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Vaselife analysis of gladiolus using different vase solutions

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ABSTRACT

The experiment was conducted in the Horticulture Laboratory of Institute of Agriculture and Animal Science, Lamjung, Nepal in order to identify the effect of the different vase solution on the postharvest life of gladiolus and to find out the best vase solution that enhance and prolongs the better flower quality and the longevity. Experiment was carried out with the nine treatment T_1 (distilled water), T_2 (150ppm HQS + 4% sucrose), T_3 (250ppm citric acid), T_4 (150ppm GA3 + 4% Sucrose), T_5 (150ppm HQS+150ppm AgNO3 + 4% sucrose),T_6 (4% sucrose), T_7 (150ppm AgNO3 + 4% sucrose), T_8 (250ppm citric acid + 4% sucrose), T_9 (150ppm salicylic acid + 4% sucrose) under completely randomized design with three replications. Gladiolus (white friendship) spikes were harvested at 2-3 floret color break stage and two spikes after the slanting cut were kept in each vase. The vase solution 150ppm HQS + 150ppm AgNO3 + 4% sucrose showed maximum water uptake; longer days for basal floret senescence (8 days) with the maximum floret open during basal senescence (9.76), maximum flowering 83.20 %, minimum fresh weight loss(18.03% at 12 days) and the longest vase life of 15 days followed by 150ppm salicylic acid + 4% sucrose (11.67days), 250ppm citric acid + 4% sucrose (10.67 days) whereas short vase life of 5 days was observed in control. 150ppm HQS + 150ppm AgNO3 + 4% sucrose vase solution was found best to extend the vase life of gladiolus.

Key Words: *Antimicrobial, Ethylene inhibitor, Gladiolus, Sucrose and Vaselife*

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I. Introduction

Gladiolus (*Gladiolus grandiflorus L.*) a "Queen of bulbous flowers" belonging to *Iridaceae* family is a glamorous flower, a flower of perfection also known as 'sword lily' because of shape of its leaves. It is one of the renowned cut flower in the world (Bai *et al.* 2009) as well as in Nepal. It is the first commercially grown cut flower crop in Nepal since 1988 (10 ropani) and ranks number one in terms of production and consumption in Nepal occupying about 365 ropani (CBS 2012) of land under its cultivation. About 6000-8000sticks of gladiolus are demanded daily in Kathmandu (FAN 2013).

Short postharvest vase life is one of the most important problems in cut flowers (Zamani *et al.* 2011) and exvitro establishment of plants and plant parts/flowers is crucial in floriculture (Sultana et al. 2011; Siddique et al. 2007; Siddique et al. 2006). But with the increasing production value of cut flower, it is imperative to achieve a good keeping quality of harvested cut flower. Short vase life of cut flowers is related to wilting, ethylene production which accelerates the senescence of many flowers and vascular blockage by air and microorganisms (Elgimabi 2011) that causes continuing water uptake and transpiration by leaves of cut flowers results in net loss of water of flower and stem tissue (Hassan 2005) thus reduce the vase life of cut. The typical life of these florets spike placed in water using as vase solution is 4 to 6 days (Mayak *et al.* 1973). Using appropriate preservatives could help to extend these vaselife of the floret spikes for consumer satisfaction and exploitation of the business. Preservative solutions are generally required to supply energy source, reduce microbial build up and vascular blockage, increase water uptake of the stem, and arrest the negative effect of ethylene (Nigussie, 2005).Thus, preservative containing the sugar, germicides and ethylene inhibitor as a vase solution would prolongs the vase solution. Sucrose that supplies the needed substrates for respiration and prolongs vase life, enables cut flowers harvested at the bud stage to open (Pun and Ichimura, 2003), citric acid that act as a *pH* regulator reduces bacterial proliferation and enhances the water conductance in xylem of cut flowers (van Doorn 1997), HQS an antimicrobial agent (Ketsa *et al.* 1995), $AgNO_3$both potent to antimicrobial and ethylene inhibitor, Salicylic acid that inhibit ethylene production (Vahdati Mashhadian *et al.* 2012), GA3 that endure membrane stability, and delays senescence (Emongor 2004), improve the water, carbohydrate contents of cut flower and can used for the improvement of longevity of cut flowers as commercial purpose.

