EFFECTS OF DIFFERENT PRESERVATIVES ON POSTHARVEST LIFE OF TUBEROSE AND GLADIOLUS

KHAIRUN NAHAR

DEPARTMENT OF HORTICULTURE AND POSTHARVEST TECHNOLOGY
SHER-E-BANGLA AGRICULTURAL UNIVERSITY
SHER-E-BANGLA NAGAR, DHAKA-1207

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BY

KHAIRUN NAHAR

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Approved by

Supervisor
Dr. Md. Nazrul Islam
(Associate Professor)
Department of Horticulture
and Postharvest Technology
SAU. Dhaka.

Co-supervisor
Md. Ruhul Amin
(Professor)
Department of Horticulture
and Postharvest Technology
SAU. Dhaka.

Prof. Md. Ruhul Amin
Chairman
Department of Horticulture and Postharvest Technology
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207.

DECEMBER 2006

CERTIFICATE

This is to certify that the thesis entitled "EFFECTS OF DIEFERENT PRESERVATIVES ON POSTHARVEST LIFE OF TUBEROSE AND GLADIOLUS" submitted to the Faculty of Agriculture Sher-e-Bangla Agricultural University, Dhaka in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in HORTICULTURE, embodies the result of a piece of bona fide research work carried out by KHAIRUN NAHAR, Reg. No.-26153/00450 under my supervision and guidance. No part of the thesis has been submitted for any other degree in any institute.

I further certify that any help or sources of information during the course of this investigation have been duly acknowledged.

Dated
Dhaka, Bangladesh

Supervisor
Dr. Md. Nazrul Islam
(Associate Professor)
Department of Horticulture and Postharvest Technology
Sher-e-Bangla Agricultural University
Dhaka.

Dedicated to

My

Beloved Parents who laid the foundation of my success

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ABSTRACT

An examination was carried out in the Laboratory of Horticulture and Postharvest Technology Department, SAU during the period from 9^{th} to 25^{th} December, 2006 to study the effects of different preservatives on postharvest life of cut flowers. For this trial spikes of tuberose and gladiolus were kept in chrysal clear (a commercial floral preservative) solution, 2% sucrose solution, 50 ppm bleach solution and 2% sucrose + 50 ppm bleach solution. Two different solutions of each preservative was prepared by using tap water and distilled water. The experiment was laid out in Complete Randomize Design. Chrysal clear gave the best result in respect of flower opening, water uptake and vase life. The highest vase life of tuberose and gladiolus was 13.75 days and 11.63 days respectively in chrysal clear whereas it was 8.13 days and 7.44 days in control. Treatment with 2% sucrose + 50 ppm bleach solution gave almost the similar result as chrysal clear which was 13.63 days and 11 days in tuberose and gladiolus respectively. Water uptake rate was the highest in chrysal clear closely followed by 2% sucrose + 50 ppm bleach solution. Percentages of flower opening were the highest in chrysal clear solution which was 90.44% in tuberose and cent percent in gladiolus. Flower opening rate was 86.64% in tuberose and 93.19% in gladiolus in treatment with 2% sucrose + 50 ppm bleach solution, whereas in control treatment it was only 66.19% and 63.76% in tuberose and gladiolus respectively. Tap water performed better than distilled water in respect of vase life, flower opening and uptaking of water but there was no significant variation between them. As 2% sucrose + 50 ppm bleach gives, more or less, similar performance as chrysal clear, so it can be a suitable substitute of chrysal clear in Bangladesh aspect.

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CHAPTER – I

INTRODUCTION

INTRODUCTION

Cut flowers are integral part of human life. Without flowers and ornamentals, the world would not have been as beautiful, as charming and as cherishing as it is today. The use of cut flowers in home decoration has become an integral part in human society. Maintenance of quality during postharvest period and enhancing postharvest life requires careful handling and some treatments.

Flowers have a soft and supple texture because they hold enough moisture. That is why fresh cut flowers are highly perishable and tend to lose their aesthetic appeal within a relatively short time. As gladiolus and tuberose have been ranked as the uppermost position in cut flower, more emphasis should be given on the activities relating to increase their vase life. Addition of sugar plays an important role in keeping the quality of cut flowers at the beginning. The optimum concentration of sugar varies significantly depending on the flowers being treated. Most flowers benefit from a continuous supply of 2% sucrose in the vase solution. When sucrose alone with a biocide is used in vase solution, it may increase vase life of cut flowers. The most common biocides used in Bangladesh is house hold bleach (Sodium hypochlorite) which can effectively reduce microbial growth, specially bacteria. A solution of 50 ppm bleach works well for most of the cut flowers. The cut surface of flower stalk is susceptible to attack by bacteria and fungi, resulting in pathological break down and death (Kader 1992). The added sucrose increase bacterial multiplication that creates blockage in the xylem vessel which ultimately reduces the vase life. The biocides in floral preservatives maintain clarity in the solution and prevent blockage of xylem vessel by micro organisms (Knee 2000).

The popularity of gladiolus and tuberose as cut flowers is increasing day by day in Bangladesh due to their long vase life and beautiful colours.

Gladiolus (*Gladiolus sp.*) is the member of Iridaceae family, which is one of the most important cut flowers in Bangladesh. It has gained popularity in many parts of the world owing to its unsurpassed beauty and economic value (Chadha and Choudhury, 1986) It has been rated as the second most important popular flower in the world , especially from the commercial point of view (Hamilton, 1976). The gladiolus is popular for its attractive spikes having florets of huge form, dazzling colours, varying sizes and long keeping quality.

Tuberose (*Polianthes tuberosa L.*) belongs to the Amaryllidaceae family, produces attractive, elegant and fragrant white flowers. It occupies a very selective and special position to flower loving people because of its prettiness, elegance and sweet pleasant fragrance. It has a great economic potential for cut flower trade and essential oil industry (Sadhu and Bose, 1973). Keeping quality of the spikes is only 3 days per floret (Rameshwar,1976), and vase life of the flowers is only few days.

Improvement of keeping quality and enhancement of vase life of cut flowers are important areas in Horticultural research. Sucrose and 8-HQS (hydroxyquinoline sulphate) increased cut flower life, by increasing water uptake and maintaining higher fresh weight of flowers (Larsen and Cromary, 1967; Larsen and Frolich, 1969; Larsen and Scholes, 1965). The vase life of gladiolus and tuberose are around 6-7 days under normal condition. Since it has many florets which open sequentially, extension of vase life of these flowers will help more economic utilization of this flower industry. Several attempts have been made to study the effect of different chemicals and sugars on the longevity and economic value of cut flowers (Halevy and Mayak, 1979). Sucrose undoubtedly serves as a respiratory substrate and to a certain extent prevents desiccation and probably replaces the depleted natural carbohydrates and eliminates the break down of other organic compounds (Marousky, 1968).

In the earlier times, most of the cut flowers were kept in water but now a days, scientists have introduced many floral preservatives to improve the vase life of cut flowers. Investigations pertaining to extend the vase life of cut flowers by chemical treatments after harvest have been made with varying success. Several preservatives/chemicals i.e. silver nitrate, aluminium sulphate, cobalt sulphate, 8-HQS, boric acid, citric acid, ascorbic acid, sucrose etc. have been used in different formulations and combinations to enhance the vase life of tuberose and gladiolus [Saini *et al.* (1994), Reddy *et al.* (1995), Reddy and Singh (1996), Sathyanarayana *et al.* (1996), Reddy *et al.* (1997)]. Among the other differently used preservatives of special concern are growth regulators i.e. benzyladenine, gibberellic acid, napthaleneacetic acid, maleic hydrazide etc. Use of floral preservative is the most economical and practicable method for extending the postharvest life of cut flowers (Salunkhe *et al.* 1990). Flowers remain fresh longer if they are placed in a suitable floral preservative (Nowak and Rundnicki 1990).

To increase vase life of cut flowers, there have been few studies on post harvest physiology (Halevy and Kofranek, 1984). Problems concerning vase life of cut flowers have been under focus for a long time. Already in the beginning of this century several experiments were conducted to study the vase life of cut flowers. Since then, a lot of work has been done on senescence, effect of sucrose (Ichimura *et al.*1998) postharvest physiology, postharvest handling and vase life of cut flowers in many countries of the world. No written literature on any specific post harvest treatment has been found that can increase the vase life of cut gladiolus and tuberoses in Bangladesh.

