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Effect of floral preservatives on vase life of gladiolus (*Gladiolus grandiflorus* L.)

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ABSTRACT

During the present study conducted on White Prosperity gladiolus, the treatment of 4% sucrose +250 ppm 8-hydroxy quinoline citrate tended to increase the days to basal floret opening (4.72 days), floral size (12.76 and 14.58 cm) of fifth and second floret, respectively, length of spike (9.84 cm), vase life (10.07 days), vase solution uptake (31.30 ml) and longevity of first five florets was registered to be the highest in spikes treated with 4 % sucrose + 300 ppm $Al_2(SO_4)_3$. The minimum values for these traits were recorded in untreated control.

Key words : Vase life, Gladiolus, Preservatives, $HgCl_2$

Gladiolus (*Gladiolus grandiflorus* L.), the queen of bulbous flower grown in many parts of the world for cut flower, garden display, maintaining ecological balance and checking pollution in the atmosphere. It plays vital role in making environment beautiful and refresh mind of human beings. Flowers have become an integral part of our trade. About 45 % of world trade floricultural products go to cut flower. Gladiolus occupies 4th place in international market for floricultural trade (Bose and Yadav, 1989). There are more than 30000 commercial cultivars of gladiolus who have developed through natural and man made crosses involving about two dozen species. It is being grown throughout India on around 1270 hectare area. In India, it occupies prime position in floriculture industry and ranks next to rose.

In cut flower industry, the most important aspect is post harvest handling in order to maintain flower freshness and original colour of the flower for longer period after cutting from the mother plant. Two sets of factors are responsible for keeping quality and vase life of cut flowers *viz*., internal mechanism that includes maintenance of optimum water balance between water uptake and water loss, stem plugging, respiration rate and production of toxic substances like ethylene and external factors that include environmental condition and microbial attack on cut end. There are various modern techniques of post-harvest handling of cut flowers such as optimum stage, breeding for improved cut flowers, conditioning, pre-cooling, impregnation, pulsing, bud opening, standard vase solution, increase absorption, storage, gamma irradiation and control of vase microbes are useful for lengthening quality and vase life of cut flowers (De *et al*., 1999).

The use of floral preservatives is the most economical practical methods for extending post harvest life of gladiolus cut flower (Salunkhe *et al*., 1990). Several types of floral preservatives in the form of germicides, ethylene antagonists and source of energy (sucrose) are in use to preserve flower quality and extending post harvest longevity of cut flowers (Shukla and Kher, 1999). Use of cheaper and easily available biocides such as aluminium sulphate, sodium hypochloride, cobalt chloride, citric acid, bleach solution, 8-hydroxy quinoline citrate etc. have been used to extend the vase life and keeping quality of cut flowers from fair to good success after cutting from the mother plant. The present investigation was carried out to determine the most suitable floral preservatives for cut flowers.

MATERIALS AND METHODS

The present study on variety 'White Prosperity' was conducted at the Horticulture Research Farm of Shri F.H. (P.G.) College, Nidhauli Kalan, Etah (U.P.) (affiliated to Dr. B.R. Ambedker University, Agra). The corms were planted at spacing of 40 cm x 15 cm and at a depth of 7 cm. The application of recommended doses of NPK and other cultural operations were followed under strict schedule of operations. Five spikes of gladiolus under a treatment having 15-18 florets were harvested with the help of secateur at 8.30 A.M., when basal florets started showing colour at bud break. Immediately after harvesting, spikes were placed in a bucket containing water and brought to the laboratory. Stem length of the spikes were maintained at 30 cm from the cut end of the base to the lower most floret bud. The cut end of the spikes were dipped in disinfectantant *i.e*., $HgCl_2$ solution (1%) to remove outside infections. Then the racking base of each spike was slantingly cut with the help of sharp blade to increase absorption area. There were 15 treatments,

replicated thrice with 5 spikes in each replication in Completely Randomized Resign (CRD). The spikes were treated with sucrose (2% and 4%), aluminium sulphate (300 ppm), cobalt chloride (400 ppm), sodium hypochloride (50 ppm) and 8-hydroxy quinoline citrate (250 ppm) and control (treated with distilled water) alone or in combination with sucrose to study their effect on vase life and other quality parameter of cut gladiolus flowers. After recording the fresh weight and length of the spikes, these were placed in 500 ml glass bottle as vase containing 300 ml of aqueous solution of various preservatives and distilled water as control. Days to basal floret open were recorded from date of placing the spike in vase solution to complete opening of the basal floret. For measuring the floral size, the diameter of fully opened 2^{nd} and 5^{th} florets were measured as length and width of each floret and average values were presented in centimeter. The length of spike was measured from basal floret bud to the tip of spike in centimeter initially at the start of the experiment and subsequently measured on 4^{th}, 8^{th} and 12^{th} day by deducting the initial length. The increase in length of spike was presented in centimeter. The longevity was observed on time taken from opening to fading of first five florets of each spike. Vase life (days) was recorded in terms of duration between the opening of first basal floret and wilting of sixth floret from the base of spike was taken as actual vase life and presented in days (Suneetha and Kumar, 1998). Solution uptake (ml) was measured by the total quantity of water in aqueous solution used by the spike up to wilting of last opened floret.

