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DETERMINING THE BEST CONDITIONING METHOD FOR MAMMOTHRED DAISY*(CHRYSANTHEMUM MORIFOLIUM)*

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ABSTRACT

Background: *Conditioning is a post-harvest step necessary in the maintenance of cut flowers. It not only helps to increase the shelf life of the cut flowers but also helps in increasing the time for which the flowers can be stored. The process of conditioning also helps in providing certain key nutrients to the cut flowers which are required for their sustainability. It also protects the flowers from getting contaminated by several disease-causing microbes. Most people usually do not pay enough attention to this process which often their beautiful and precious flowers to decay earlier than usual. Proper conditioning method can provide a solution to all these problems by providing optimum conditions for the flower and protects the cut flowers against early aging.* **Objective:** *The study was carried out with the objectives (1) to determine the best conditioning method for cut Mammoth Red Daisy flowers through scientific experiments and (2) to get views on the flowering behaviour under different conditions based on visual parameters.* **Methodology:** *This study's methodology combined experimental and observational research methods. The experiment was performed in the on-premises housekeeping lab at IHM Pusa, under the supervision of the research guide and lab attendant. Through the use of a Google Form-created questionnaire, the observational study was conducted. This questionnaire was filled out by subject experts in the domain based on the visual parameters from the experiment conducted.* **Results:** *A little contradictory from the expected, SET 'A' was voted the best in visual parameters however the best conditioning method for the Mammoth Red Daisy was provided by SET 'C' from the experiment conducted which contained a solution of bleach, citric acid and sucrose, prepared in distilled water.* **Conclusion:** *According to the findings of the experiment and the observations made, it was found that the solution made in distilled water with bleach, citric acid, and sucrose proved to be the most effective in conditioning the Mammoth Daisy. Thus, it can be inferred that applying the aforementioned solution can significantly delay the early aging of cut flowers, lengthen their life, and aid in achieving sustainability.*

Key Words: *Conditioning, Cut-flowers, Floriculture, Vase-life.*

INTRODUCTION

In previous times, the flower had a short vase life when science and technology were not as advanced. In most countries, the flower, a perishable commodity was extensively used as a local crop. The cut flowers were supposed to last only a day or two once cut off from their life-sustaining source, the roots. But as soon as research started coming up on conditioning and maintenance of cut flowers post harvest, the scenario changed. Now the concerned florists were aware that nutrition and care are required to sustain the cut flowers, these need to be protected from infection-causing microbes. A majority of cut flowers can now be expected to last for several days if not weeks provided, they are given proper care and treatment. As flowers were now able to survive the wrath of time, soon they were getting transported around the globe. Although the Netherlands has maintained rank 1 as the exporter of flowers

for over 200 years, the countries in the tropical and subtropical regions are gaining equal importance.

According to data gathered in 2019, cut flowers rank as the 346th most traded good in the world. In India, the floriculture industry is expanding quickly. According to the National Horticulture Database, which was published by the National Horticulture Board during 2019-20, the expected area under floriculture in India at this time is 305 thousand (in hectares), and the production of flowers is approximately 2301 thousand (in tonnes) of loose flowers and 762 thousand (in tonnes) of cut flowers. India has managed to export 15 thousand (in tonnes) of flowers to the world of an estimated cost of 576 crores/ 77.84 USD million in 2020-2021. The maximum export has been done to USA.Roses, Carnations, Chrysanthemum, Daisies, Gerbera, Gladiolus, Gypsophila, Orchids, and Lilies (Oriental) are considered as the major floriculture crop.

Mammoth Red Daisy (*Chrysanthemum morifolium)*which is also known asred daisy mumsis a hybrid perennial flower first released in the American market in 2007. Later these got circulated all over the globe very quickly because of their adaptability. These hardy plants are tough, dense, and, easy to take care of, however full sun exposure is required for their optimum growth. Because of their attractive yellow centre and bright maroon petals, they are able to attract a lot of butterflies. Mammoth daisies are low-maintenance and do not require regular pruning.

In a study carried out by Zelter and Mayak (1995), it was found that using sugar as a nutritive for flowers post harvesting, not only extends their longevity but also supports the growth of flowering. In another study done on a hybrid *Limonium* flower by Doi and Reid (1995) it was found that sucrose increased the life of cut flowers significantly. Another study by Van Doorn (2001) found that sugars decrease sensitivity to ethylene and postpone the aging process in flowers that are sensitive to ethylene, with orchids and some types of roses serving as the best examples.