The aim of this study was to investigate the effect of different postharvest treatments to find out the most effective one that can increase vase life of cut flowers. So the main objectives were:

1. To study the effects of different preservatives on the postharvest life of cut flowers.

2. To investigate the effects of different water quality on postharvest life of cut flowers.

3. To find out best preservatives for enhancing the vase life of tuberose and gladiolus as cut flowers.

CHAPTER – II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Tuberose and gladiolus are the two most important cut flowers in the world. Many research work have been done on various aspects of these important cut flowers in different countries of the world. However, a very limited research work has been carried out on the vase life of cut flowers under Bangladesh condition. However , available information related to this study are reviewed here under.

Response of Different Preservatives on Cut Flower (Gladiolus)

Ezhilmathi *et al.* (2007) conducted an experiment to study the effect of 5-sulfosalicylic acid (5-SSA) on the vase life of cut flowers of *Gladiolus grandiflora* variety 'Green Willow'. The vase solution having 5-SSA significantly increased cumulative uptake of vase solution, vase life, number of opened florets and decreased the number of unopened florets compared to the controls. Spikes kept in vase solution containing 5-SSA also exhibited lower respiration rates, lipid peroxidation and lipoxygenase (LOX) activity, and higher membrane stability, soluble protein concentration, and activity of superoxide dismutase (SOD) and catalase. Results suggest that 5-SSA increases vase life by increasing the reactive oxygen species (ROS) scavenging activity of the gladiolus cut flowers.

Al-Humaid (2004) conducted an experiment to find out the effect of biocide on postharvest quality and vase life of cut gladiolus (*Gladiolus gandavensis*).Vase life was significantly improved by placing the inflorescence in vase solutions containing antibiotics (200 ppm penicillin +

250 ppm streptomycin) and glucose (5, 10 or 20%). The addition of the biocide to the preservative solution reduced the bacterial counts in the solution, inhibited the microbial growth, improved flower-opening rates, and reduced flower deterioration rate. Although there were positive proportional relationships among sugar concentration (up to 10%) and total bacterial counts in the solution, the addition of the biocide reduced the bacterial counts, resulting in the improvement of postharvest quality of tested cultivars. The highest and lowest number of opened and deteriorated flowers, respectively, were achieved when the preservative solution contained a mixture of biocide and 20% glucose. Presence of biocide in the vase solution reduced both total carbohydrates and chlorophyll contents in the leaves of the cut gladiolus spikes.

Kumar and Ichimura (2003) found that prolongation of the vase life of cut flowers by sugar application has also been attributed to the increase in the uptake of water by the flowers. Sucrose at lower concentrations prolonged the vase life of gladiolus florets by increasing the uptake, whereas higher concentrations seemed to impede the uptake. It is suggested that the increase in the water uptake by sucrose treatments could be due to the increase in the osmotic concentration of the florets and leaves.

Reid (2002) said that flowers of gladiolus and tuberose open further up the spike, are bigger, and have a longer vase life after overnight treatment with a solution containing 20 percent sucrose and a biocide to inhibit bacterial growth. Removing ethylene using specially formulated products prolongs vase life.

Singh and Sharma (2001) conducted an experiment to study the effect of sucrose in combination with metal salts on the postharvest life of pulsed (20% sucrose for 24 hours) gladiolus spikes cv. White Prosperity. Combination of sucrose and metal salts increased the vase life of cut gladiolus spikes in sucrose (5%) + 8-hydroxyquinoline citrate (8-HQC) 600 mg/L.

Anonymous (2001) said that a holding solution may contain carbohydrates, ethylene inhibitors, minerals salts etc. for prolonging the vase life and improving quality of flowers. $AgNO_3$ 25 ppm can be used very effectively as holding solution for gladiolus cut flowers to increase diameter of the flower and vase life. A combination of holding solution containing 150-200 ppm 8-hydroxyquinoline sulphate and 4% sucrose is also good for improving post harvest life.

Bhat (2000) conducted an experiment on evaluation of post harvest handling methods for carnation and gladiolus cut flowers. Addition of 50 ppm BA to 4mm STS + 10% sucrose improved vase life (12.43-12.60 days) and number of fully open florets (15.20-15.16) was maximum in the same pulsing treatment in gladiolus. Silver thiosulphate (STS) acts as an ethylene antagonist, BA maintains petal turgidity for an extended period and sucrose fulfils the requirements for a carbohydrate source.

Roychowdhury and Sarkar (1995) conducted an experiment to study the effect of adding different chemicals ($MgSO_4$, $ZnSO_4$, $FeSO_4$, $AgNO_3$, $NiCl_2$, $CoCl_2$ and $Al_2(SO_4)_3$, each at either 500 or 1000 ppm, and sucrose at either 2 or 4 %) to the vase water for gladiolus, the longest spike longevity was obtained with 500 ppm $NiCl_2$ at 1000 ppm. $NiCl_2$also gave maximum longevity and maximum period of prime beauty for the individual flowers while it delayed flower opening. The other treatments also gave results superior to that of control (pure water). In general, treatments with $FeSO_4$ and $AgNO_3$ hastened flower opening, but the longevity of the spikes was increased compared to control. The results suggest the use of $NiCl_2$at 500 ppm as a vase solution for preserving quality and to increase longevity of gladiolus spikes.

Nowak and Rundnicki (1990) suggested that the maturity of the spike at harvest will determine its storage time and vase life. Less mature spikes store longer than more mature spikes. Gladiolus harvested with closed florets can be stored upright and dry-wrapped in moisture-proof materials for one week at 36°–40°F. Spikes with closed florets can also be stored upright in preservative for 1–2 weeks. More mature spikes (more open florets) will store a shorter time and have shorter vase life.

Gowda and Gowda (1990) suggested that vase life of gladiolus can be increased by about 7 to 9 days more by using non toxic metal salts in vase solutions. Total uptake of solution was maximum with aluminum sulphate and Sucrose. Maximum vase life of 18.31 and 17.0 days resulted due to Aluminum sulphate (1.0 M) and sucrose (3%), respectively.

Nowak (1989) found that a preservative solution consisting of 8 HQC (Hydroxy Quinolin Citrate) at 200 mg/ l + GA at 60 mg/l + Sucrose at 30 gm/litre markedly improved bud opening, increased spike length, floret diameter and the longevity of whole inflorescence.

Garibaldi and Deambrogio (1989) conducted an experiment with sucrose, 8- HQS, 3,4,5- T (Trichlorophenol)and distilled water. It was observed that sucrose was significantly better than distilled water for preserving cut flowers of cultivar Priscilla and Moana.

Anserwadekar and Patil (1986) conducted an experiment to study the vase life of gladiolus. The treatments were 6% sucrose , GA_3 at 60 ppm and distilled water. It was observed that sucrose maintained vase life for 11 days batter than GA_3 or distilled water.

Merwe *et al.* (1986) conducted an experiment to study the effects of sucrose uptake from a vase medium on the starch metabolism of senescing gladiolus inflorescence. The treatments were sucrose solution of different concentrations. It was observed that the vase life, general appearance, fresh mass and volume of medium uptake of the inflorescences improved with sucrose treatment. It was suggested that a concentration of 30gm sucrose / litre (i.e. 3% sucrose) was the most effective treatment.

Wang and Gu (1985) reported that a vase solution consisting of 5% sucrose + $AgNO_3$ at 50 ppm + 8 – HQS at 300 ppm improved cut flower quality compared with the control (distilled water).

Mayak *et al.* (1973) shown that gladiolus flowers are insensitive to ethylene even when exposed to 1 ppm of ethylene. However, treatment with 1 mM STS (an anti-ethylene compound) for 2 hours improves the opening of the small buds and consequently the postharvest life of the cut stems.

Response of different preservatives on cut flower (tuberose)

Jowkar and Salehi (2005) conducted an experiment in order to find a suitable preservative which provides the longest vase life for tuberose. The experiments were carried out by applying the carelessness of most consumers: not recutting stem ends nor changing the vase solutions. In the first experiment the preservative solutions were: sucrose (1, 2 and 3%), silver thiosulphate (0.4, 0.8 and 1.2 mM), silver nitrate (50, 100 and 150 mg l-1), citric acid (150, 300 and 450 mg l-1) and tap water as the control. In the first days of the experiment, silver thiosulphate caused severe burning of the florets; silver nitrate caused wilting of the florets and bent the end of the flower spikes; and sucrose didn't have any useful effect, it decreased the vase life. The longest vase life belonged to citric acid followed by the control (tap water).