RESULTS AND DISCUSSION

The data (Table 1) show that the days taken for opening of basal floret was maximum (4.72 days) in sucrose 4% + 250 ppm 8-HQC followed by 50 ppm NaOCl (4.65 days) and it was minimum with control (2.92 days). All the other treatments were found better than the control for opening of basal floret. The opening of florets is considered as a growth process. Two of the basic requirements to maintain growth are a carbohydrate availability and fully turgid tissue. Sucrose in floral preservatives fulfills these two requirements first by supplying the tissues with carbohydrate and secondly by decreasing the water potential and thus improving the water uptake of the spike (Bravdo *et al*., 1974) which accelerates floret opening. There was a significant variation in floret size in all vase reactions of floral preservatives over control (Table 1). The maximum size of second floret was found with 4% sucrose + 250 ppm 8-HQC (14.58 cm) followed by 2% sucrose + 50 ppm NaOCl (12.41 cm). However, the minimum floret size was obtained in control (8.16 cm). But in case of fifth floret, the maximum floret size was recorded in case of 4%sucrose + 250 ppm 8-HQC (12.76 cm) followed by 4% sucrose + 400 ppm $CoCl_2$ (12.42 cm). The increase in floret size by various floral preservatives might be due

Table 1 : Effect of floral preservatives on days taken for opening of basal floret, floral size (cm) and increase in spike length of gladiolus spike

Floral preservatives	Days taken for opening of basal floret	Floret size (cm)		Increase in spike length (cm)		
		2^{nd} floret	5^{th} floret	4^{th} day	8^{th} day	12^{th} day
T_0 –Control	2.92	8.16	6.18	4.40	4.65	5.00
T_1 –Cobalt chloride (400 ppm)	3.43	11.05	9.86	7.16	7.24	8.73
T_2 –Aluminium sulphate (300 ppm)	4.00	10.20	9.44	4.93	5.42	6.84
T_3 –Sodium hypochloride (50 ppm)	4.65	9.34	9.37	5.28	7.06	6.92
T_4 –8-hydroxy quinoline citrate (250 ppm)	4.39	10.00	10.92	5.86	6.98	6.51
T_5 –Sucrose (2 %)	3.81	10.10	9.50	5.82	6.96	6.65
T_6 –Sucrose (4 %)	4.13	10.50	9.36	5.76	6.21	6.28
T_7 –Sucrose (2 %) + Cobalt chloride (400ppm)	3.65	10.42	9.95	7.02	7.70	8.26
T_8 –Sucrose (2 %)+ Aluminium sulphate (300 ppm)	4.35	11.08	9.81	6.25	7.15	7.39
T_9 –Sucrose (2 %) + Sodium hypochoride (50 ppm)	4.65	12.41	10.20	5.95	6.84	6.77
T_{10} –Sucrose (2 %) + 8-hydroxy quinoline citrate (250 ppm)	4.20	11.06	11.48	6.86	8.62	8.69
T_{11} –Sucrose 4% + Cobalt chloride (400 ppm)	3.15	11.54	12.42	7.08	8.93	8.27
T_{12}–Sucrose 4 % + Aluminium sulphate (300 ppm)	3.05	11.50	11.30	8.25	9.18	8.54
T_{13} –Sucrose (4 %) + Sodium hypochloride (50 ppm)	2.28	10.13	10.35	7.63	8.31	8.35
T_{14} –Sucrose 4% +8-hydroxy quinoline citrate (250 ppm)	4.72	14.58	12.76	8.00	9.40	9.84
S.E.±	0.341	0.827	0.750	0.562	0.649	0.661
C.D. (P=0.05)	0.985	2.338	2.166	1.626	1.874	1.910

to the fact that sucrose provides energy for growth and helps in higher uptake of mineral salts such as $CoCl_2$, $Al_2(SO_4)_3$, 8-HQC and germicides have profound effect to check deleterious microbial effect (Basemer,1971 and Farnham *et al*., 1972). Rameshwar (1974) has reported beneficial effect of sucrose in combination of floral preservatives (like 8-HQC and aluminium sulphate) on cut flowers.

