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Vase life improvement of yellow gladiolus through different preservative solutions

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ABSTRACT

An experiment was conducted to find out the suitable preservative solution which provides the longest vase life for yellow gladiolus against eight preservative solutions coded from T_0 to T_7 and these were T_1: 100-ppm silvar thiosulphate (STS); T_2: 3% sucrose + 100-ppm citric acid (CA); T_3: 3% sucrose + 100-ppm salicylic acid (SA); T_4: 3% sucrose + 100-ppm STS; T_5: 5% sucrose + 100-ppm CA; T_6: 5% sucrose + 100-ppm SA; T_7: 5% sucrose + 100-ppm STS with T_0: Control (Tap water). T_4 treatment provided maximum spike diameter (13.9 mm) and floret opening (96.8%) at 12th days after treating, maximum days to basal floret senescence (12.4), maximum no. of floret open during basal floret senescence (10.5), maximum solution absorption (47.8 ml/spike), maximum vase life (21.5 days) with minimum fresh weight loss (25.1%) and floret wilting (29.3%) at 12th days after treating which was closely followed by T_3. However, incidence of stem rotting was not in T_2, T_3 and T_4. Blend solutions of STS/SA (100-ppm) and 3% sucrose is recommended to use for the maximization of the postharvest life of yellow gladiolus.

Key Words: *Gladiolus, Preservative solutions and Vase life*

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I. Introduction

Commercial floriculture is one of the most profitable agro industries in the world (Ezhilmathi *et al.*, 2008). Gladiolus (*Gladiolus grandiflorus* L.) is one of the popular cut flower with short longevity which is a major problem in consumer preference. Vase life of cut flowers is mainly affected by two main factors namely ethylene which accelerates the senescence of many flowers and microorganisms which cause vascular blockage thus reduce the vase life of cut flowers (Van Doorn *et al.*, 1994; Zencirkiran, 2005; Zencirkiran, 2010). A floral preservative usually is a complex mixture of sucrose, microorganism's inhibitor and also an ethylene action or synthesis inhibitor. Pulsing treatments prevent vascular infections and inhibit ethylene production and thereby result in prolong storage period and higher quality flowers with increased vase life (Sankar and Bhattacharjee, 2002). Citric acid (CA) is a widespread organic acid in the plant kingdom and makes a weak acid in water. CA is used to adjust water pH and to control the growth of microorganisms. SA is a phenolic compound that inhibits ethylene production, the inhibitory actions of SA most closely resembled with that of dinitro phenol, a known inhibitor of ethylene forming enzyme (Leslie and Romani, 1988). Ezhilmathi *et al.* (2007) reported that 5-sulfoSA as a salicylate derivative was effective in extending vase life of cut gladiolus. The inhibition of ethylene action by pulse pre-treatment with STS has become an important commercial technique for improving the vase life of flowers, especially when they are to be handled in ethylene-contaminated environments such as supermarkets (Serek *et al.*, 1995; Zencirkiran, 2005). However, Silver is a potent environmental pollutant. Therefore, it needs to be replaced by other non – toxic chemicals (Serek *et al.*, 1995; Ichimura *et al.*, 2002). Therefore the present experiments were conducted to find a suitable preservative solution which provides the longest vase life for gladiolus.