Hutchinson *et al.* (2003) reported that tuberose flowers held in de-ionised water (DIW) had a vase life of 13 days with 63% floret opening. Addition of gibberellins (GA_4+7) in the vase solution had no effect on vase life or floret opening along the spike. Pulsing of the cut flowers with 10% sucrose for 24 hr before transfer to DIW improved their vase life by 4 days and improved the floret opening by 21% above DIW controls. A 24 hr pulse in 10% sucrose improved the vase-life by 3.6 days and floret opening by 13%. Overall results suggest that STS (silver thiosulphate), BA and sucrose can help improve tuberose vase life and floret opening through improvement of the water balance.

Reid and Michael (2002) conducted an experiment to find out the effect of biocide to prevent the growth of bacteria in the vase solution. Quaternary ammonium, hydroxyquinoline salts, aluminum sulfate, and slow-release chlorine compounds are commonly used. A simple biocide can be prepared by adding 1 teaspoon of household bleach (5 percent hypochlorite) to 8 gallons of water. This is very effective, but must be replaced every two or three days.

Huang and Chen (2002) suggested that Pulsing with gibberellic acid at 10 or 20 mg/L plus 8-hydroxyquinoline sulfate (200 mg/L) for 24 h followed by continuous sucrose treatments (4 or 8%) plus 8-hydroxyquinoline sulfate extended the vase life and significantly promoted flower bud opening as compared with the 8-hydroxyquinoline sulfate controls. Cut stems continuously placed in solutions containing sucrose produced less ethylene than those without sucrose. It is suggested that a gibberellic acid pulse at 10 mg/L followed by continuous sucrose treatment at 4% be recommended to growers for extending the vase life and enhancing flower bud opening in cut *P. tuberosa*.

Akbar *et al.* (2001) conducted an experiment on tuberose using $CaCl_2.2H_2O$, $AgNO_3$, ascorbic acid and Tri-Miltox Forte (a fungicide) solutions with various concentrations to see their effects on keeping quality and vase life of the flowers. $CaCl_2.2H_2O$, $AgNO_3$ and Tri-Miltox Forte delayed flower opening as compared to ascorbic acid and standard preservative, but stood at par with control. $CaCl_2.2H_2O$ at concentrations of 750 to 1250 ppm and Tri-Miltox Forte at 1500 ppm resulted in minimum flower wilting after six days. $AgNO_3$ was found to have adverse effects on fragrance of the flowers. Water uptake by the spikes was more in those kept in standard preservative and $CaCl_2.2H_2O$ 750 and 1000 ppm solutions. However, $AgNO_3$ 50 and 200 ppm solutions resulted in maximum vase life (8 days) of cut flowers. Percentages of flowers opened and wilted were significantly negatively correlated with the vase life.

Bakhsh *et al.* (1999) conducted an experiment to find out the effect of different chemicals on vase life and quality of cut tuberose. Vase life was increased three times by using a solution containing 200 ppm silver nitrate ($AgNO_3$) and 4m M silver thiosulfate (STS). Pulsing cut tuberose stems in a solution containing glucose and sucrose prolonged vase life and improved quality. Flower harvested at right bud stage had significantly longer vase life compared to flowers cut at half open bud stage. The quality of flowers was also improved greatly by pulsing flowers in silver nitrate ($AgNO_3$) and silver thiosulfate (STS) chemicals.

Reid (1996) tested the effect of putting freshly-cut tuberose spikes in a preservative vase solution containing 8-HQC and 2% sucrose. The results demonstrate that holding flowers in preservative increased floret opening and vase life by over 30%.

Reddy and Singh (1996) studied the effect of aluminium sulphate and sucrose on the postharvest physiology of tuberose flower spikes. Aluminium sulphate in combination with sucrose significantly enhanced the vase life and quality of tuberose spikes by increasing the water uptake, maintaining better water balance and higher fresh weight for longer periods. Optimum concentrations for the combined treatment were 0.50 mm aluminium sulphate and 4% sucrose.

Gowda and Gowda (1990) conducted an experiment where cut *Polianthes tuberosa* spikes were placed in solutions containing 2% sucrose and aluminium sulphate at 200 or 400 ppm and held for up to 12 days. The vase life was longest (12 days) in 1% sucrose + 200 ppm aluminium sulphate, and 2% sucrose + 400 ppm aluminium sulphate.

Naidu and Reid, (1989) suggested that tuberose flowers pulsed for 24 h at 20 to 25 °C (68 to 77 °F) with a preservative solution augmented with 20% sucrose significantly improve vase life and opening of buds on the flower spikes.

Response of Water Quality on Vase Life of Cut Flowers

Dole (2005) conducted an experiment with 12 cut flower and found that there was no significant difference between distilled water and regular tap water using to prepare vase solution or control.

Jowkar and Salehi (2005) conducted an experiment for determining the role of the water quality. In this part the treatments were: sterilized distilled water, citric acid made with sterilized distilled water (150, 300 and 450 mg l-1) and tap water as the control. The longest and the shortest vase life belonged to sterilized distilled water and the control (tap water), respectively. The citric acid prepared with sterilized distilled water had a desirable effect on the vase life of cut tuberose flowers. This effect increased with the increment of the acid up to 450 mg l^{-1}.

Evans and Burge (2002) conducted an experiment where both tap water and MilliQ water were used as controls, tap water was used for the experiment because it gave consistently longer vase life than the completely nonionic Milli-Q water in the experiment . The tap water was filtered but was otherwise completely untreated. Tap water gave better performance than nonionic Milli-Q water .

Van Meteren et al. (2001) also found positive postharvest effects with tap water compared to deionised water and this was attributed to the ions in the tap water. They said that regular tap water was better than deionised water for cut flowers.

Response of Different Preservatives on Other Cut Flowers

Islam *et al.* (2003) suggested that vase life was affected only when the commercial preservative Chrysal Clear(CC) or sucrose with 8-hydroxyquinoline sulphate (HQS) , compared with the water control (reverse osmosis water). Use of sugar combined with HQS in the vase solution are important factors for prolonging the vase life of *Eustoma* .

Verma (2003) conducted an experiment to study the effect of pre and post harvest treatments on the vase life of cut flowers. Studies carried out revealed that vase life of cut flowers increased with 2% sucrose + 200 ppm

8-Hydroxy Quinoline Citrate (8-HQC) in chrysanthemum. However, maximum flower size opening was found in 2% sucrose + 200 ppm 8-HQC.

O'Donoghue *et al.* (2002) suggested that vase solutions containing sugar can improve the vase life of any cut flower crops. Since cut sandersonia flowers supplied with 2% sucrose are firmer during wilting compared to water-fed controls. Effects of sucrose treatment extend to alterations in cell wall structure in the floral tissues, which may influence the wilting-related flower softening.

Huang and Chen (2002) Conducted an experiment to measure the effects of pulse treatments of BA, sucrose, and BA before, after, or with sucrose, on the vase life of cut Eustoma flowers. A BA pulse at 50 mg(.)L-1 before 4% sucrose promoted the longevity of cut Eustoma flowers better than other treatments. Simultaneously, sucrose, glucose, and mannose concentrations in flowers during vase periods were maintained at higher levels in double pulse treatments than in the single pulses. Ethylene production in flowers 2 days after vase treatment was highest in the BA-treated flowers; intermediate in flowers pulsed with BA before, after, or with sucrose; and lowest in sucrose-treated flowers. Although a BA pulse increased ethylene production over that of controls, it inhibited senescence in cut Eustoma flowers. Respiration in flowers pulse-treated with sucrose or with BA before, after, or with sucrose, was significantly higher than that in controls. Results suggest that the vase life of cut *Eustoma* flowers is improved by either BA or sucrose in vase solution and especially when BA was pulsed before the sucrose pulse.

Kawabata and Sakiyama (1999) found that the percentage of flowers that opened with normal color was higher in HQS + Sucrose and Chrysal clear solution compared to HQS alone and RO water. Treatment with sucrose increased the anthocyanin concentration in flower petals as well as extended the vase life. Carbohydrate supply seems sufficient for pigmentation, and other metabolites may not be required in pigment formation in *Eustoma* flower.

Ketsa *et al.* (1995) opined that $AgNO_3$ prevented microbial occlusion of xylem vessels in Dendrobium, thereby enhancing water uptake and increasing longevity of flowers.

Steinitz (1982) opined that addition of sucrose to the solution increased the mechanical rigidity of the stem by inducing cell wall thickening and lignifications of vascular tissues of cut gerbera flower stalks..

Rogers (1973). Confirmed that sucrose helps maintaining the water balance and turgidity. Hence, addition of sucrose to the holding solution might have led increased uptake of the holding solution that ultimately led to increase vase life of cut flowers.

