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EFFECT OF CHEMICAL PRESERVATIVES ON ENHANCING VASE-LIFE OF GERBERA FLOWERS

Gerbera (*Gerbera jamesonii*) popularly known as Transvaal daisy, is one of the ten most popular commercial cut flowers in the world and according to the global trends in floriculture, it occupies the fourth place among cut flowers (Choudhary and Prasad, 2000). It is in considerable demand in both domestic and export markets. The blooms are attractive, suitable for any type of floral arrangements and are available in different shades and hues. Besides floral arrangements, gerbera is widely used in bouquets and in dry flower crafts. The cut flowers have a long vase-life, which fetches premium market prices. The flowers are hardy and stand the rigors of transportation admirably.

Gerbera comes up well under a wide range of climatic conditions and topographies. The Andaman and Nicobar group of islands, situated between 6° and 14° N latitude and 92° and 94° E longitude in the Bay of Bengal have a warm and humid tropical climate. The temperature ranges from 22 to 32°C. The mean relative humidity is 82 per cent and the average rainfall varies from 300 to 380 cm with a short dry spell of four months (January to April). Due to changes in social and cultural life style of people, cut flowers have found an important place in various social functions and daily activities.

Keeping quality is an important parameter for evaluation of cut flower quality, for both domestic and export markets. Addition of chemical preservatives to the holding solution is recommended to prolong the vase-life of cut flowers. All holding solutions must essentially contain two components viz., sugar and germicides. The sugars provide a respiratory substrate, while the germicides control harmful bacteria and prevent plugging of the conducting tissues. Therefore, the techniques of prolonging the vase-life of flowers will be a great asset to the growers and users. This experiment was conducted during 2000 and 2001 to prolong vase-life of cut gerbera blooms through use of floral preservatives under Bay island conditions where there is a shortage of cut flowers at affordable prices.

Gerbera flowers were harvested when all the florets opened fully and were perpendicular to the stalk. The flowers were harvested early in the morning and were immediately placed in water for pre-cooling. The stalks were cut again prior to placing them in holding solution to study the keeping quality. Graduated glass test tubes were used to hold the floral preservatives and a uniform volume of 50 ml of holding solution was prepared freshly and dispensed into the tubes. The tubes were kept at room temperature (28°C), RH of 75% and with adequate aeration. The flowers were placed away from direct sunlight.

Table 1. Treatment details of holding solutions employed in the study

Sl. no.	Treatment	Details
1	T1	10 ppm $AgNO_3$
2	T2	20 ppm $AgNO_3$
3	T3	30 ppm $AgNO_3$
4	T4	2% sucrose
5	T5	4% sucrose
6	T6	6% sucrose
7	T7	10 ppm $AgNO_3$ + 2% sucrose
8	T8	10 ppm $AgNO_3$ + 4% sucrose
9	T9	10 ppm $AgNO_3$ + 6% sucrose
10	T10	20 ppm $AgNO_3$ + 2% sucrose
11	T11	20 ppm $AgNO_3$ + 4% sucrose
12	T12	20 ppm $AgNO_3$ + 6% sucrose
13	T13	30 ppm $AgNO_3$ + 2% sucrose
14	T14	30 ppm $AgNO_3$ + 4% sucrose
15	T15	30 ppm $AgNO_3$ + 6% sucrose
16	T16	1% ascorbic acid
17	T17	2% ascorbic acid
18	T18	3% ascorbic acid
19	T19	250 ppm potassium metabisulphite
20	T20	500 ppm potassium metabisulphite
21	T21	750 ppm potassium metabisulphite
22	T22	100 ppm 8-hydroxyquinoline citrate
23	T23	200 ppm 8-hydroxyquinoline citrate
24	T24	300 ppm 8-hydroxyquinoline citrate
25	T25	Control (distilled water)

Twenty-five treatments of holding solutions were used and the experiment was conducted in completely randomized design with three replications (Table 1). Observations recorded were days taken for drooping of flower heads, discolouration of petals, first petal fall and the total

Table 2. Effect of floral preservatives on the vase life of cut gerbera blooms

Treat. notations	Treatments	Days taken for drooping of flower heads	Days taken for discolouration of petals	Days taken for petal fall	Solution absorbed by the flower (ml)
T1	10 ppm $AgNO_3$	8.47	9.68	10.80	16.22
T2	20 ppm $AgNO_3$	7.35	10.00	11.94	19.77
T3	30 ppm $AgNO_3$	7.15	8.93	10.58	18.97
T4	2% sucrose	8.73	9.67	10.71	16.28
T5	4% sucrose	7.80	9.29	11.62	13.82
T6	6% sucrose	9.70	11.48	12.99	10.98
T7	10 ppm $AgNO_3$ + 2% sucrose	10.71	12.10	13.64	17.10
T8	10 ppm $AgNO_3$ + 4% sucrose	11.17	12.85	14.35	17.97
T9	10 ppm $AgNO_3$ + 6% sucrose	11.33	13.37	15.61	22.34
T10	20 ppm $AgNO_3$ + 2% sucrose	12.14	13.07	14.86	24.09
T11	20 ppm $AgNO_3$ + 4% sucrose	16.12	15.17	16.60	22.98
T12	20 ppm $AgNO_3$ + 6% sucrose	14.80	16.77	17.78	24.63
T13	30 ppm $AgNO_3$ + 2% sucrose	7.37	9.77	11.30	21.22
T14	30 ppm $AgNO_3$ + 4% sucrose	8.26	10.65	12.42	22.80
T15	30 ppm $AgNO_3$ + 6% sucrose	7.09	8.79	11.33	20.58
T16	1% ascorbic acid	10.50	11.74	14.07	14.67
T17	2% ascorbic acid	10.21	12.07	13.57	16.89
T18	3% ascorbic acid	12.74	14.20	15.93	17.89
T19	250 ppm potassium metabisulphite	8.28	10.53	12.84	8.76
T20	500 ppm potassium metabisulphite	8.43	10.93	13.26	10.51
T21	750 ppm potassium metabisulphite	9.42	12.82	15.47	11.05
T22	100 ppm 8-hydroxyquinoline citrate	11.27	12.84	15.15	11.39
T23	200 ppm 8-hydroxyquinoline citrate	12.70	14.43	17.21	10.44
T24	300 ppm 8-hydroxyquinoline citrate	9.84	13.13	16.14	9.30
T25	Control	6.93	8.00	10.01	7.55
CD (0.05)		1.20	3.10	1.55	2.03

