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Influence of pulsing and holding solutions in vase-life of *Gladiolus* cv. American beauty

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Abstract
The results revealed that the vase life were found maximum (11.37days) with the 10% sucrose +8-HQ 200ppm in the factor A. In case of factor B Silver Nitrate @ 50ppm gave the better vase life of (10.80days). In the interaction effect treatment combination 8% sucrose + 8-HQ 200ppm + Citric acid @ 2000ppm gave the maximum vase life of (11.94days).In the factor A the percentage of floret opening was recorded maximum (93.10%) in 10% sucrose + 8-HQ 200ppm and in the factor B Citric acid @ 2000ppm gave the maximum (89.28%). In case of interaction 8% sucrose + 8-HQ 200ppm + Citric acid @ 2000ppm gave the maximum of (95.21%).Diameter of floret were found maximum (12.36cm) with the 2% sucrose + 8-HQ 200ppm in factor A and in factor B it was found maximum (11.71cm) with Aluminum sulphate @ 300ppm.in case of interaction treatment combination maximum diameter (13.18cm) were found with 2% sucrose + 8-HQ 200ppm + Aluminum sulphate @ 300ppm. In the water relation factor A 8% sucrose + 8-HQ 200ppm and factor B Silver Nitrate @ 50ppm showed the remarkable influence on water uptake (61.7ml) and water balance (0.981) as individual and in the interaction effect also. The minimum water losses (60.86ml, 60.99ml) were observed with the factor A 8% sucrose + 8-HQ 200ppm and factor B Silver Nitrate @ 50ppm but in case of interaction the minimum loss (60.36ml) were found with the distilled water + Silver Nitrate @ 50ppm.

Keywords: pulsing, holding solution, vase-life

Introduction
Bulbous plants constitute as one of the most important groups of plants grown for their floral wealth. Gladiolus (*Gladiolus grandiflorus)* is considered to be the “queen of bulbous flowers”. The genus Gladiolus belongs to the family Iridaceae. The word gladiolus was coined by Pliny the Elder (AD 23-79) and has been derived from a Latin word “Gladius” meaning “Sword” (sword like leaves of plant). It has gained popularity owing to its magnificent, unsurpassed beauty, attractive colours, various sizes and shapes of flowers with long lasting spikes. The modern cultivated gladiolus has a complex ancestry of natural and artificial hybridization involving at least a dozen species (Everett, 1981) [3]. Gladiolus is cultivated as a commercial cut flower crop in India. In India the area under gladiolus cultivation is estimated to be 9.3 thousand ha with a production of 6869.9 lakh cut flowers.
Prolongation of the vase life of cut flowers, which began as an amateur interest, has now become a commercial practice based on scientific principles. Cut flowers are living tissues with an active metabolism, subject to the same basic ageing phenomenon as that of other plant parts. Flowers harvested from the plants generally deteriorate much more quickly than other flowers left on the plant under similar environmental conditions because in detached flowers the continuity of water from roots to the flowers is disrupted. The flowers are highly perishable and therefore need to be treated with suitable chemicals, to enhance their vase life and improve quality (Talukdar and Barooah, 2011) [12]. There are reports that improper postharvest handling accounts to 20 to 30% of cut-flower loss during marketing. . Keeping this point in view, the present experiment was undertaken to determine the post-harvest handling of harvested spikes using pulsing and holding solutions.

Materials and Methods
The experiment was conducted in the departmental laboratory, Department of Floriculture Medicinal and Aromatic plants, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, Pundibari, at ambient temperature range 26-30ºC in Factorial-CRD (Factorial Completely Randomized Design). Individual spikes of uniform length were used for the experiment.

Spikes were harvested with the help of sharp knife by giving a slant cut when one or two basal florets are started to open. Immediately after harvest, the spikes were put in water to remove the field heat. The spikes were prepared by removing all the leaves and then they are placed in prepared solutions. The total 15 treatment combinations where first factors as pulsing solution and second factor as holding solution were taken as cited below.

Treatment details

Factor - A	**Pulsing Solutions**
S_0	Control (Distilled water)
S_1	2% sucrose + 8HQ 200ppm
S_2	5% sucrose + 8HQ 200ppm
S_3	8% sucrose + 8HQ 200ppm
S_4	10% sucrose + 8HQ 200ppm
Factor - B	**Holding Solutions**
H1	Citric acid @ 2000ppm
H2	Aluminum sulphate @ 300ppm
H3	Silver Nitrate @ 50ppm

The observations were also recorded on floral characters like Vase life in days, Diameter of the floret (cm), Total water uptake by spikes (ml), Percentage of floret opening, Water loss (ml) and Water balance (ml).