CHAPTER – III

MATERIALS AND METHODS

MATERIALS AND METHODS

The experiment was carried out at the Horticulture & Postharvest Technology Laboratory of Sher-e- Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka during the period from 9th December to 25th December, 2006 at room condition to study the postharvest physiology of gladiolus and tuberose and to find out the effective treatment that can increase their postharvest life.

Design of Experiment

The experiment was laid out in Complete Randomize Design (CRD) with two factor.

The two factors were-

- Different quality of water
- Different preservatives

There were 10 treatments in the experiment comprising the chemicals and water sources.

These were-

In Tap Water

Chrysal clear solution = CC

50 ppm Bleach solution = B

2% Sucrose solution = S

2% Sucrose + 50 ppm Bleach solution = (B+S)

Control = O (No preservative)

In Distilled Water

Chrysal clear solution = CC

50 ppm Bleach solution = B

2% Sucrose solution = S

2% Sucrose + 50 ppm Bleach solution = (B+S)

Control = O (No preservative)

Each treatment had eight replications. Spikes of tuberose and gladiolus were kept in different glass bottle randomly, containing vase solution of different chemicals (Plate 1).

Preparation of vase solutions

Different preservatives were used to prepare vase solutions in this experiment. The vase solutions were made up with tap water and distilled water and they were as follows:

2% sucrose solution

Twenty gm sucrose was dissolved in one litre of water to make 2% sucrose solution.

50 ppm bleach solution

One ml of bleach was added with one litre of water to make 50 ppm bleach solution.

Chrysal clear solution

Chrysal clear is a well known commercial preservative for the cut flowers. One packet containing 10 gm powder was dissolved in one litre of warm water to make the solution.

Solution with bleach and sucrose combination

One ml of bleach and 20 gm sucrose were added with one litre of water to prepare this solution.

Control solution

No preservative was added here. Distilled water and tap water were used. Tap water was collected from the Horticulture and Postharvest Technology laboratory. Distilled water was collected from the laboratory of Soil Science Department, Sher- e- Bangla Agricultural University.

Maintaining pH level

A few drops of citric acid was added with the solutions for lowering the pH level of each solutions. The pH of the solutions was maintained at 4.5-5.0.

The Flower Vase

Glass bottle (250 ml) was used as flower vase in this experiment. After preparing the solutions each glass bottle was filled in with 200 ml of desired solution. Each bottle was marked for easy identification. Water level was marked with a permanent marker after placing flower spike. The mouth of the glass bottles were open.

Collection of Flower Spikes

Gladiolus

Gladiolus (White) was collected from Savar, Dhaka. The spikes were harvested early in the morning from the field with a sharp knife to avoid mechanical damage. Harvesting was done after opening of the first floret. The spikes were placed in cool water just after harvesting.

Tuberose

Tuberose was collected from Chuadanga district after opening of the lowest floret. Same procedure as gladiolus was followed during flower spike collection.

Placement of spikes on the vase

Stems were cut at a length of 70 cm both in case of tuberose and gladiolus and placed in the vase solutions after removing the lower leaves and allowing no leaf in the vase solutions. Slanting cut was made to create a wider surface area for increased water absorption.

Vase life evaluation

Vase life can be defined as the number of days from the moment of placing the flowers in the vase (day 0) until the moment when their condition was considered unacceptable.

The condition of the flowers was rated daily until the moment when they were considered unacceptable. It happened when the top ends were bended above 90^{o} and /or 75% of the open florets were wilted (Plate 3 and Plate 4).

Water uptake rate

Water uptake by inflorescences was measured everyday at 5.00 P.M. by raising the fluid in the water bottle to the marked level. Water uptake was measured until the inflorescence had become unacceptable.

Collection of data

Data was collected on the following characters -

Water uptake rate
Initial floret number
Floret at the end
Percent flower opening
Vase life

Light supply

For sufficient and equal distribution of light for each treatment, four florescent tube lights were provided in the laboratory during the experimental period. A lighting period of 10 hour was maintained for the flowers from 8 A.M. to 6 P.M. daily.

Statistical analysis

The data collected on different parameters were analyzed statistically using MSTAT software to find out the significance of variation resulting from the experimental treatments. Least Significant Difference (LSD) test was applied to compare the differences among the treatment means at 5 % and or 1% probability level.

CHAPTER – IV

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

The experiment was conducted to investigate the effect of different postharvest treatments on vase life of cut flowers (gladiolus and tuberose). Postharvest success begins with providing the best growing conditions possible and harvesting at optimum harvest stage. Postharvest treatments play an important role in increasing their vase life. There is a common view of providing food supply in using the different preservatives for postharvest treatments. Researcher gave emphasis on food supply or to provide carbohydrate for the flower, a biocide to reduce the microbial growth and maintaining a lower pH value of the vase solution. Some preservatives are used for increased water uptake. The ultimate goal is to increase the vase life. It had been already mentioned that preservatives used in this experiment were able to fulfill the common view of increasing vase life of cut gladiolus and tuberose flowers.

The analyses of variances for different characters had been presented in appendices I and II. Data of the different parameters analyzed statistically and the result had been presented in tables 1 to 12 and figures 1 and 2. Some plates were also presented to observe the condition of flowers at different stage. The results of the present study had been presented and discussed in this chapter under the following headings.

WATER UPTAKE RATE

Preservatives and water uptake rate

When flowers are detached from the plant, water loss from the flowers continues through transpiration. An ideal flower preservative is that which allows water absorption in flower tissues (Salunkhe *et al.* 1990). Water absorption from the preservative solution maintains a better water balance and flower freshness and saves from early wilting resulting in enhanced vase life. Bacteria grow quickly in any liquid containing sugars and other organic matter. When stems are cut, they release sugars, amino acids, proteins and other materials that are perfect food for bacteria. They start to grow at the base of cut stems as soon as flowers are put into water. To prevent the growth of bacteria, commercial preservatives contain anti-microbial compounds, or biocides. Any solution containing biocide helps reduce microbial growth which ultimately leads to higher water uptake. 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 led to increased uptake of the holding solution.

Vascular blockage of stems caused water deficit that reduced water uptake. An effective germicide inhibits vascular occlusion and can extend water uptake rate.