II. Materials and Methods

The experiment was conducted at Department of Horticulture, Sher-e-Bangla agricultural University, Bangladesh between October, 2012-March, 2013 to find out the suitable preservative solution which provides the longest vase life for yellow gladiolus. Gladiolus were grown horticulture farm, SAU through homogeneously maintained growing conditions and uniform sticks (total 40) of yellow gladiolus were collected.Sticks were trimmed in equal length. Slanting cut was made to provide more solution accumulated area. Seven preservative solutions viz. T_1: 100-ppm STS; T_2: 3% sucrose + 100-ppm CA; T_3: 3% sucrose + 100-ppm SA; T_4: 3% sucrose + 100-ppm STS; T_5: 5% sucrose + 100-ppm CA; T_6: 5% sucrose + 100-ppm SA; T_7: 5% sucrose + 100-ppm STS with T_0: Control (Tap water) were used for experiment following completely randomized design through five replicates. Flowers were kept in room temperature during the period of experiment and the vase solutions were not changed. Data wee collected on spike diameter, fresh weight loss, floret opening and wilting, days to basal floret senescence, no of floret open during basal floret senescence, solution absorption, vase life and incidence of stem rotting. Fresh weight loss was measured by subtracting the weight of the respective treatments from the initial weight. For the measurement of the solution absorption the bottle of the vase solution was air tight to protect the loss of solution through evaporation. The solution absorption was then measured by the difference between the initial and final volume of the solutions. Incidence of stem rotting was recorded by organoleptic test at the last day of each treatment. Collected data were statistically analyzed using MSTAT-C computer package program. Mean was calculated and analysis of variance for each of treatment was represented by F-test (Variance Ratio). Differences between treatments were evaluated by LSD Test at 5% level of significance (Gomez and Gomez, 1984).

III. Results

Spike diameter

Spike diameter of the yellow gladiolus was decreased significantly with days after treating among the preservative solutions. Maximum spike diameter was observed from T_4 (13.9 mm) while minimum from T_0 (10.0 mm) at 12th days after treating (Figure 01a).

Fresh weight loss

Fresh weight loss of the yellow gladiolus spike was also varied significantly among the preservative solutions. Minimum fresh weight loss was observed from T_4 (25.1%) which was statistically similar with the T_3 (25.8%) while maximum from T_1 (33.9%) at 12th days after treating (Figure 01b).

Floret opening

Maximum floret opening of yellow gladiolus spike was found from T_4 (96.8%) followed by T_3 (91.1%) whereas minimum from T_0 (56.9%) at 12th days after treating (Figure 01c).

Floret wilting

Minimum floret wilting of yellow gladiolus spike was found from T_4 (29.3%) followed by T_3 (30.9%) whereas maximum from T_0 (42.8%) at 12th days after treating (Figure 01d).

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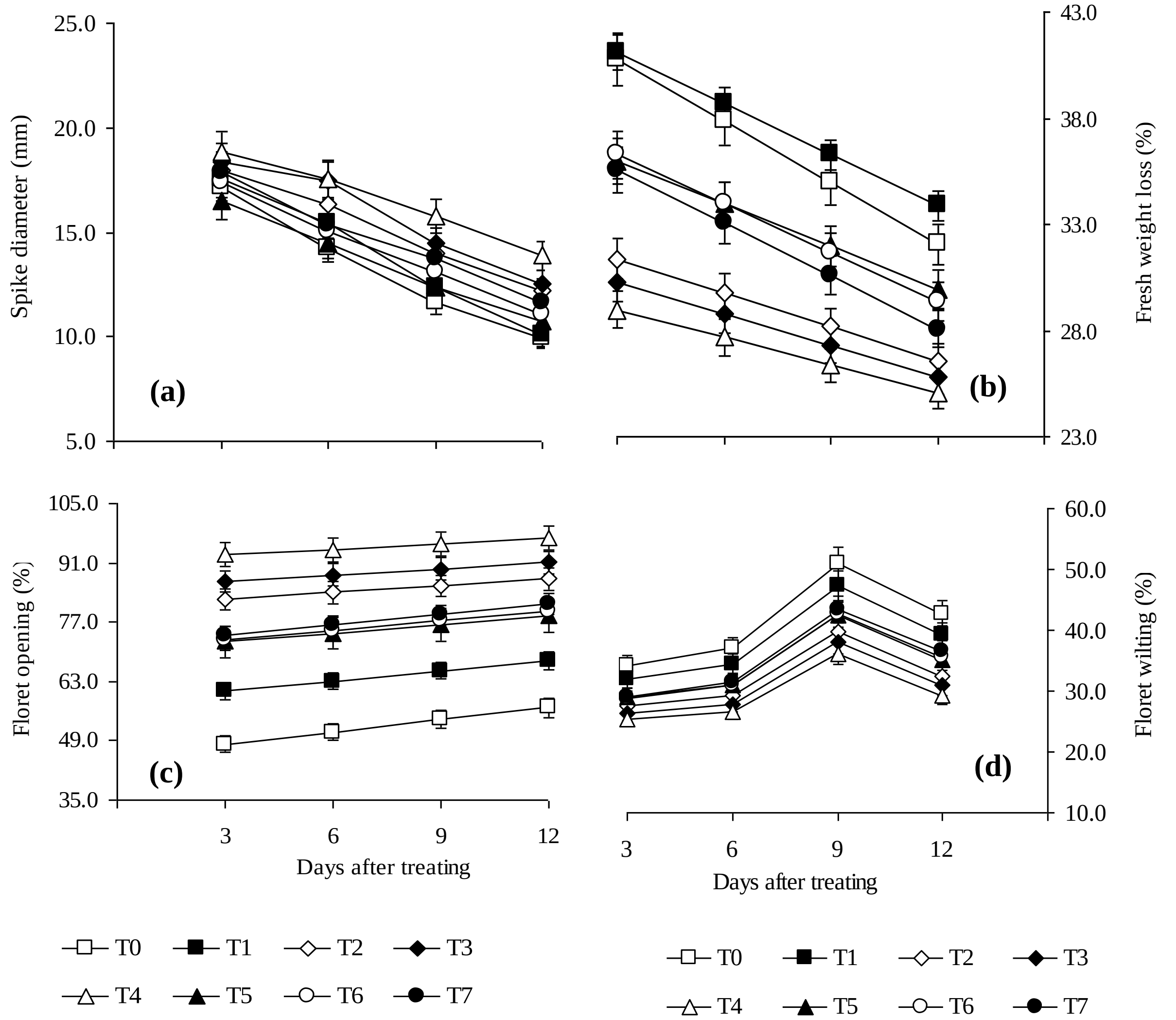

