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EFFECT OF CITRIC ACID, SUGAR AND WATER ON POST HARVEST PERFORMANCES OF CUT FLOWERS

Khan, S.A.K.U,* S.S.Hasan, , M.N Islam, and C. Basu

Agrotechnology Discipline, Life Science School, Khulna University, Khulna-9208, Bangladesh

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Abstract: To observe the effect of different concentrations of citric acid, sugar and water on the postharvest performance i.e. vase life, neck bending and number of open florets of tuberose and gladiolus, freshly harvested cut flowers were collected and pretreated for 24 hours with the preservative solutions prepared with different concentrations of citric acid and different levels of sugar. The pretreated flowers were kept in distilled water. Water from different sources (tap water, natural water and distilled water) was used to preserve untreated sticks of tuberose and gladiolus. Flowers pretreated with 2 g L^{-1} citric acid and 40 g L^{-1} sugar performed better. Water sources had no significant effect on postharvest performances of the cut flowers.

Key words: Postharvest, preservation, tuberose, gladiolus, citric acid, sugar and water.

Introduction:

Flowers or inflorescences used as cut flowers are normally cut at the tied bud stage when the buds show full color but the petals have not started unfolding (Kaicker, 1984). The floricultural products of commercial importance mainly consist of cut flowers. In Bangladesh cut flowers could be a good export item because of its demand in many countries. But due to postharvest preservation problem, it is difficult to export cut flowers. Cut flowers are perishable and can not be stored fresh for long time (Edmond *et al.*, 1992; Randhawa and Mukhopadhyay, 2000). Due to ignorance, flower growers and shopkeepers do not follow any recognized preservation method to increase the vase life of the flowers.

Several preservatives are used to enhance the postharvest life of cut flowers. Different solutions containing different concentrations of sugar, citric acid, 8- Hydroxy Quinoline Sulfate (8-HQS), 8-Hydroxy Quinoline Citrate (8-HQC), silver nitrate, aluminium sulphate etc. are used to prolong the post harvest life of cut flowers (Bose and Yadav, 1998). Some of the preservatives are very costly and the methods of using these preservatives are also very complex for poor farmers and small flower entrepreneurs of Bangladesh. So improvement of post harvest life of cut flowers by using cheap and readily available preservatives has a great scope of investigation. From this point of view, the study was conducted to find the effect of different levels of citric acid, sugar and water from different sources on some selected post harvest characteristics as vase life, neck bending and open floret of tuberose (*Polianthes tuberosa* L.) and gladiolus (*Gladiolus sp.*).

Materials and methods:

Freshly harvested flower sticks of tuberose and gladiolus were used in the studies. All the studies were conducted following two factors Completely Randomized Design with 3 replications.
The two kinds of flowers i.e. tuberose and gladiolus were marked as F_1 and F_2 respectively.

In the first set of experiment the five levels of citric acid were marked as:
C_1 = 0.0 g L^{-1} citric acid, C_2 = 0.5 g L^{-1} citric acid, C_3 = 1 g L^{-1} citric acid, C_4 = 1.5 g L^{-1} citric acid and C_5 = 2 g L^{-1} citric acid

In the second set of experiment the five levels of sugar solutions used as follows:
T_1 = 0.0 g L^{-1} sugar, T_2 = 20 g L^{-1} sugar, T_3 = 30 g L^{-1} sugar, T_4 = 40 g L^{-1} sugar and T_5 = 50 g L^{-1} sugar

In the third set of experiment three types of water were marked as: W_1 = tap water (p^H 7.6), W_2 = distilled water (p^H 6.6) and W_3 = natural water (p^H 8.33)

Data were collected on every morning on different parameters of post harvest life i.e. vase life, neck bending and number of open floret of tuberose and gladiolus. Data of 20 days' were recorded. Vase life was determined as the time from harvest to the time when all the florets wilted. Neck bending indicates the time when stalks started bending. Open florets are the number of florets opened until the termination of the study.

The data were analyzed by using MSTAT-C program. The significance of differences between pair of means was evaluated by Least Significant Different (LSD) test (Gomez and Gomez, 1976).