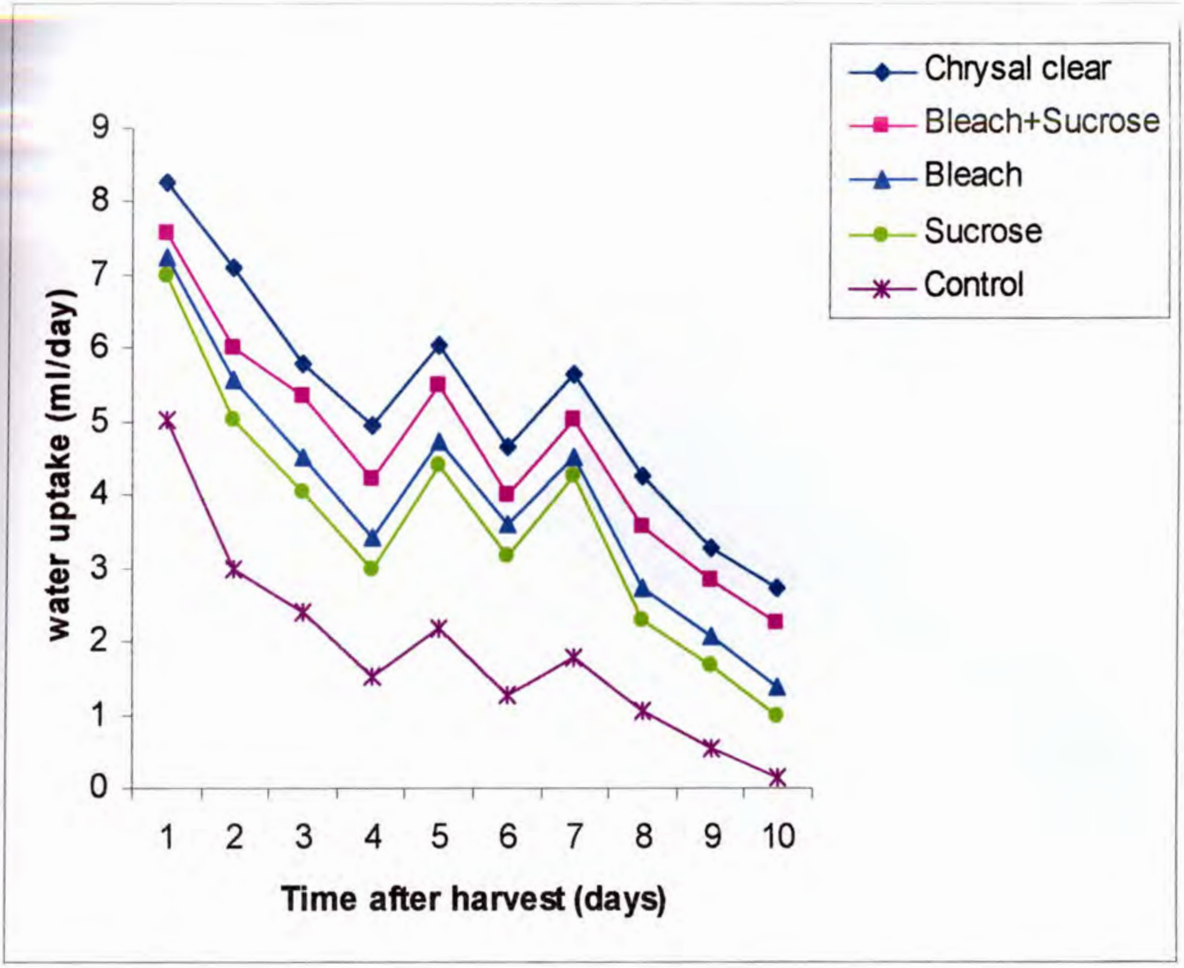

Fig. 1 Effect of preservatives on water uptake rate of tuberose

Total water uptake was significantly influenced by different preservatives. Both in tuberose and gladiolus, maximum water was taken up at the first day for all the treatments. Results regarding the water uptake by the cut spikes of tuberose (fig.1) and gladiolus (fig.2) show that maximum water was taken up by the spikes kept in chrysal clear followed by the treatment with sucrose + bleach. Average water uptake for ten days was 5.27 ml in chrysal clear and 4.63 ml in sucrose + bleach in tuberose. In case of gladiolus it was 8.75 ml and 7.34 ml for chrysal clear and sucrose + bleach respectively.

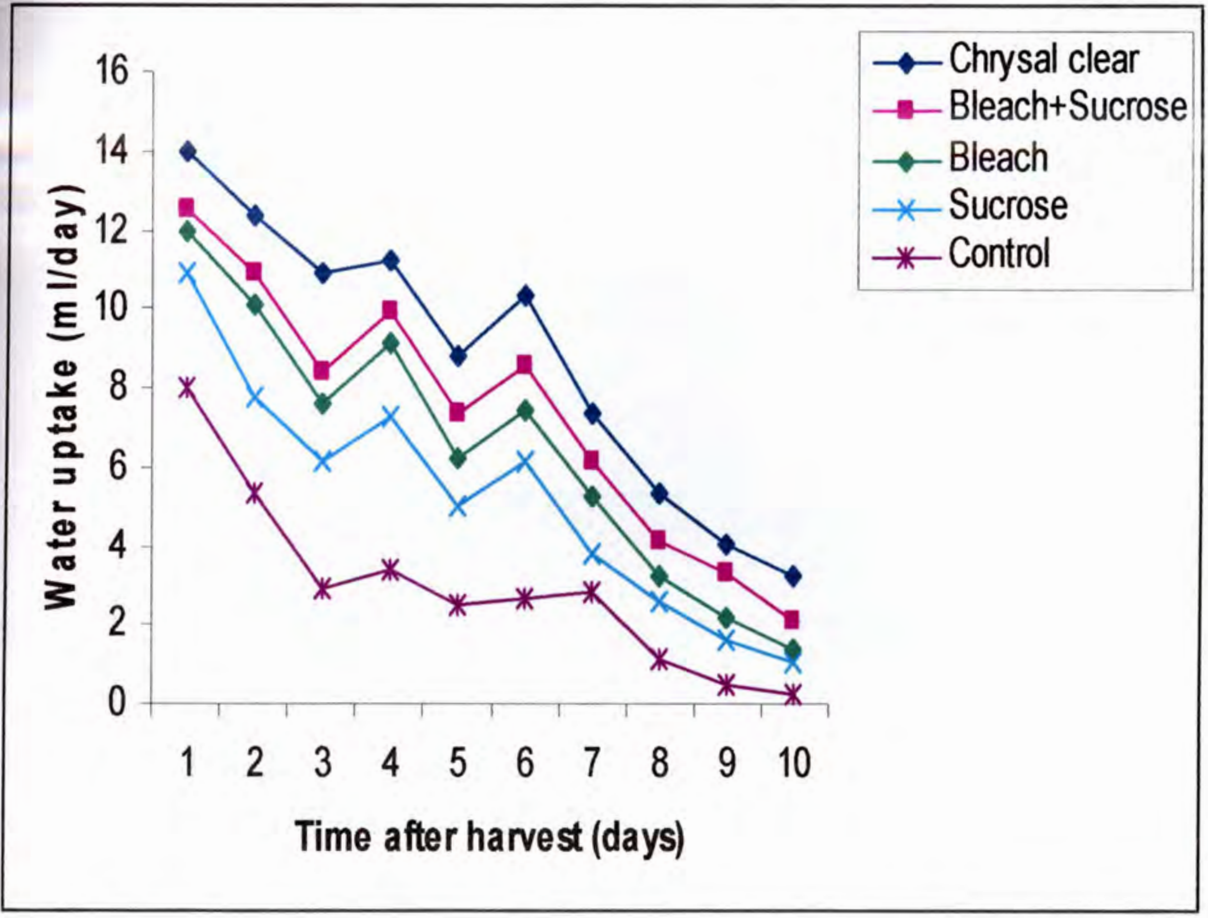

Fig. 2 Effect of preservatives on water uptake rate of gladiolus

Minimum water was taken up in control treatment and the average was 1.90 ml and 2.94 ml in tuberose and gladiolus respectively. Figure 1 and figure 2 show that in control treatment both in tuberose and gladiolus water uptake rate was significantly lower from the beginning up to the end of vase life compare to other treatments. Water uptake by the spikes in sucrose was lower than the bleach. Average water uptake for ten days in tuberose was 3.98 ml and 3.58 ml for the treatment with bleach and sucrose respectively, but statistically this difference is not significant. There was a common observation for all the treatments that from the 8^{th} day water uptake rate was gradually decreased both in tuberose and gladiolus.

Water quality and water uptake rate

Table 1 : Effect of water quality on water uptake rate of tuberose

Water quality	Water Uptake rate from day 1 to day 10										Mean
	1	2	3	4	5	6	7	8	9	10	
Tap Water	7.10	5.63	4.75	3.72	5.00	3.58	4.56	3.15	2.50	1.70	4.16
Distilled Water	6.95	5.37	4.39	3.41	4.46	3.20	3.92	2.88	1.97	1.50	3.80
LSD at 5%	0.39	0.36	0.39	0.33	0.41	0.34	0.40	0.30	0.27	0.22	0.34
LSD at 1%	0.53	0.48	0.53	0.44	0.55	0.45	0.54	0.40	0.36	0.30	0.45
CV%	12.36	14.76	19.73	17.18	19.64	22.38	20.77	13.63	18.59	20.51	17.95

Table 2 : Effect of water quality on water uptake rate of gladiolus

Water quality	Water Uptake rate from day 1 to day 10										Mean
	1	2	3	4	5	6	7	8	9	10	
Tap Water	11.60	9.52	7.85	8.69	6.34	7.16	5.30	3.44	2.42	1.67	6.30
Distilled Water	11.38	9.05	6.93	7.98	5.95	6.89	4.88	3.13	2.24	1.55	5.99
LSD at 5%	0.57	0.62	0.53	0.63	0.45	0.50	0.41	0.30	0.27	0.25	0.45
LSD at 1%	0.81	0.87	0.74	0.88	0.64	0.66	0.55	0.41	0.36	0.34	0.62
CV%	10.34	13.86	15.23	15.91	15.67	16.07	17.68	20.51	25.39	21.26	17.19

Water uptake rate was not too much influenced by different water quality. Tap water and distilled water in respect of water uptake rate was, more or less, similar. Average water uptake rate was 4.16 ml in tuberose (table 1) and 6.30 ml in gladiolus (table 2) in tap water. On the other hand, in case of distilled water it was 3.80 ml (table 1) and 5.99 ml (table 2) in tuberose and gladiolus respectively .