Figure 01. Performance of different pulsing treatments on (a) Spike diameter, (b) fresh weight loss, (c) floret opening and (d) floret wilting.

Here, T_0: Control (Tap water); T_1: 100-ppm STS; T_2: 3% sucrose + 100-ppm CA; T_3: 3% sucrose + 100-ppm SA; T_4: 3% sucrose + 100-ppm STS; T_5: 5% sucrose + 100-ppm CA; T_6: 5% sucrose + 100-ppm SA and T_7: 5% sucrose + 100-ppm STS.

Days to basal floret senescence

Maximum days required for the basal floret senescence of yellow gladiolus spike by T_4 (12.4) which was statistically similar to the T_3 (12.1) and T_4 (11.8) whereas minimum from T_0 (5.5) (Table 01).

No of floret open during basal floret senescence

Maximum number of floret open during the basal floret senescence of yellow gladiolus spike was found from T_4 (10.5) which was statistically similar with the T_3 (10.4), T_2 (10.4), T_6 (10.0), T_7 (10.0) and T_5 (9.9) (Table 1). On the other hand, minimum was found from T_0 (7.2) which were statistically similar with T_1 (7.8) (Table 01).

Solution absorption

Amount of the solution absorption by yellow gladiolus spike was varied significantly among the preservative solution. Maximum solution absorption was found from T_4 (48.8 ml/spike) whereas minimum from T_0 (23.1 ml/spike) (Table 01).

Vase life (days)

Vase life of the yellow gladiolus was varied significantly among the preservative solutions. Maximum vase life was found from T_4 (21.5 days) followed by T_3 (20.2 days) while minimum from T_0 (13.7 days) (Table 01).

Incidence of stem rotting

Stem rotting was not found at T_2, T_3 and T_4 preservative solutions whereas rest of the preservative solutions showed the incidence of stem rotting (Table 01).