Results and discussions:

The effect of different concentrations of citric acid was found significant regarding vase life of the flowers (Table 1). Maximum vase life (16.67 days) was found in tuberose treated with C_5 (2.0 g L^{-1} citric acid). Similar result was obtained in chrysanthemum by Singh *et al.*, (1995) and De *et al.*, (1996) in gladiolus. Neck bending of flowers differed significantly due to different concentrations of citric acid (Table 1). Neck bending started after 13.00 days in gladiolus when the flower stalks were pretreated with C_5, whereas it was only 7.67 days in the same when not pretreated with citric acid. The effect of

*Corresponding author: Tel: +880-41-721791, Ext. 211; Fax: +880-41-731244; E-mail: sakuk@bttb.net.bd
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different concentrations of citric acid on opening of the florets was also statistically significant (Table 1). Maximum number of open floret (13.33) was observed in tuberose treated with C_3 and C_5 and lowest number (8.33) of open floret was observed there treated with C_1 and C_4.

Table 1: Effect of different concentrations of citric acid on post harvest performance of Tuberose and Gladiolus

Concentration of citric acid	Vase life (VL) (days)		Neck Bending (NB) (days)		Open Floret (OF)	
	Tuberose	Gladiolus	Tuberose	Gladiolus	Tuberose	Gladiolus
C_1	8.00	10.00	8.67	7.67	8.33	8.67
C_2	10.67	11.67	10.33	9.33	12.67	10.00
C_3	13.00	13.67	10.00	9.00	13.33	9.33
C_4	15.00	14.00	9.33	9.00	8.33	10.67
C_5	16.67	14.33	12.67	13.00	13.33	12.00
Level of significance	*	*	*	*	*	*

* = Significant at 5% level of significance, C_1 = 0.0 g citric acid/L, C_2 =0.5 g citric acid/L, C_3 = 1.0 g citric acid/L, C_4 = 1.5 g citric acid/L, C5 = 2.0 g citric acid/L

The effect of different concentrations of citric acid on the number of open florets has been shown in Fig.1. The pace of floret opening was more up to 8th days of preservation and then declined. C_2 level shows the maximum number of open florets and C_5 level shows variations on the opening of the florets. Due to the effect of citric acid, the number of open florets increased in tuberose with the passing of days. However, there it declined after 8 days preservation and then increased and finally decreased. But in case of gladiolus, the number of floret opening increased at a similar pace and then declined accordingly after 10 days of preservation (Fig. 2).

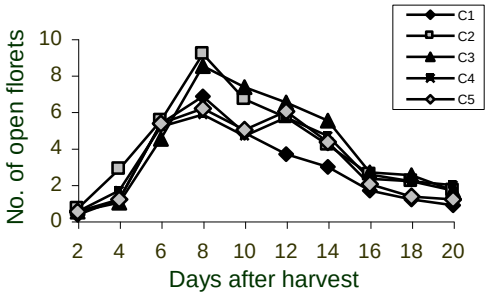

Fig 1. Effect of different concentration of citric acid on the number of open florets

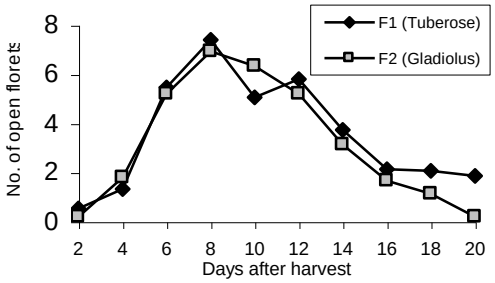

Fig 2. Performances of the flowers regarding opening of florets preserved in citric acid

Significant difference was found among different concentrations of sugar regarding vase life, neck bending and number of open florets of the flowers (Table 2). Maximum vase life (15.67 days) was observed in tuberose treated with T_4 (40 g L^{-1} sugar). Similar results in gladiolus and tuberose have been reported by De *et al.*, (1996), Misra and Bhatacharjee (1996) and Reddy *et al.*, (1995). Neck bending started after 8.00 days in tuberose when no sugar was used. Venkatarayapa *et al.*, (1980) also obtained similar results. Neck bending was delayed up to 14.67 days in tuberose when 40 g L^{-1} sugar was used. Highest number of open floret (13.67) was obtained in tuberose when the flowers were treated with 40 g L^{-1} sugar and the lowest number of open floret was in case of the treatment T_1 (Distilled water). Similar trend was observed in gladiolus (Table 2). A large amount of soluble carbohydrates is required for flower bud opening as substrates for cell walls and respiration as well as for their osmotic properties (Ichimura *et al.*, 1998). Since the carbon source of cut flowers is limited, addition of sugars such as sucrose and glucose to vase water is highly effective in promoting flower opening. Mayak *et al.*, (1973) also got the similar results.