Results regarding water uptake by the cut spikes of tuberose and gladiolus showed that the maximum water was taken up by the spikes kept in tap water. When flowers are detached from the plant, water loss from these continued through transpiration. Water absorption from the vase maintained a better water balance and flower freshness (Reddy and Singh 1996), and saved from early wilting resulting in enhanced vase life.

From the result of this experiment it was evident that there was no significant difference using tap water and distilled water in water uptake rate of tuberose and gladiolus. Similar trend of results were reported by Van Meteren *et al.* (2001).

Water - Preservative combination and water uptake rate

Table 3 : Combined effect of water quality and preservatives on water uptake rate of tuberose

Water Quality	Preservatives	Water Uptake Rate (ml) from day 1 to day 10									
		1	2	3	4	5	6	7	8	9	10
Tap Water	CC	8.75	8.00	6.56	5.69	6.75	5.31	6.25	4.81	3.94	3.25
	(B+S)	7.25	5.81	5.69	4.56	5.94	4.19	5.25	3.69	3.25	2.31
	B	7.25	5.81	4.75	3.63	4.94	3.88	4.88	3.13	2.31	1.56
	S	7.00	8.13	3.94	3.13	4.56	3.19	4.50	2.81	2.19	1.13
	O	5.25	3.38	2.81	1.63	2.81	1.31	1.94	1.31	0.81	0.25
Distilled Water	CC	7.77	6.19	5.00	4.19	5.38	4.00	5.00	3.75	2.63	2.25
	(B+S)	7.94	6.25	5.00	3.88	5.06	3.81	4.81	3.44	2.44	2.19
	B	7.25	5.38	4.31	3.19	4.56	3.31	4.19	2.31	1.88	1.19
	S	7.00	4.94	4.13	2.88	4.25	3.13	4.00	1.81	1.13	0.81
	O	4.81	2.63	2.00	1.44	1.56	1.25	1.63	0.81	0.31	0.06
LSD at 5%		0.88	0.80	0.89	0.73	0.91	0.76	0.90	0.67	0.60	0.51
LSD at 1%		1.19	1.08	1.19	0.99	1.23	1.02	1.21	0.90	0.82	0.69
CV%		12.36	14.76	19.73	17.18	19.64	22.38	20.77	13.63	18.59	20.51

CC = Chrysal Clear
(B+S) = Bleach + Sucrose
B = Bleach
S = Sucrose
O = Control

Table 4 : Combined effect of water and preservatives on water uptake rate of gladiolus

Water Quality	Preservatives	Water Uptake rate (ml) from day 1 to day 10									
		1	2	3	4	5	6	7	8	9	10
Tap Water	CC	14.81	13.00	10.94	11.75	9.63	10.38	6.38	5.13	4.25	3.63
	(B+S)	12.13	11.25	8.88	10.25	7.63	8.56	5.69	3.75	3.25	2.06
	B	11.88	10.69	8.19	10.13	6.25	7.50	4.81	2.88	2.25	1.25
	S	10.69	7.25	6.25	7.31	5.13	6.63	4.13	2.44	1.50	1.00
	O	8.51	5.44	3.00	4.00	3.06	3.38	2.75	1.44	0.88	0.44
Distilled Water	CC	13.19	11.69	8.88	10.69	8.06	10.31	8.38	5.50	3.81	2.81
	(B+S)	13.00	10.56	7.94	9.63	7.13	8.63	6.56	4.56	3.38	2.13
	B	12.13	9.56	7.00	8.13	6.19	7.31	5.75	3.63	2.19	1.56
	S	11.06	8.25	6.06	7.19	4.88	5.69	3.50	2.69	1.69	1.13
	O	7.50	5.19	2.75	2.75	2.00	2.50	2.31	0.81	0.13	0.13
LSD at 5%		1.29	1.40	1.19	1.41	1.02	1.12	0.91	0.68	0.60	0.58
LSD at 1%		1.81	1.96	1.67	1.98	1.43	1.49	1.23	0.92	0.81	0.78
CV%		10.34	13.86	15.23	15.91	15.67	16.07	17.68	20.51	25.39	21.26

CC = Chrysal Clear
(B+S) = Bleach + Sucrose
B = Bleach
S = Sucrose
O = Control

Results regarding the water uptake by the cut spikes of tuberose and gladiolus showed that water in combination with preservatives significantly differed from each other. Water uptake rate was the highest in tap water in combination with CC from the first day up to last, which was 8.75 ml (table 3) and 14.81 ml (table 4) in tuberose and gladiolus respectively on the first day. Treatment with (B + S) and treatment with B performed, more or less, similar in water up taking both in tap and distilled water in case of tuberose (table 3).

Spikes held on control treatment showed the lowest water uptake from first day to the end of vase life. This was significantly different from all other treatments. The minimum water was taken up by distilled water which was 0.25 ml and 0.06 ml on the tenth day in tuberose and gladiolus respectively.

In case of gladiolus, From the first day to third day water uptaking was gradually decreased. In the fourth day uptaking of water was higher than the third day and in sixth day it was higher than the fifth day. This might be due to cut off the lower half inches of the spike at the third and fifth day. Water uptaking was not increased at eighth day although it was cut off at the lower half inches at the seventh day. Multiplication of bacteria was higher at the cut end. After recutting half inches from the lower portion, percentage of blockage may reduced. May be this was the reason of increased water uptake at the days after recutting. No influence of recutting was found after seventh day (table-4). In case of tuberose, recutting was done on fourth, sixth, and eighth day and similar trend of water uptaking as gladiolus was found in this case (table-3).

From the table 3 and table 4 it was evident that all the treatments behaved statistically different and there was significant difference among the treatment combination of water and preservatives both in tuberose and gladiolus.

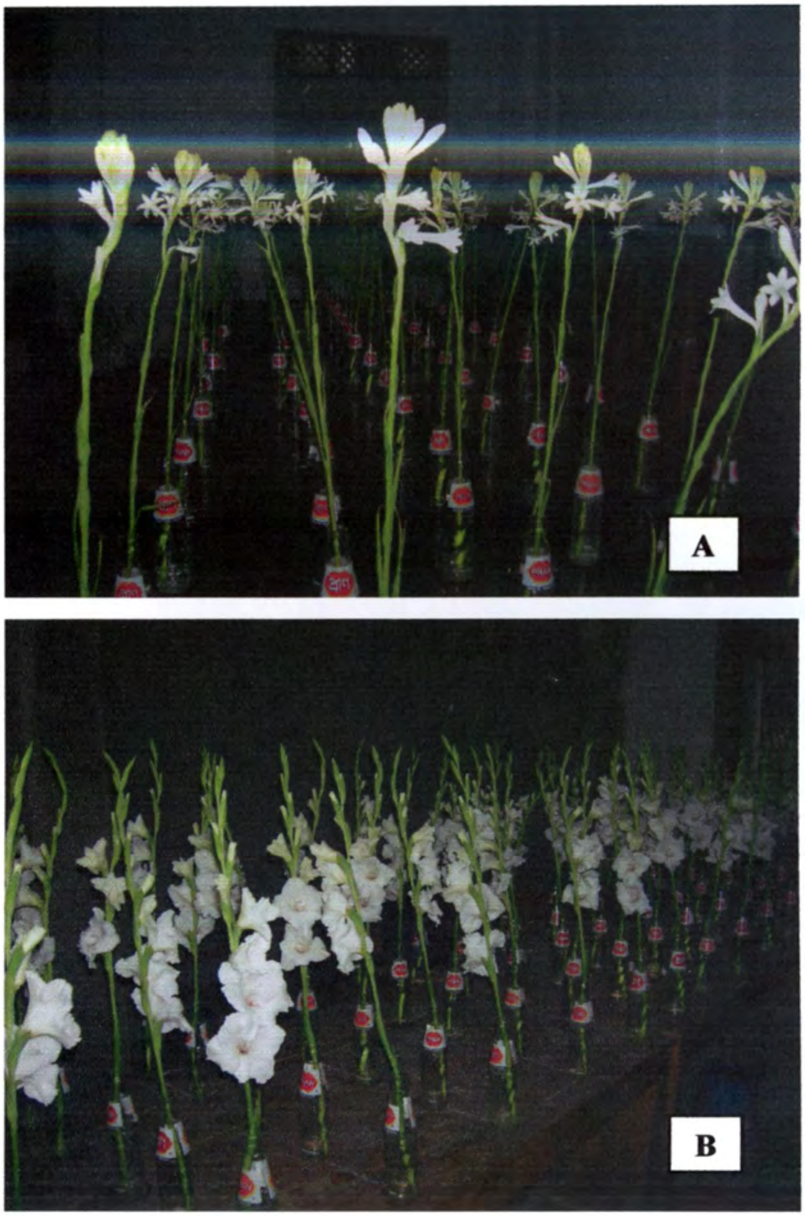

Plate 1. Placement of flower spikes on glass bottle

A. Tuberose B. Gladiolus

FLOWER OPENING

Preservatives and flower opening

Preservatives play an important role in flower opening. In spikes of tuberose and gladiolus flowers opened further up to the spike were bigger and had a longer vase life after treatment with commercial preservative followed by a solution containing sucrose and a biocide to inhibit bacterial growth.