In flowers having tender foliage such as *Daisy, rose* and *Chrysanthemum,* sugar pulse should be maintained at low concentrations because of foliage damage caused by excessive sugar in the solution. Halevy and Mayak, (1974) concluded this in their experiment of examining sugar pulse in roses.

Cut flowers' shelf lives can be extended while maintaining quality with the help of floral preservatives. Cut Stock flowers' vase life was maintained by preservative solutions containing carbohydrate sources, according to Rudnicki et al., (1986) and Song et al., (1996). In experiments conducted by Celikel et al., (2002), floral preservatives increased bud opening and floret longevity in post-harvest flowers like daisies and carnations.

According to studies by Staden and Molenaar (1975) and Staby and Erwin (1978), variations in the tap water's composition used in the vase may affect the cut flowers' quality and shelf life. The composition of tap or regular water also influences how useful the chemicals are. Therefore, Halevy (1976) recommended using de-ionized water for pre-harvest conditioning of cut flowers based on his study of Treatment to improve the water balance of cut flowers. Later, on the same note, Reid and Kofranek (1980) recommended using distilled water as a measure of common control.

In his research into the physiology of cut flowers after harvest, Aarts (1957) discovered that the water balance-the interplay between a flower's ability to retain water, water transport, and transpiration-was the primary factor affecting vase life. He came to the conclusion that the effect of low pH was due to a decrease in the microbial population of vase water, delaying microbial stem blockages.

Plants are found to absorb acidic water [pH 3.5- 4.5] more rapidly than non-acidic water through their cut surfaces, suggests the study done by Weinstein and Laurencot (1958) on the water acidity relations of plants.

Van Doorn and Perik (1990) after experimenting on the favourable pH of water for cut flower conditioning found that the bacterial growth in the stems of the plant is inhibited as a result of effective buffering of acid around pH 3.

Aarts (1957a) in a study reported that the inclusion of acid in the water will prevent bacterial growth but the addition of acid to a solution that was already applied to prevent bacterial growth, further increases the vase life of *Roses, Dahlia (Chrysanthemums), and Convallaria.*

A biocide kills the accumulation and growth of bacteria and fungi like microbes so they do not cause hindrance in transpiration by blocking the water vessels, as suggested by Van Doorn *et al.*(1991) in their study on the importance of biocide as one of the constitutes for vase water. Bleach is one of the common disinfectants used as a biocide.

All the cut flowers are short-lived and perishable commodities. They require special and right treatment during harvesting, handling, transport, and storage to prevent loss, which could be qualitative and quantitative. Cut flowers undergo stresses during the post-harvest duration in terms of dehydration, decay, and depression due to a lack of proper conditioning, treatment, and ambient storage.

This research work primarily focuses on the conditioning step of the cut flowers which is done after their harvesting, grading, and sorting. Conditioning of a cut flower is a process where plants material or cut flowers are loosely kept in a large container of water in an upright position to restore the turgidity or lack of water and nutrients of the cut flower under stress brought during their storage and transportation. This may be achieved by treating the cut- flowers with various natural or artificial substances mixed in water. Proper conditioning can help in increasing the vase life of the cut flowers thereby maintaining sustain ability and reducing monetary expenses.

The study was carried out with the objectives:

- To determine the best conditioning method for cut Mammoth Red Daisy flowers through scientific experiments and
- To get views on the flowering behavior under different conditions based on visual parameter.

METHODOLOGY

set of questions based on the conditional parameters of the conducted experiment which would help in determining the expected result in a better way. The experiment concerned with the research project was carried out in the housekeeping department lab present in the Institute of Hotel Management (IHM), Pusa, New Delhi. The survey was done using a google form and was filled up by faculty, support staff, florists, and some students of IHM Pusa, New Delhi who were well aware of the experiment and had some knowledge related to this research work.

Research Design: Experimental method was used to determine the primary data. A survey method was used to obtain the secondary data based on observations.

Locale: The experiment was conducted in the housekeeping department lab of Institute of Hotel Management, Pusa, New Delhi. The flower samples were collected from the flower mandi of Ghazipur Village, Delhi- NCR.

Sampling Design: A total of 20 long stem bunch of Indian Daisies were taken, 5 for each set A, B, C & D. For the survey 30 people were selected to fill up the google form. The respondents included both males & females mostly from an age group of 18-25, designated as students or florists.

Tools and Technique: *For Experiment*- A total of 20 long stems of bunched Mammoth Red Daisies were taken, and distributed into 4 sets- set A, B, C, and D. Each set containing 5 bunch of flowers was put for an experiment in different vases for over a duration of 10 days. This experiment is preferably conducted in the winter season (Indian Winter – 10°C to 15°C) as cold temperatures are favourable for flowers.