Table 01. Assessment of different pulsing treatments on yellow gladiolus to different post harvest related attributes

Treatments	Days to basal floret senescence	No of floret open during basal floret senescence	Solution absorption (ml/spike)	Vase life (days)	Incidence of stem rotting
T_0	5.5 f	7.2 b	23.1 g	13.7 f	positive
T_1	7.3 e	7.8 b	28.0 f	16.3 e	positive
T_2	11.8 ab	10.4 a	33.3 cd	19.9 bc	negative
T_3	12.1 ab	10.4 a	34.8 b	20.2 b	negative
T_4	12.4 a	10.5 a	47.8 a	21.5 a	negative
T_5	10.0 d	9.9 a	30.9 e	18.5 d	positive
T_6	10.6 cd	10.0 a	32.4 d	19.0 cd	positive
T_7	11.3 bc	10.0 a	33.6 c	19.4 bcd	positive
LSD0.05	*1.0*	*1.0*	*0.9*	*0.9*	
CV%	*5.5*	*5.9*	*1.7*	*3.0*	

T_0: Control (Tap water); T_1: 100-ppm STS; T_2: 3% sucrose + 100-ppm CA; T_3: 3% sucrose + 100-ppm SA; T_4: 3% sucrose + 100-ppm STS; T_5: 5% sucrose + 100-ppm CA; T_6: 5% sucrose + 100-ppm SA and T_7: 5% sucrose + 100-ppm STS.

IV. Discussion

A large number of factors such as pre-harvest conditions, packaging and post harvest handling as well as storage interfere in the vase life. STS in association with 3% sucrose has been found to play key role in regulating the vase life related attributes and vase life of yellow gladiolus. Spike diameter, fresh weight loss (%), floret opening (%), days to basal floret senescence, no. of floret open during basal floret senescence, flower longevity was varied due to the variation of pulsing treatments (Mehraj *et al.*, 2013; Marandi *et al.*, 2011). Present study denoted that vase life of yellow gladiolus varied from 13.7-21.5 days due to the variation of the pulsing treatments. The vase life of the gladiolus spike was maximum 21.0 days reported by Marandi *et al.* (2011) and their finding was closely related to the present study. Significant toxic properties of chemical preservatives such as STS on environment trends researchers intend to find a novel way to enhancement longevity of cut flowers. STS - ethylene production inhibitor was added to sucrose solutions 3% to improvement the vase life of gladiolus cut flowers, which enhanced the longevity of cut flowers. Sucrose in combination with STS increased the vase life of cut flowers (Beura *et al.*, 2001). Sucrose and STS act similarly at least on soluble sugar changes and ethylene production that are associated with inhibiting flower senescence (Zhang and Leung, 2001). Pulsing gladiolus spikes with sucrose resulted in increased glucose and fructose concentration and improved the maintenance of high starch concentration in the floret during flower opening. Adding STS to the holding solution increased the concentrations of glucose and fructose in florets may improve sucrose uptake and its subsequent hydrolysis (Meir *et al.*, 1995). Other beneficial effects of STS are their antimicrobial activity and it is showed that STS decreased the bacterial population in cut flowers (Torre and Fjeld, 2001). Addition of STS (100ppm) with 3% sucrose to vase water was shown to extend the longevity of cut yellow gladiolus. STS with sucrose increase the shelf life of gerbra (Khan et al., 2015a) while SA with sucrose increase in rose (Khan et al., 2015b) and tuberose (Jamal Uddin et al., 2016). Addition of SA in holding solution had positive effect on cut white gladiolus also extended vase life in association with 3% sucrose. Mehraj et al. (2016) found SA as avase

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life extending solution with chitosan as a carbohydrate sources in gerbera. SA protects to grow basal pathogens as well as for the inducible defense mechanism, systemic acquired resistance which confers resistance against a broad-spectrum of pathogens (Chaturvedi and Shah, 2007). SA inhibited ethylene biosynthesis and delayed senescence progress in plant tissues (Leslie and Romani, 1986). Pathogens also affect vase life due to vascular blockage. SA will make acidic solution that inhibits bacteria growth and proliferation. Addition of SA (100ppm) with 3% sucrose to vase water also shown to extend the longevity of cut yellow gladiolus.

V. Conclusion

From the results of the present study it can be concluded that 3% sucrose + 100-ppm STS was the best preservative solution for yellow gladiolus. 3% sucrose + 100-ppm SA also provided the better result in terms of the other preservative solutions. Thus both the preservative solutions could be used as the preservative solutions for the yellow gladiolus.

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