Table 5 : Effect of preservatives on percent flower opening of tuberose

Name of chemicals	Initial floret number	End floret number	% flower open
Chrysal clear	32.23	3.26	90.44
Bleach + Sucrose	32.51	4.25	86.64
Bleach	31.63	8.00	74.16
Sucrose	31.54	4.75	82.91
Control	31.08	9.16	66.19
LSD at 5%	1.59	0.62	2.21
LSD at 1%	2.13	0.83	2.97
CV%	6.93	14.55	3.83

Table 6: Effect of preservatives on percent flower opening of gladiolus

Name of Chemicals	Initial floret number	End floret number	% flower open
Chrysal Clear	10.19	0.23	100
Bleach + Sucrose	10.56	1.00	93.19
Bleach	9.97	2.78	66.75
Sucrose	9.63	2.19	76.22
Control	10.03	3.67	63.76
LSD at 5%	0.30	0.43	0.73
LSD at 1%	0.87	0.58	1.45
CV%	9.19	21.03	10.75

It was observed from table 5 that different preservatives had significant role in flower opening. The maximum number of flower opening was recorded in vase solution containing chrysal clear which was about 90.44% (table 5) and cent percent (table 6) in tuberose and gladiolus respectively. Chrysal clear; the commercial preservative may contain all the necessary elements needed for cut flowers i.e. food source, anti-microbial agent, pH lowering compound and others. Probably that was the reason of giving the maximum number of flower (Plate 2 A) opening both in tuberose and gladiolus.

The combined treatment with bleach and sucrose extended flower opening. This was not found with sucrose or bleach alone. Vase solution containing bleach and sucrose combination gave 86.64% opened flower where as 82.91% opened flower (table 5) in treatment with sucrose for tuberose. This was probably due to the presence of nutrition source sucrose in both solutions. The lowest 66.19% flower was opened in control treatment (plate 2B).

Combined treatment with bleach and sucrose gave 93.19% opened flower (table 6) in gladiolus. Spikes held in sucrose solution gave 76.22% opened flower whereas the minimum 63.76% flower was opened in control treatment (table 6). Therefore it could be suggested that increased level of carbohydrate was responsible for the increased flower opening.

In case of bleach, only 74.16% (table 5) and 66.75% (table 6) floret was opened. This was probably due to lack of food supply. Biocide in combination with nutrition source gave significantly different value in flower opening but biocide alone failed to show similar performance.

It was evident from table 5 and table 6 that chrysal clear showed the best performance in flower opening. Solution containing a biocide with carbohydrate source could be a substitute of this both for the tuberose and gladiolus. Similar trend of result was found by Ichimura (1998).

Maximum opening Minimum opening

Plate 2. Effects of preservatives on flower opening of tuberose

A. Maximum opening in chrysal clear

B. Minimum opening in control

Water quality and flower opening

Without water, flowers wilt. When spikes are cut, two things happen to restrict water flow:

- Air gets into the spikes and blocks the uptake of water.
- Bacteria begin to grow in the vase water and clog the spikes.

Table 7 : Effect of water quality on percent flower opening of tuberose

Type of water	Initial floret number	End floret	% flower open
Tap water	32.27	5.74	81.06
Distilled water	31.40	5.97	79.82
LSD at 5%	1.00	0.72	1.72
LSD at 1%	1.45	0.63	2.08
CV %	6.93	14.55	3.83

Table 8 : Effect of water quality on percent flower opening of gladiolus

Type of water	Initial floret number	End floret	% flower open
Tap water	9.77	1.77	79.50
Distilled water	9.85	1.98	79.27
LSD at 5%	0.19	0.27	0.52
LSD at 1%	0.55	0.36	0.97
CV%	9.19	21.03	10.75

Different source of water may used in preparing vase solutions. It was already mentioned that tap water and distilled water was used to prepare vase solutions in this experiment. Result of this experiment showed that there was no significant difference using tap water and distilled water.

Results presented in table 7 and table 8 showed that after placing the spikes in two different sources of water, the maximum flower opening was recorded in tap water which was about 81.06% in tuberose (table 7) and 79.50% in gladiolus(table 8). On the other hand, in case of distilled water it was 79.82% (table 7) and 79.27% (table8) in tuberose and gladiolus respectively.

Performance of tap water was better than distilled water in respect of to flower opening. Statistically this difference was not significant.

All the treatments behaved statistically alike and there was no significant difference in using tap water and distilled water. Similar results had been reported by Dole (2005).

Water – Preservative combination and flower opening

Table 9 : Combined effect of water quality and preservatives on flower opening of tuberose

Water quality	Preservatives	Initial floret number	End floret number	% flower open
Tap water	CC	32.50	2.36	92.73
	(B+S)	32.78	3.63	88.92
	B	32.25	8.13	74.79
	S	31.86	5.63	82.47
	O	31.17	8.96	68.67
Distilled water	CC	31.97	3.89	88.15
	(B+S)	32.25	4.87	84.37
	B	31.00	7.88	73.53
	S	31.23	3.88	83.32
	O	31.00	9.36	63.72
LSD at 5%		2.24	0.88	3.12
LSD at 1%		3.02	1.18	4.20
CV%		6.93	14.55	3.83

CC = Chrysal Clear
(B+S) = Bleach + Sucrose
B = Bleach
S = Sucrose
O = Control

Table 10 : Combined effect of water quality and preservatives on flower opening of gladiolus

Water quality	Preservatives	Initial floret number	End floret number	% flower open
Tap water	CC	10.45	0.25	100
	(B+S)	10.63	1.38	93.33
	B	9.58	1.25	66.19
	S	9.67	2.38	73.41
	O	9.25	3.63	64.56
Distilled water	CC	10.25	0.00	100
	(B+S)	9.75	0.63	93.05
	B	9.75	3.13	67.30
	S	9.50	2.50	73.03
	O	10.00	3.63	62.96
LSD at 5%		0.43	0.61	1.04
LSD at 1%		1.2	0.82	2.04
CV%		9.19	21.03	10.75

CC = Chrysal Clear
(B+S) = Bleach + Sucrose
B = Bleach
S = Sucrose
O = Control

Water quality and preservative combination showed significant difference in flower opening. It was observed that CC with tap water showed best performance than any other treatment combination which was about 92.73% in tuberose (table 9) and 100% in gladiolus (table 10). Treatment with (B+S) in tap water and CC in distilled water combination gave 88.92% and 88.15% (table 9)open flowers in tuberose. This two treatment was statistically identical. Treatment with S in tap and distilled water and (B+S) with distilled water gave 82.47%, 83.32% and 84.37% open flowers (table 9) in tuberose. There was no significant difference among them. This probably due to presence of sucrose in each case. Sucrose in tap and distilled water gives almost the similar result. The lowest performance was observed in control treatment with distilled water which was about 63.72% (table 9) only.

Treatment with (B+S) both in tap and distilled water gave 93.33% and 93.05% opened flower (table 10) in gladiolus. The lowest performance was observed in control treatment with distilled water which was about 62.96% (table 10) only.

From the table 9 and table 10 it was evident that all the treatments behaved statistically different and there was significant difference among the treatment combinations of water quality and different preservatives.

EFFECTS OF WATER QUALITY AND PRESERVATIVES ON VASE LIFE

Vase life was greatly influenced by different preservatives in combination with two different sources of water. Microorganisms, which grow in vase water, include bacteria, yeasts and molds. These are harmful to cut flowers through their development and their consequent blockage of xylem at cut ends, preventing the water absorption. They also produce ethylene and toxins, which accelerate flower senescence and reduce vase life. Adding a suitable germicide in vase water can check the growth of microbes. Bleach is an effective bactericide (used in Bangladesh), which is often added in vase water at a concentration of 50 ppm for the extension of vase life. However, the result showed that there was no positive effect of bleach alone on the vase life of cut flowers.