II. Materials and Methods

The experiment was conducted at the Department of Horticulture, institute of agriculture and animal science, Tribhuwan University, Lamjung, Nepal during the month of March-April 2015. White colored uniform gladioli spikes were harvested at 2–3 florets color break stage from Chitwan, Nepal. After that spikes were pulsed in sugar solution for two minutes, were wrapped by newspaper, and were loosely tied with a rope. They were brought to horticulture lab of IAAS, Lamjung after three hours of journey from Chitwan to Lamjung, and in horticultural lab of Lamjung spikes were given Slanting cut to provide more solution accumulated area under water to avoid air embolism before placing in vase solution. The study was conducted by following Completely Randomized Block Design (CRD) with three replications. Nine treatments were exerted in experiment considering availability and easily usable in flower vase of one's commercial purpose and the treatments were, distilled water (T1); 150ppmHQS + 4%sucrose (T2); 250ppmcitric acid (T3);100ppmGA3 + 4%sucrose (T4); 150ppmHQS + 150ppm$AgNO_3$ + 4%sucrose (T5); 4%sucrose (T6); 150ppm$AgNO_3$ + 4%sucrose (T7); 250ppmcitric acid + 4%sucrose (T8); 150ppmsalicylic acid+ 4%sucrose (T9). Two spikes were kept in each vase solution and kept in room temperature (mean 27^{o}C) during the period of experiment and the vase solutions were changed after six days. Flowers on vase solutions were examined as and when necessary and continued up to the end of vase life of flower. Fresh weight of cut gladioli was measured before treating. Different days after treating weight of gladioli were measured and percentages weight losses were calculated. Water uptake, days to basal senescence, number of floret opening during basal senescence and floret opening percentage was carefully observed and calculated. Flower longevity was allowed during the upper floret opening and counting the days. Data were tested to meet the assumptions of ANOVA, those that did not met the assumptions were subjected to log transformation. Data was analyzed by using SPSS 16.0 version and means were separated by using Duncan's test at 0.05 level.

III. Results and Discussion

Effect of different treatment on water uptake (g) and fresh weight gain or loss (%) of gladiolus

Water uptake

Water uptake was varied highly significantly among the different treatment at 6th day. Maximum water uptake 7.89g was found in150ppmAgNO3+ 4%sucrose followed by 150ppmHQS + 150ppmAgNO3 + 4%sucrose with the minimum 1.51g in control (Table 01). Similarly the variation in water uptake was

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non- significant among the different treatments at 12th days but mean comparison showed maximum water uptake in 150ppmHQS+ 150ppmAgNO3+ 4%sucrose while zero in control (Table 01). Results of the present study can be explained on basis of antimicrobial property of HQS and AgNO3 that play an important role in improving the water uptake of gladioli cut flowers by preventing the growth of microorganism in xylem and thus maintained water uptake by flower stems.

Fresh weight gain or loss percentage

At 6th day the different treatment had no significant effect in fresh weight gain of gladioli spikes. The highest fresh weight gain of 30.79% was observed in 150ppm HQS+ 150ppm AgNO3+ 4% sucrose followed by 150ppm AgNO3+ 4%sucrose and 150ppm HQS+ 4% sucrose while 9.8% weight loss by control. But at 12th day there was significant effect on fresh weight loss with the minimum fresh weight loss (18.03%) by 150ppm HQS+ 150 ppmAgNO3+ 4% sucrose followed by 150ppm AgNO3 +4% sucrose and 150ppm HQS +4% sucrose while maximum weight loss (44.26%) by control(Table 1). Among all the treatments; 150ppm HQS+ 150 ppm AgNO3+ 4% sucrose afforded minimum fresh weight loss (%), this might be due to maximum uptake of water with reserve food. As HQS and AgNO3 in vase solution act as a germicide improving the water uptake and sucrose act as reserved food.

Table 01. Effect of different vaselife solution on water uptake and fresh weight gain or loss percentage of gladiolus in Lamjung Campus

Treatments	Water uptake at 6th day(g)	Water uptake at 12th day(g)	Fresh weight gain or loss at 6th day (%)	Fresh weight gain or loss at 12th day (%)
T_1 (distilled water)	1.51^{f}	-3.48	-9.8	-44.26^{d}
T_2 (HQS+sucrose)	5.78^{bc}	1.19	16.30	-22.96^{ab}
T_3 (citric acid)	3.25^{de}	4.62	4.94	-35.11^{cd}
T_4 (GA3+ Sucrose)	4.42^{cd}	0.90	2.84	-35.46^{cd}
T_5 (HQS+AgNO3+sucrose)	6.31^{ab}	6.69	30.79	-18.03^{a}
T_6 (sucrose)	1.99^{ef}	5.10	0.41	-35.46^{cd}
T_7 (AgNO3+sucrose)	7.48^{a}	1.82	22.03	-20.23^{ab}
T_8 (citric acid+sucrose)	4.52^{cd}	1.07	14.12	-27.73^{ab}
T_9 (salicylic acid+sucrose)	4.94^{cb}	4.37	7.67	-31.27^{bc}
Significance	**	**	NS	*

Means in columns followed by the same letter(s) are not significantly different at P=0.05.

