sucrose 3%	5.18	5.40	1.05	5.40	38.00	9.50	1.67	33.70	13.00
T_9	Sucrose 3% + Aluminium sulphate @ 100 ppm	5.78	4.60	0.79	5.30	39.00	8.33	2.17	35.00	14.00
T_{10}	Sucrose 3% + Aluminium sulphate @ 200 ppm	5.48	5.00	0.91	5.50	37.50	8.00	1.83	34.50	13.00
	F Test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	SE.d	**0.30**	**0.36**	**0.10**	**0.32**	**0.79**	**0.97**	**0.18**	**0.36**	**0.48**
	CD (5%)	**0.63**	**0.75**	**0.20**	**0.66**	**1.66**	**2.05**	**0.38**	**0.75**	**1.01**

sulfate treatment significantly increased vase life and improved postharvest visual quality by retaining freshness even at the end of vase life". Singh et al. [17] "in Lilium flowers treated with sucrose 2% in combination with Al_2SO_4 (100 or 200 ppm) delayed petal senescence and extended the vase life (12.8 days)".

4. CONCLUSION

From the present investigation, it is concluded that treatment T_7 performed best in terms of water uptake, flower diameter, weight of spikes, spike length, spike diameter, total solution consumption, vase life, gross returns, and net returns. The highest B:C ratio was also found in the same treatment T_7 i.e., sucrose 2 % + $Al_2(SO_4)_3$ 200 ppm and also attained maximum vase life among other treatments.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sajid M, Rab A, Khan LA, Jan I, Amin NU, Mateen A, Usman H, Alam M, Shah TS. The pre harvest foliar application influenced the flower quality and vase life of chrysanthemum cultivars. Horticulture International Journal. 2018;2(4):145-52.
2. Carter CD. Introduction to floriculture, New York Academic Press; 1980.
3. Rahman A, Ayub G, Shahab M, Jamal A, Rashid A, Aman Z, Jawad A, Rahman KU. Rooting and growth of chrysanthemum cultivars in response to different levels of calcium. International Journal of Biosciences. 2016;8(2):124-29.
4. Gokongwei J. Growing Chrysanthemum Pinoy Bisnes. 2009;1-2.
5. Kumar A. Effect of post-harvest preservatives on vase life of chrysanthemum (*Dendranthema grandiflora*) Department of Horticulture, Floriculture and Landscape Architecture, College of Horticulture. 2016;65.
6. Khalid ME. Evaluation of several holding solutions for prolonging vase life and quality of cut sweet pea flowers (*Lathyrus odaratus* L.). Saudi Journal of Biological Sciences. 2012;19(2):195-202.
7. Jowkar MM, Kafi M, Khalighi M, Hasanzadeh N. Evaluation of aluminum sulphate as vase solution biocide on postharvest microbial and physilogical properties of cherry Brandy rose. Ann of Biol Res. 2012;3:1132-1144.
8. Kaur A, Ashraf R, Bhat AH, Slathia D, Devi NN. Effect of sucrose and aluminium sulphate on vase life of cut chrysanthemum (*Dendranthema grandiflora*.) cv. Yellow Star. Frontiers in crop Improvement; 2021;9(11):3828-3833.
9. Jamil MK, Rahman MM, Hossain MM, Hossain MT, Karim AJM. Effect of potting media on growth, flowering and bulb production of Hippeastrum. International Journal of Applied Sciences and Biotechnology. 2016;4(3):259-271.
10. Farahat MM, Aziz AE, NGA, Hashish KI, Gaber A. Postharvest physiology and vase life of rose (Rosa hybrid) cut flowers as flounced by using sucrose some chemical treatments. Middle East journal Agriculture Research. 2014;3(4):815-819.
11. Butt HJ, Cappella B, Kappl M. Force measurements with the atomic force microscope: Technique, interpretation and applications. Surface science reports. 2005 Oct 1;59(1-6):1-52.
12. Halvey AH, Mayak S. Sensescence and post harvest physiology of cut flowers, Horticulture Research. 1981;3:59-143.
13. Liao LJ, Lin YH, Huangand KL, Chen WS. Vase life of *Eustoma grandiflorum* as affected by aluminium sulphate. Botanical Bul. of Academia Sinica. 2001;42:35-38.
14. Hassanpour MA, Hatamzadeh A, Nakhai F. Study on the effect of temperature and various chemical treatments to increase vase life of cut rose flower Baccara. Agricultural Science Research Journal of Guilan Agriculture Faculty. 2014;1(4):121-129.
15. Ichimura K, Taguchi M, Norikoshi R. Extension of the vase life in cut roses by treatment with glucose, isothiazolinonic germicide, citric acid and aluminium sulphate solution. Japan Agricultural Research Quarterly. 2006;40(3):263-269.
16. Singh PV, Sharma M. The post harvest life of pulsed gladiolus spike. Acta Horticulturae. 2008;624:389-398.

17. Singh AK, Asmita, Sisodia A, Pal AK, Barman K. Effect of sucrose and aluminium sulphate on postharvest life of lilium cv. Monarch. Journal of Hill Agriculture. 2016;7(2):204-208.

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