The different treatments of floral preservatives showed significant effect on increase in spike length over control (Table 1). On 4th day in vase, increase in spike length ranged from 4.40 to 8.25 cm. The highest increase in spike length was observed in 4% sucrose + 300 ppm $Al_2(SO_4)_3$ (8.25 cm) followed by 4% Sucrose + 250ppm 8-HQC (8.00 cm) while it was lowest in control (4.40 cm). But on the 8th day, it was highest (9.40 cm) in 4% sucrose + 250 ppm 8-HQC followed by 2% sucrose +8-HQC (250 ppm), 300 ppm $Al_2(SO_4)_3$ and 4% sucrose + 400 ppm $CoCl_2$, while the minimum was observed in control (4.65 cm). On 12th day in vase, the highest increase in spike length was recorded in 4% sucrose + 250 ppm 8-HQC (9.84 cm) followed by 2% sucrose + 250 ppm 8-HQC (8.69 cm), respectively. However, the minimum increase in spike length was noted in control (5.00 cm). Increase in spike length has earlier been reported by Singh (1998) in Gladiolous cv. 'MELODY'. The 8-HQC was found most effective germicide used in floral preservative solution (Larson and Scholes, 1966; Marousky, 1969).

The perusal of data (Table 1) reveals that all the floral preservatives differed significantly in their effect on fresh weight change of flower spike. On 7th day, increase in fresh weight of flower was recorded in all floral preservatives except control. The maximum increase in fresh weight of flower spike was recorded in 4% sucrose + Al_2 300 ppm $(SO_4)_3$ (130.78 %) followed by 4% sucrose + 250 ppm 8-HQC (111.98 %) and the minimum in control (67.49 %), while on the last day in vase change in fresh weight of spike ranged between 73.70-114.3 % being maximum in 4% sucrose + 250 ppm 8-HQC (114.31 %) and minimum in 4% sucrose (73.70 %). The variation in fresh weight might be due to the difference in solution uptake, transpirational losses and water balance in the flower spike. Marwe *et al.* (1986) reported that fresh mass and volume of water uptake in spike were improved with sucrose application in vase solution. However, a significant increase in fresh weight was observed due to holding solution containing 5% sucrose + 250 ppm 8-HQC in cultivars 'Hunting Song', 'Song' and 'Spice Span' (Song *et al*., 1992). Gowda and Murthy (1993) reported the maximum increase in fresh weight in $Al_2(SO_4)_3$ treated flowers.

The data in Table 2 show that the longevity of floret was significantly affected by floral preservatives over control. In first floret, the longevity ranged between 2.35 to 4.23 days being highest with 2% sucrose + 400 ppm $CoCl_2$ (4.23 days), while it was in 400 ppm $CoCl_2$ (2.35 days). In second floret, longevity ranged between 2.54 to 4.42 days being highest with 2% sucrose and showing party with 50 ppm NaOCl, sucrose + 4% 400 ppm $CoCl_2$, 4 % sucrose + 300ppm $Al_2(SO_4)_3$, 4% sucrose + 300ppm

Table 2 : Effect of floral preservatives on vase life (days), longevity (days) and vase solution uptake of gladiolus spike

Floral preservatives	Vase life (days)	Longevity (days)					Vase solution uptake (ml)
		1st	2nd	3rd	4th	5th	
T_0 –Control	5.40	3.11	3.44	2.67	2.92	2.30	61.30
T_1 –Cobalt chloride (400 ppm)	6.11	2.35	2.54	3.12	2.42	2.32	80.61
T_2 –Aluminium sulphate (300 ppm)	7.00	2.80	2.89	3.00	3.00	2.46	82.28
T_3 –Sodium hypochloride (50 ppm)	7.24	3.46	4.00	3.56	3.12	3.00	69.06
T_4 –8-hydroxy quinoline citrate (250 ppm)	8.27	3.85	3.25	2.81	3.34	3.10	90.11
T_5 –Sucrose (2 %)	7.68	3.67	4.42	2.82	3.56	3.05	65.00
T_6 –Sucrose (4 %)	7.82	3.36	3.22	3.22	2.56	3.22	45.24
T_7 –Sucrose (2 %) + Cobalt chloride (400ppm)	8.50	4.23	3.20	3.45	3.30	3.13	84.24
T_8 –Sucrose (2 %)+ Aluminium sulphate (300 ppm)	7.95	3.68	3.77	3.44	3.55	3.17	81.06
T_9 –Sucrose (2 %) + Sodium hypochoride (50 ppm)	8.62	3.35	3.90	4.00	5.23	3.02	76.26
T_{10} –Sucrose (2 %) + 8-hydroxy quinoline citrate (250 ppm)	8.40	3.18	2.95	3.73	2.50	2.88	100.76
T_{11} –Sucrose 4% + Cobalt chloride (400 ppm)	9.34	4.16	4.33	3.68	3.02	3.56	95.96
T_{12}–Sucrose 4 % + Aluminium sulphate (300 ppm)	9.54	3.68	4.35	4.00	4.21	4.13	96.89
T_{13} –Sucrose (4 %) + Sodium hypochloride (50 ppm)	8.14	3.70	4.21	4.28	3.00	3.45	80.54
T_{14} –Sucrose 4% +8-hydroxy quinoline citrate (250 ppm)	10.07	3.69	3.24	2.89	3.36	3.00	104.67
S.E.±	0.700	0.303	0.314	0.300	0.274	0.267	7.136
C.D. (P=0.05)	2.023	0.877	0.907	0.868	0.791	0.772	20.611