Table 2: Effect of different concentrations of sugar on post harvest performance of Tuberose and Gladiolus

Concentration of sugar	Vase life (VL) (days)		Neck Bending (NB) (days)		Open Floret (OF)	
	Tuberose	Gladiolus	Tuberose	Gladiolus	Tuberose	Gladiolus
T_1	9.33	10.00	8.00	8.33	8.67	8.33
T_2	10.67	10.33	9.33	10.67	11.33	10.67
T_3	8.67	9.33	9.33	8.67	8.67	8.67
T_4	15.67	13.00	14.67	12.33	13.67	12.00
T_5	9.67	9.00	9.67	9.00	9.00	9.33
Level of significance	*	*	*	*	*	*

* = Significant at 5% level of significance, T_1 = Distilled water, T_2 =20 g/L sugar, T_3 = 30 g/L sugar, T_4 = 40 g/L sugar and T_5 = 50 g/L sugar

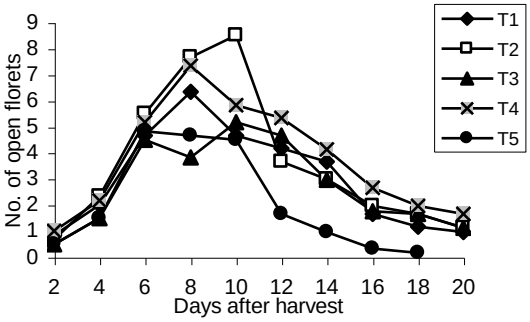

Fig 3. Effect of different concentrations of sugar on the number of the florets

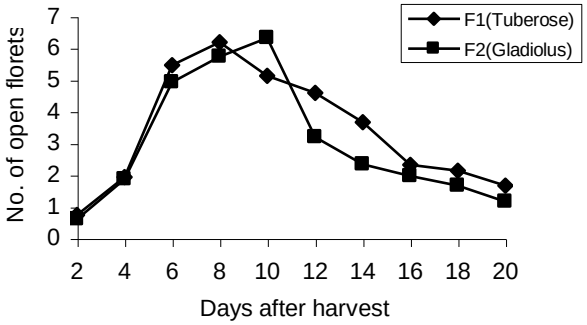

Fig 4. Performances of flowers regarding opening of florets preserved in sugar solution

In case of the flowers treated with 20 g L^{-1} of sugar (T_2), the number of open florets was highest up to 12 days of preservation and then declining tendency was observed in all cases, however it started decreasing from 8th days in case of T_3 and T_5 (Fig. 3). Due to the effect of sugar, the number of open florets increased in tuberose in a steady trend and decreased at the same pace, but in case of gladiolus floret opening increased rapidly and also decreased in a similar way (Fig. 4).

Effect of water from different sources on post harvest characteristics of cut flowers was non-significant (Table 3). In post harvest stage of cut flowers, their performance depends on the presence of good source for soluble carbohydrates to nourish the cell walls and maintain respiration as well as for their osmotic properties (Ichimura *et al.,* 1998). Since the waters from different sources are devoid of carbohydrate, then there was no significant effect of them on post harvest performance of the flowers under study.

Table 3: Effect of water from different sources on post harvest performance cut flowers

Source of water	Vase life (VL) (days)		Neck Bending (NB) (days)		Open Floret (OF)	
	Tuberose	Gladiolus	Tuberose	Gladiolus	Tuberose	Gladiolus
W_1	8.00	8.00	6.00	7.67	5.33	7.67
W_2	9.00	8.33	8.67	8.00	7.67	9.67
W_3	8.33	7.67	7.00	8.33	6.33	8.00
Level of significance	NS	NS	NS	NS	NS	NS

W_1 = Tap water, W_2 = Distilled water, W_3 = Natural water, NS = Non Significant

It was observed that the number of open florets increased rapidly up to 6th days of preservation and then started declining quickly when water from different sources was used to preserve them (Fig. 5). Floret opening trend of the flowers has been shown in Fig. 6. The trend of floret opening was more or less same in tuberose and gladiolus and after 5-6 days the flowers became in full bloom condition.