SET A- Flowers held in a vase filled with "tap water". The water is changed once every 2 days.

SET B- Flowers held in a vase filled with "distilled water". The water is changed once every 2 days.

SET C- Flowers held in a vase filled with "[distilled water + sucrose (5%) + bleach (100 ppm) + citric acid (200 ppm)]". Water changes once every 3 days.

SET D- Flowers held in a vase filled with "[distilled water +

Floralife (an artificial flower food by Oasis ®)]". Water is changed once every 3 days

Tap water is a source of various infections causing microbes and pathogens. It also contains numerous good and bad nutrients and minerals in varying amounts. Cut flowers when placed in tap water have a higher chance of decaying and rotting.

Distilled water or de-mineralized water is free from the presence of microorganisms and minerals or any other type of foreign substances. Flowers when placed in distilled water have a lower chance of decaying but also there is no source of nutrition for the flowers.

Sugar or sucrose serves as food for the flowers and promotes nourishment and longevity. When used in higher percentages (5%- 40%), it is proved to be effective on the bud opening of the plant.

Bleach is a common disinfectant that prevents or inhibits the growth of microbes when used in the right concentrations, which is 100 ppm.

Citric acid is a common acid that helps in reducing the pH of water. Water with pH [3.5-4.5] increases the water uptake by the cut plants and is most suitable for plants to maintain hydration. Citric acid also helps in eliminating bacterial growth.

A mixture of Sugar, Bleach, and Citric acid is a basic combination that cut flowers seek for their long vase life and sustainability. Sugar provides nourishment, bleach acts as a disinfectant and acidity helps in water uptake.

Commercial preservatives like Floralife by oasis® are proven to increase the vase life of cut flowers. They contain the required concentrations of active ingredients which are helpful in cut flower sustainability.

For the Survey-A google form questionnaire was created and circulated to the concerned experts of the domain for their views and insights based on the visual/observational parameters. This google form survey questionnaire included pictures from the experiment conducted from day 1 to day 7 and was aimed to get responses from the respondents based on visual parameters like wilting of the flower head, colour, flower-bud opening, dullness, etc. Each question had 4 options to select from and these were Set A, Set B, Set C, and Set D. the respondents were required to select the most appropriate option based on their observations made from the flower pictures attached from the experiment conducted. After the survey was over, the responses were compiled and the results were produced combining them all into a single pie-chart graph, showing the average percentage value obtained for each option.

Data Analysis and Statistical Analysis: The primary data collected from the experiment was noted and assessed daily to obtain a quantitative and analytical statement. The data collected through Google Forms in the form of percentages were noted separately. Both these data were assessed quantitatively and qualitatively in the most justified manner to obtain a conclusion.

RESULTS AND DISCUSSION

Table 1: This table contains the responses made on the google form for the Mammoth Red Daisy flower

Parameters (based on visual appearance)	SET A	SET B	SET C	SET D
Least wilting of the flower head	80%	0%	13.3%	6.7%
Least change in the colour of the flower	70%	3.3%	23.3%	3.3%
Delay in rotting up/ blackening of the stems	70%	3.3%	16.7%	10%
Delay in opening of the flower/ bud opening	73.3%	0%	10%	16.7%
Least drying up/ dehydration in the flower	76.7%	0%	16.7%	6.7%
out of the flower head	76.7%	3.3%	13.3%	6.7%
Least falling of the anthers/ pollen grains	73.3%	0%	16.7%	10%
Average Percentage	74%	1%	15.71%	8.59%

From this table, it can be seen that the Indian Daisy performed the best in SET 'A.' SET A was filled with tap water. With an average vote percentage of **74%** set A has been voted to be the best conditioner for the Mammoth Red Daisy flower.

Table 2: This table contains the researcher's observations made on the Mammoth Red Daisy flower during the experiment conducted

Additional parameters (based on researcher's observations)	SET A	SET B	SET C	SET D
Least change in odour/ smell of the flower			✓	
Least change in firmness of the flower			✓	
Least slimminess/ stickiness in the vase water			✓	
Least change in color/ rigidity of the stems			✓	
Least slimminess/ blackening at the cut of stem			✓	
Least fungus built up over the flower head	✓			
Least fungus built up at the bottom of stem			✓	
Least change in colour/ clarity of vase water			✓	

According to the observations made during the experiment, the Mammoth Red Daisy flower seemed to perform better in set C about all the above-mentioned parameters except *fungus built-up over the flower head.* As set C contains citric acid and bleach which helps fight bacteria and hence bad odour was not felt in set C. Sugar content in set C helped maintained the flower its nutrition, citric acid helped in water uptake and thus hydration of the flower. Therefore, the flowers showed better firmness in set C also the stems were found to be more rigid about the same cause. Fungus built-up at the base was comparatively low and blackening of the stems was not observed in set C due to the presence of bleach. The fungus built up over the head could relate to the presence of excess sugar. comparatively low and blackening of the stems was not observed in set C due to the presence of bleach. The fungus built up over the head could relate to the presence of excess sugar.