NaOCl and 4 % sucrose + 250 ppm 8-HQC. The lowest longevity was found with 400 ppm $CoCl_2$. In third floret, the minimum longevity of floret was observed in 4% sucrose + 50 ppm NaOCl (4.00 days) and 4% sucrose + 300 ppm $Al_2(SO_4)_3$ (4 days) followed by 2% sucrose + 250 ppm 8- HQC (3.73 days) showing its minimum value in control (2.67days). In fourth floret, 2% sucrose + 50 ppm NaOCl showed the highest longevity (5.23 days) which remained at par with 4% sucrose + 300 ppm $Al_2(SO_4)_3$ (4.21 days), while it was minimum in 400 ppm $CoCl_2$ (2.42 days). In fifth floret, the value for longevity was highest in 4% sucrose + 300 ppm $Al_2(SO_4)_3$ (4.13 days)treated florets showing statistically parity with 4% sucrose + 400 ppm $CoCl_2$ (3.56 days). The minimum longevity of fifth floret was observed in control (2.30 days). Water balance is mainly considered to be the major factor which determines the quality and longevity of florets (Rogor, 1973). An increase in longevity of floret of gladiolus in the present study can also be attributed to the evacuation in ethylene by cobalt (Reid *et al*., 1989).

The presented data summarized in Table 2 showed that the floral preservatives significantly influenced the vase life of spikes over control. Longest vase life of spike was noticed in 4% sucrose + 250 ppm 8-HQC (10.7 days) which was at par with 4 % sucrose + 300 ppm $Al_2(SO_4)_3$ (9.54 days) and 2% sucrose + 400 ppm $CoCl_2$ (9.34 days) and showed shortest with control (4.40 days). Choi and Roh (1980) reported that 250 ppm 8-HQC and 100/(200 ppm $AgNO_3$ solution increased vase life of gladiolus cv. 'FIRE BRAND'. Suneetha and Kumar (De *et al.,* 1999) reported increased vase life in 5% sucrose +600 ppm 8-HQC. Singh *et al.* (2000) reported maximum vase life in 'Suchitra' and 'Jackson Ville Gold' cultivars of gladiolus when treated with 2 %sucrose + 250 ppm 8-HQC and 2% sucrose + 400 ppm $Al_2(SO_4)_3$, respectively. The floral preservatives significantly affected the solution uptake and its highest value was recorded in 4% sucrose + 250 ppm 8-HQC (104.67 ml) without showing any significant difference with 2% sucrose + 250 ppm 8-HQC (100.76 ml), 4% sucrose + 300ppm $Al_2(SO_4)_3$ (96.89ml) and 4% sucrose + 400 ppm $CoCl_2$ (95.96 ml). Marousky (1968) and Bravdo *et al*. (1974) reported that sucrose helped in increasing water uptake and decreased the transpirational loss by decreasing stomatal opening thereby maintaining turgidity of flowers. Volume of water uptake was improved with sucrose application to the vase solution (Marwe *et al*., 1986). All acidifies the holding solution Halevy and Mayak (1981) and keep it free from microorganisms and helps in preventing the plugging of contracting tissues (Deswal and Patil, 1983; Murali and Reddy, 1993b and Zhou *et al*., 1994).

Conclusion :

The application of 4 % sucrose + 250 ppm 8-HQC as vase solution proved to be the best efficacious treatment to increase the vase life of 'White Prosperity' gladiolus.

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