Table 11 : Effect of water quality and preservatives on vase life of tuberose

Vase life (days)						Mean
Water quality	Name of preservatives					
	Chrysal clear	Sucrose + Bleach	Sucrose	Bleach	Control	
Tap water	13.75	13.50	11.63	11.13	8.50	11.70
Distilled water	13.75	13.75	11.13	11.25	7.75	11.52
Mean	13.75	13.63	11.39	11.20	8.13	-

Results regarding the vase life by the cut spikes showed that vase life was the maximum in the spikes kept in tap water which was about 11.70 days in tuberose (table 11)and 10 days in gladiolus (table 12). On the other hand, distilled water gave vase life 11.52 days (table 11) and 9.57 days (table 12)in tuberose and gladiolus respectively. This was statistically identical and there was no significant difference in using tap water and distilled water on vase life of tuberose and gladiolus flowers. Similar trend of results was reported by Jowkar and Salehi (2005).

Table 12 : Effect of water quality and preservatives on vase life of gladiolus

Vase life (days)						Mean
Water quality	Name of Preservatives					
	Chrysal clear	Sucrose + Bleach	Sucrose	Bleach	Control	
Tap water	11.75	11.00	9.75	9.34	7.88	10.00
Distilled water	11.50	11.00	9.25	9.13	7.00	9.57
Mean	11.63	11.00	9.5	9.24	7.44	-

The result reveled that there was a significant variation on vase life of tuberose and gladiolus spike among the treatment combination of different preservatives.

The maximum vase life 13.75 days and 11.63 days was observed in treatment Chrysal clear which was statistically different from the other treatments except the treatment with sucrose + bleach. The second highest vase life 13.50 days (table 11) was observed in this treatment with tap water for tuberose. The minimum vase life was noted in control treatment which was 7.75 days (table 11) and 7 days (table 12) in distilled water for tuberose and gladiolus respectively.

Treatment with sucrose + bleach also extended the vase life. This was not found with sucrose alone, most likely because sucrose encouraged multiplication of bacteria, which eventually blocked the xylem vessel, while biocides could prevent this. For tuberose sucrose gave 11.63 days and 11.13 days vase life in tap water and distilled water respectively. It was 9.75days and 9.25 days for gladiolus in tap water and distilled water respectively.

It was evident that the increased level of carbohydrate was responsible for the increased vase life of tuberose and gladiolus but a germicide was needed for this purpose.

Similar trend of results were reported by Knee (2000) and Ichimura. (1998).

Plate 3. Beginning and ending conditions of tuberose flower

A. At the beginning

B. At the end

Plate 4. Beginning and ending conditions of gladiolus flower

A. At the beginning

B. At the end

CHAPTER – V

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

The present experiment was carried out at the Horticulture & Postharvest Technology Laboratory of Sher-e- Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka during the period from December 09 to December 25, 2006 at room condition to study the postharvest physiology of gladiolus and tuberose and to find out the effective treatment for long postharvest life. The two factor experiment was laid out in Complete Randomize Design (CRD) with eight replications. There were altogether 10 treatment combinations in this experiment.

Cut spikes of tuberose and gladiolus were kept in solutions containing different chemicals such as 2% sucrose, 50 ppm bleach, chrysal clear (a commercial preservative) and 2% sucrose + 50 ppm bleach. Two different solutions of each preservative was prepared using tap water and distilled water. pH range of each solution was maintained to 4.5-5.0. Citric acid was used for lowering the pH level.

Data was collected on water uptake rate, initial number of florets, end florets, percentage of flower opening and vase life both in tuberose and gladiolus flower.

The highest vase life of tuberose and gladiolus was observed in chrysal clear which was 13.75 days and 11.63 days respectively compared to 8.13 days and 7.44 days in control. Treatment with sucrose + bleach gave vase life of 13.63 days and 11 days in tuberose and gladiolus respectively, which was almost similar to the result of chrysal clear. Treatment with sucrose solution gave vase life of 11.39 days in tuberose closely followed by 11.20 days in bleach solution. In case of gladiolus sucrose gave vase life of 9.5 days and 9.24 days of vase life was given by bleach solution. Two source of water (tap water and distilled water) gave almost similar result in context of vase life and no significant variation was found between them.

Percentage of flower opening was highest in chrysal clear closely followed by treatment with sucrose + bleach which was 90.44% and 86.64% in tuberose. Performance of chrysal clear was excellent in gladiolus. Chrysal clear gave cent percent open flower closely followed by 2% sucrose + 50 ppm bleach which gave 93.19% opened flower. Flower opening was higher in sucrose (82.9%) in compare to bleach (74.16 %) in the tuberose and in gladiolus it was 76.22% in sucrose and 66.75% in bleach alone. The minimum flower was opened in control treatment which was 66.19% in tuberose and 63.76% in gladiolus. Water quality gave almost similar result in flower opening. In tuberose 81.06% flower was opened in tap water and 79.82% in distilled water. In gladiolus it was 79.50% and 79.27% in tap water and distilled water respectively.

Water uptake rate was higher in bleach compare to sucrose both in tuberose and gladiolus. But the highest amount of water was up taken by chrysal clear closely followed by treatment with 2%sucrose + 50 ppm bleach.

A significant variation was observed among the treatments with respect to majority of the observed parameters. The result of the experiment reveled that chrysal clear and combination of sucrose and bleach had significant influence on all the parameters studied.

Analyzing the results accomplished in the present studies, the following conclusions may be drawn –

- Chrysal clear; the commercial flower preservative increase the vase life and quality of cut tuberose and gladiolus. As it is not available in Bangladesh, 2% sucrose + 50 ppm bleach can be used as a suitable substitute of chrysal clear for increasing postharvest life of tuberose and gladiolus spike.

- Tap water and distilled water gives almost the similar result. So tap water can be used for vase solutions.

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APPENDICES

Appendix I: Analysis of variance of % flower opening, water uptake rate and vase life of tuberose

Source of variation	Degrees of Freedom (d.f.)	Mean Square			
		Initial floret number	End floret number	% flower open	Vase life (day)
Water	1	23.11	1.25	19.75 NS	0.61NS
Chemicals	4	83.07	73.70	1484.47 **	84.20 **
Water × Chemicals	4	4.30	3.87	21.97*	4.61*
Error	70	4.84	0.74	9.34	0.58

Appendix I. Contd.

Source of variation	Degrees of Freedom (d.f.)	Mean Square									
		Water uptake from day 1 to day 10 (ml)									
		1	2	3	4	5	6	7	8	9	10
Water	1	0.42 NS	1.05NS	0.77 NS	1.50NS	2.02NS	1.01NS	2.12NS	0.51NS	0.61NS	0.50NS
Chemicals	4	23.49**	36.75**	27.70**	26.73**	35.30**	26.01**	34.69**	24.15**	18.03**	16.91**
Water × Chemicals	4	3.52*	4.75*	5.60*	4.13*	5.95*	4.05*	4.54*	3.47*	3.55*	2.48*
Error	70	0.75	0.62	0.76	0.52	0.80	0.55	0.77	0.43	0.35	0.25

** = Highly significant at 1% level of probability
* = Significant at 5% level of probability
NS = Not significant

Appendix II : Analysis of variance of % flower opening, water uptake rate and vase life of gladiolus

Source	Degrees of Freedom (d.f.)	Mean Square			
		Initial floret number	End floret number	% flower open	Vase life (day)
Water	1	0.11	0.80	1.05NS	1.61NS
Chemicals	4	4.62	29.21	4228.48**	42.45**
Water × Chemicals	4	4.17	3.95	103.76*	4.56*
Error	70	0.81	0.36	35.80	0.88

Appendix II. Contd.

Source	Degrees of Freedom (d.f.)	Mean Square									
		Water uptake from day 1 to day 10 (ml)									
		1	2	3	4	5	6	7	8	9	10
Water	1	1.02NS	2.51NS	3.11NS	2.50NS	1.45NS	2.12NS	2.16NS	1.53NS	1.03NS	0.98NS
Chemicals	4	80.98**	123.30**	140.56**	148.67**	92.23**	134.94**	52.02**	40.23**	31.05**	19.71**
Water × Chemicals	4	4.36*	3.39*	10.11*	9.97*	4.52*	6.06*	6.26*	1.32*	6.33*	1.97*
Error	70	1.41	1.65	1.19	1.69	0.88	1.27	0.80	0.45	0.35	0.32

** = Highly significant at 1% level of probability
* = Significant at 5% level of probability
NS = Not significant