According to a 1995 study by Zelter and Mayak on the value of sugar as a nutritive for post-harvest flowers, sugar strengthens flower growth and lengthens the flowers' shelf life. According to a study conducted by Van Doorn in 2001, sugars may help delay the early aging of ethylene-sensitive flowers by reducing their sensitivity to ethylene.

According to studies by Staden and Molenaar in 1975 and Staby and Erwin in 1978, variations in the composition of tap water used as vase water can affect how well cut flowers maintain their quality. The efficacy of chemicals used is also impacted by the composition of tap water. De-ionized water was therefore recommended by Halevy and Mayak in 1974 for conditioning cut flowers after harvest. On the same note, Reid and Kofranek suggested using distilled water as a measure of common control later on.

Aarts (1957) in his study of the post-harvest physiology of cut flowers concluded that the effect of low pH was attributed to a reduction of the microbial population of vase water. On the same note studies conducted by Weinstein and Laurencot (1958) suggested that flower stems are found to absorb acidic water (pH 3.5-4.5) more rapidly than non-acidic water through their cut surfaces.

Amplified build-up of bacteria and fungi in the vase solution can hasten the deterioration by blocking the eater's vessels, therefore several biocides are used to prevent this as suggested by Reid and Kofranek in 1980, Halevyand Mayak in 1981, in their study of biocides and their importance as an inhibitor of bacteria and fungi. Following the same line, on the importance of biocide such as bleach, it was suggested by Van Doorn *et al.* (1989) that a biocide kills the accumulation and growth of

bacteria and fungi like microbes, thus they do not cause hindrance in transpiration by blocking the water vessels.

CONCLUSION

Set **'A'** was voted the best conditioning method for Mammoth Red Daisy by the google form evaluators and under the observations made by the researcher during the conduction of this experiment, Set C was found to provide apt conditioning for the flower. For the Mammoth Red Daisies, we get little contradicting results than it was expected, these were expected to perform the best in Set 'C' which contained a solution of sugar, citric acid, and bleach in distilled water, but the results obtained were unfavourable.

Set 'A' was voted the best conditioning method for Mammoth Red Daisies by the Google form evaluators with a vote percentage of 78%. Whereas under the observations made by the researcher, set 'C' was found to be the apt conditioning method for this flower. Ideally, the flower should have performed better in set C owing to the presence of all the nutrients, preservatives, and catalysts. We found that the Mammoth Red Daisy performed better in tap water (set A) in visual aspects and in physical aspects, it was found to perform better in set C. A possible explanation for the ambiguity could be the Mammoth Red Daisy are robust and somewhat wildly grown flowers, and since a product of hybridization, they are dormant to features of normal tap water and the presence of a little impurity and microbes do not possess a major threat to them.

However, set 'C' should be considered as an ideal conditioning method for Mammoth Red Daisy, the reason being that tap water could be unpredictable and may contain impurities and microbes in different concentrations at different places. Whereas, distilled water has a ubiquitous quality and is the same throughout the world. The result percentages of both visual and physical parameters were deeply compared to obtain a conclusive statement.

The presence of sugar in the water provided nutrition and life to the flowers in the form of sucrose and starch. Bleach helped in the eradication of bacteria, and other harmful microorganisms. Citric acid helped in balancing the pH of the water and in the hydration of flowers by allowing more water uptake.

It can therefore finally be concluded that a mixture of sucrose, citric acid, and bleach in distilled water in controlled and predetermined concentrations is beneficial for the conditioning of cut Mammoth Red Daisy and it is recommended to use this solution for increasing the shelf life of the flower. The first thing one must do after bringing the cut flower from the market is to dip the cut stem part of the flower in the experimented mixture after giving a fresh slant cut at the bottom of the stem(this is done to increase the surface area at the stem for the absorption of water). The items required to make the solution are all easily available in the market, and the cost-bearing is minimal. This research would help a lot of people who are related to the flower business, professional florists, or a homemaker by reducing flower decay significantly, and that in turn would help attain sustainability

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