quantity of solution absorbed by the flower. The data were pooled and analyzed statistically as suggested by Panse and Sukhatme (1967).

The maximum number of days taken for flower head drooping was recorded in the treatment 20 ppm $AgNO_3$ + 4% sucrose (16.12), followed by 20 ppm $AgNO_3$ + 6% sucrose (14.80). Control registered the minimum number of days (6.93) for flower head drooping (Table 2). The maximum number of days for discolouration of petals was in the treatment 20 ppm $AgNO_3$ + 6% sucrose (16.77) and was on par with 20 ppm $AgNO_3$ + 4% sucrose (15.17). The minimum number of days for discolouration of petals was taken by the control (8.00). The treatment 20 ppm $AgNO_3$ + 6 % sucrose recorded the maximum number of days for petal fall (17.78) and was on par with 20 ppm $AgNO_3$ + 4% sucrose (16.60). The control registered the minimum number of days (10.01) for petal fall. The useful vase-life of the cut blooms terminated when the flower heads started drooping, which was followed by discolouration and fall of petals, which represented the end of effective vase-life of cut flowers. The improvement in vase-life of cut flowers in 20 ppm silver nitrate ($AgNO_3$) solution might be due to the fact that it is a very effective biocide, which completely inhibits the microbial growth. It is in conformity with the findings of Ketsa *et al.* (1995) who opined that $AgNO_3$ prevented microbial occlusion of xylem vessels in *Dendrobium*, thereby enhancing water uptake and increasing longevity of flowers. Awad *et al.* (1986) also attributed the beneficial effect of $AgNO_3$ in the vase-water to the produc-

tion of Ag^+ ions, which might inhibit the rise of ethylene precursor, thereby enhancing the longevity of cut flowers. Sucrose is widely used in floral preservatives, which acts as a food source or respiratory substrate and delays the degradation of proteins and improves the water balance of cut flowers. Steinitz (1982) opined that addition of sucrose to the solution increased the mechanical rigidity of the stem by inducing cell wall thickening and lignification of vascular tissues. Sucrose antagonizes the effect of ABA, which promotes senescence (Halevy and Mayak, 1979). Sugars alone, however, tends to promote microbial growth. Hence, the combination of sugars and biocides might have extended the vase-life of cut flowers. $AgNO_3$ or sucrose alone was less effective as compared to their combinations with regard to vase-life. Similar results were also reported by Steinitz (1982) and Awad *et al*. (1986) in gerbera and zinnia, respectively.

Petal fall in cut blooms represented the termination of the effective vase-life which was prolonged by using 20 ppm $AgNO_3$ + 6% sucrose in the holding solution or 20 ppm $AgNO_3$ + 4% sucrose. The petal fall was accelerated when no preservatives were added to the holding solution.

The maximum quantity of holding solution was absorbed (Table 2) in the treatment 20 ppm $AgNO_3$ + 6% sucrose (24.63 ml), which was at par with 20 ppm $AgNO_3$ + 2% sucrose (24.09 ml) and 20 ppm $AgNO_3$ + 4% sucrose (22.98 ml) and least in control (7.55 ml). This might be due to the fact that the $AgNO_3$ present in the holding solution acted as a biocide inhibiting microbial population that might have resulted in blockage of the vascular tissues. The stems of gerbera are highly prone to water stress. The blockage of the base of stem due to bacterial plugging results in decrease of water uptake by stem. A very high level of turgidity is necessary for continuation of normal metabolic activities in the cut flowers. Sucrose helps in maintaining the water balance and turgidity. Hence, addition of sucrose to the holding solution might have lead to increased uptake of the holding solution. This was in conformity with the findings of Rogers (1973). The present investigation revealed that the best holding solution for cut gerbera blooms would be a combination of silver nitrate and sucrose. The vase-life was prolonged by about nine days by holding the flowers in solution containing 20 ppm $AgNO_3$ + 4% sucrose. It may be concluded that the best combination of chemicals in the holding solution should be 20 ppm $AgNO_3$ + 4% sucrose as this treatment recorded the maximum useful vase-life. Thereafter the cut blooms had little or no value in floral arrangements.

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