Effect of different vaselife solution on days to first basal senescence, no of floret open during basal senescence, maximum flowering and longevity of gladiolus

Days to basal floret senescence

Days to basal floret senescence was varied highly significantly among the different treatments. The maximum days (8 days) for basal senescence was observed in 150ppm HQS + 150ppm AgNO3 + 4% sucrose followed by 150ppm salicylic acid+ 4% sucrose(7.33days), which was statistically at par with 150ppmHQS + 4%sucrose and 150ppmAgNO$_3$ + 4%sucrose, whereas minimum in control (3.67 days) (Table 02). It is because treatment with anti-ethylene compounds and anti-microbial compounds increased the amount of carbohydrates to flower, water uptake by flower; inhibit the ethylene production that caused the early senescence. As AgNo$_3$ is both potent ethylene inhibitor and antimicrobial agent and salicylic acid is ethylene inhibitor (Vahdati Mashhadian *et al.* 2012), treatment containing these take a longer day to basal floret senescence than other.

Number of floret opening during basal floret senescence

At the period of basal floret senescence, the number of floret opening was significant among the different treatments. Maximum number of floret (9.67 florets) was opened during basal floret senescence in 150ppmHQS + 150-ppmAgNO3 + 4%sucrose treatment while least (4.33 florets) was in control (Table 02).

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Floret opening percentage

Floret opening was significantly varied among the treatments at 12th days after treating. However, floret opening percentage was highest in150ppmHQS+ 150ppmAgNO3+ 4%sucrose (83.20%) which was statically at par with 150ppm salicylic acid+ 4% sucrose(78.12%),150 ppm HQS + 4% sucrose(76.95%) and 150-ppm $AgNO_3$ + 4% sucrose (74.99%) while minimum 32.28% was in control (Table 02).

Flower longevity

Highly Significant variation was found on flower longevity among treatments (Table 02). Cut gladioli were stayed maximum 15 days in flower vase when treated with 150ppm HQS+ 150ppm AgNO3+4% sucrose followed by 150ppm salicylic acid +4% sucrose (11.67days), 250ppm citric acid+4% sucrose (10.67 days) while short vaselife of 5 days was observed in control. It is due to the fact that Short vase life of cut flowers is generally related to wilting, ethylene production and vascular blockage by air and microorganisms (Elgimabi, 2011). But when sucrose in combination with antimicrobial agent and ethylene inhibitor is used a synergistic effect, which improves the water balance and osmotic potential since HQS and AgNO3 inhibits the microbial growth, arrest the negative effect of ethylene (Nigussie, 2005) and sucrose was observed to reduce moisture stress in cut flowers by affecting stomata closure, preventing transpiration and water loss as well as it provides energy required by flower. Thus resulting in longer vaselife. Asrar (2012) found longer vaselife (14 days) for snapdragon treating with 200pppmHQS+sucroseon vase life while only 3-4 days in pure water and Cho and Lee (1980) found doubled vase life in cut rose when treated with 3% Sucrose+50 ppmAgNO3 compared to control that justify the current finding.

Table 02. Effect of different vaselife solution on days to first basal senescence, no of floret open during basal senescence, maximum flowering and longevity of gladiolus in Lamjung Campus

Treatments	Days to first basal senescence	No. of floret open during basal senescence	Floret opening % at 12th days	Flower longevity(Days)
T_1 (distilled water)	3.66^{d}	4.33^{c}	32.28^{c}	5^{e}
T_2 (HQS+sucrose)	6.66^{ab}	7.67^{abc}	76.95^{a}	9^{cd}
T_3 (citric acid)	5.33^{cd}	4.67^{c}	47.91^{bc}	6.33^{de}
T_4 (GA3+ Sucrose)	5.66^{bc}	6^{abc}	51.04^{bc}	8.67^{cd}
T_5(HQS+AgNO3+sucrose)	8^{a}	9.67^{a}	83.20^{a}	15^{a}
T_6 (sucrose)	5.33^{cd}	5.67^{bc}	37.49^{c}	9.33^{cd}
T_7 (AgNO3+sucrose)	6.66^{ab}	9.33^{abc}	74.99^{a}	8.67^{cd}
T_8 (citric acid+sucrose)	5.66^{bc}	6.67^{abc}	67.83^{ab}	10.67^{bc}
T_9 (salicylic acid+sucrose)	7.33^{ab}	8.67^{ab}	78.12^{a}	11.67^{bc}
significance	**	*	**	**

Means in columns followed by the same letter(s) are not significantly different at P=0.05.

IV. Conclusion

With the changing life style, urban affluence and modernizations gladiolus is emerging as a new agri-venture in Nepal but the short postharvest life is the major problem. But by using the appropriate preservatives or vase solution postharvest flower quality and the longevity can be enhanced and prolongs. Sucrose in combination with antimicrobial (HQS and AgNO3) and ethylene inhibitor (AgNO3) agent increased carbohydrate to flower, increased water uptake, delay senescence, maintain turgidity of flower, reduced bacterial proliferation and xylem blockage resulting in better flower quality and longevity.

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