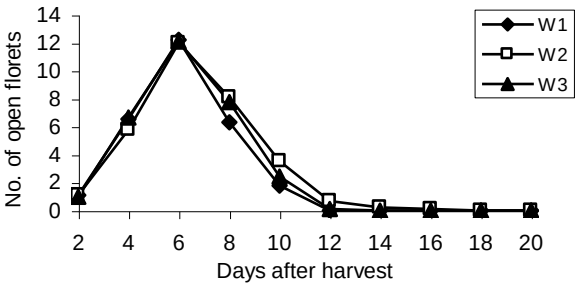

Fig 5. Effect of water on the number of open florets

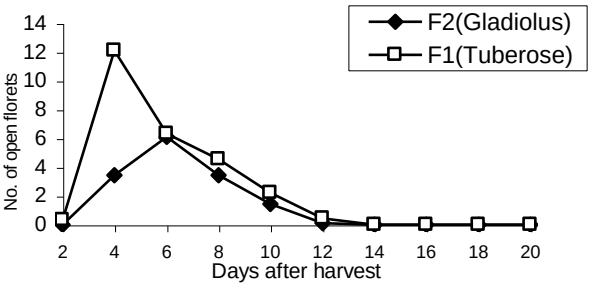

Fig 6. Performances of flowers regarding opening of florets preserved in water from different sources

Summary and conclusion:

From the study it was revealed that to preserve tuberose and gladiolus citric acid and sugar has important role and they may be kept in water from any sources available within the reach. Citric acid may be used as 2.0 g L^{-1} and sugar as 40.0 g L^{-1} for better performances of the preserved cut flowers. Though the water from different sources had no significant effect, but storage of cut flowers in distilled water showed somewhat good performances. More detailed study is recommended to find the combined effect of citric acid and sugar for long time preservation of cut flowers.

*Corresponding author: Tel: +880-41-721791, Ext. 211; Fax: +880-41-731244; E-mail: sakuk@bttb.net.bd

References:

Bose, T.K., and L.P. Yadav. 1998. Commercial Flowers. Naya Prakash Publisher Limited, Kolkata, India. 853 p.

De, L.C., S.K. Bhattacharjee and R.L. Misra. 1996. Postharvest life of pulsed gladiolus spikes as affected by different chemicals. Journal of Ornamental Horticulture, India. 4:1-2, 18-22.

Edmond, J.B., T.L. Senn, F.S. Andrews and R.G. Halfacre. 1992. Fundamentals of Horticulture. Mc Graw Hill Book Company, New Delhi, India.

Gomez, K.A. and Gomez, A.A. 1976. Statistical Procedures for Agricultural Research. 2nd Edition, John Willey and Sons. Philippines. 680 p.

Ichimura, K., M. Shimamura and T. Hisamatsu. 1998. Role of ethylene in senescence of cut Eustoma flowers. National Research Institute of Vegetables, Ornamental Plants and Tea, Japan. 14:2, 193-198.

Kaicker, U.S., 1984. Indian Horticulture. 29: 41-47 [Cited from: Yadav, L.P., N.K. Dadlani and R.S. Malik. Rose. *In:* Bose, T.K. and L.P. Yadav. Commercial Flowers. Naya Prakash Publisher Limited, Kolkata, India]

Mayak, S., B. Bravdo, A. Gvilli and A.H. Halevy. 1973. Scientia Horticulture.1: 357-65. [Cited from: Misra, R.L and B. Singh. Gladiolus. *In:* Bose, T.K. and L.P. Yadav. Commercial Flowers. Naya Prakash Publisher Limited, Kolkata, India.]

Misra, R.L., L.C. De and Bhatacharjee. 1996. Pulsing and impregnation of gladiolus cut spikes with sucrose and other chemicals. Orissa Journal of Horticulture, India. 24:1, 10-17.

Randhawa, G.S. and A. Mukhopadhyay. 2000. Floriculture in India. Allied Publishers Limited, New Delhi, India. 656 p.

Reddy, B.S., K. Singh, A. Singh, Reddy B. Sathyanarayana, Kartar Singh and Amerjeet Singh. 1995. Effect of sucrose, citric acid and 8-hydroxyquinoline sulphate on the post harvest physiology of tuberose cv. Single. Advances in Agricultural Research in India. 3:161-167.

Singh, K., J.S. Arora and K. Singh. 1995. Effect of 8-hydroxyquinoline citrate, silver nitrate and chrysal on vase life of cut chrysanthemum flowers. Journal of Ornamental Horticulture, India. 3:1, 32-35.

Venkatarayappa, T., K.J. Tsujita and D.P. Murr. 1980. Journal of American Society of Horticultural Science. 105: 148-51. [Cited from: Yadav, L.P., N.K. Dadlani and R.S. Malik. Rose *In* Bose, T.K. and L.P. Yadav. Commercial Flowers. Naya Prakash Publisher Limited, Kolkata, India.].