Results and Discussion

In the present experiment Sucrose and 8-Hydroxyquinoline were used as a pulsing solution namely 2% sucrose + 8-HQ 200ppm, 5% sucrose + 8-HQ 200ppm, 8% sucrose + 8-HQ 200ppm, 10% sucrose + 8-HQ 200ppm. Three different holding solutions containing Citric acid at the rate of 2000ppm, Aluminum sulphate at the rate of 300ppm and Silver Nitrate at the rate of 50ppm were used in combination with the pulsing solutions to evaluate the post-harvest longevity of Gladiolus cv. American Beauty. Results revealed that vase-life; percentage of opening of florets and diameter of floret were influenced significantly by the various levels of pulsing and holding solutions. The maximum days of vase-life were obtained from the pulsing solution containing 10% sucrose + 8-HQ 200ppm. In case of holding solutions treatment with Silver Nitrate @ 50ppm recorded the longest post-harvest life. The interaction effect of pulsing and holding solutions represent the pulsing with 8% sucrose + 8-HQ 200ppm followed by placing the spikes in holding solutions containing Citric acid @ 2000ppm perform the best results in respect of vase-life of cut spikes of Gladiolus. The exogenous supply of sucrose maintained the carbohydrate reserve in cut spikes which was utilized during the postharvest life of flower and thereby enhanced vase-life of gladiolus (Kumar, 2005) [5]. Sucrose is only effective when used with antimicrobial agents in pulsing and holding solutions otherwise stem xylem is blocked by microbes (Singh *et al*., 2000) [11]. 8-Hydroxyquinoline is an organic compound well known for its biocidal and germicidal effect with lesser mammalian toxicity. Here this compound acted as a stem sterilants allowing better uptake of sucrose solution leading to build up of carbohydrate reserve in the cut spike (Pal *et al*., 2003) [8].
10% sucrose + 8-HQ 200ppm when used in pulsing solution resulted maximum percentage of floret opening. Holding solution comprising Citric acid @ 2000ppm performs better. In this aspect the interaction effect of the factors revealed that treatment combination S_3H_1 (8% sucrose + 8-HQ 200ppm followed by Citric acid @ 2000ppm) was found helpful regarding % of floret opening. Increased uptake of cut flowers placed in citric acid in present experiment suggesting a possible decrease in xylem blockage due to reduced microbial growth also observed by (Azizi and Onsinejad, 2015) [1]
The diameter of the floret was influenced by the sole use of pulsing and holding solutions as well as in the combination respectively. The maximum floret diameter was found pulsing solution 5% sucrose + 8-HQ 200ppm and the treatment H_2 (Aluminum sulphate @ 300ppm) gave the better result as holding solution. In case of their interaction was found statistically non-significant. Many workers found better results with aluminum sulphate as vase solution in Gladiolus. The spikes held in Aluminium sulphate showed increased floret diameter, vase life and fresh weight gain. Aluminium sulphate when used as a pulsing agent at 300ppm for 24 hours increased the vase-life apart from maintaining the quality (Danai and Yongyout, 1989) [2]. Aluminium sulphate at 0.5 and 1.0μM in combination with sucrose increased the vase life over control in gladiolus (Gowda and Gowda, 1990) [4]. $Al_2(SO4)_3$ proved effective in showing the greater percentage of blooming florets and significantly promoted the vase-life of cut tuberoses (Mukhopadhyay, 1980) [6].
The water uptake was found better with the treatment combination S_3H_2 (8% sucrose + 8-HQ 200ppm followed by Aluminum sulphate @ 300ppm in the first year, second year as well as in pooled effects too. The water loss was found minimum with S_0H_3 (distilled water followed by Silver Nitrate @ 50ppm). In case of water balance the treatment combination S_3H_3 (8% sucrose + 8-HQ 200ppm followed by Silver Nitrate @ 50ppm) performed better in all the cases. Schnabl (1976) [10] observed that aluminium sulphate was effective when applied as a foliar spray in reducing transpiration losses thus improving longevity of cut rose and carnations. Presence of aluminum in the holding solution reduces transpiration and improves the water balance of cut roses inducing Stomatal closure. Namita *et al*., (2006) [7] reported that the gladiolus cut flowers held in solution of sucrose @ 4% and aluminum sulphate @ 400ppm recorded maximum floret diameter, floret longevity, floret opening, and water uptake. Reddy and Singh (1996) [9] reported that increase in water uptake by pulsing of gladiolus might be due to translocated sugars accumulated in flowers increased the osmotic potential thereby improved the ability of spikes to absorb water.

Table 1: Effect of pulsing and holding solutions in vase-life (days), Percentage of floret opening (%) and Diameter of the basal floret (cm) of cut spike of Gladiolus (*Gladiolus grandiflorus* L.) cv. American Beauty

Treatments	**Vase-life (Days)**			**Percentage of floret opening**			**Diameter of basal floret (cm)**		
	Year 1	Year 2	**Pooled**	Year 1	Year 2	**Pooled**	Year 1	Year 2	**Pooled**
Factor-A									
S_0	8.98	9.41	9.17	81.75	82.19	81.97	10.06	9.95	10.00
S_1	10.72	9.58	10.16	86.51	85.78	86.15	11.47	10.86	11.17
S_2	11.07	10.89	11.03	91.09	91.09	91.09	12.30	12.42	12.36
S_3	10.42	11.43	10.81	91.9	92.18	92.07	11.95	11.52	11.74
S_4	11.37	11.04	11.23	92.8	93.33	93.10	11.68	11.44	11.56

S.Em(±)	0.16	0.35	0.19	0.27	0.41	0.41	0.24	0.23	0.59
C.D. at 5%	0.48	1.02	0.57	0.78	1.19	1.25	0.18	0.68	0.20
Factor-B									
H_1	10.31	10.35	10.25	75.48	89.04	89.28	11.32	10.76	11.04
H_2	10.38	10.43	10.42	81.03	88.43	88.49	11.58	11.84	11.71
H_3	10.80	10.64	10.77	73.99	89.27	88.86	11.57	11.12	11.35
S.Em(±)	0.12	0.27	0.15	0.21	0.32	0.32	0.18	0.18	0.15
C.D. at 5%	0.37	ns	ns	0.60	ns	ns	ns	0.53	0.46
Interaction AXB									
$S_0 H_1$	8.32	8.36	8.34	79.35	79.11	79.23	9.62	9.52	9.57
$S_0 H_2$	8.37	9.45	8.91	85.22	86.36	85.79	10.15	10.25	10.20
$S_0 H_3$	10.01	10.44	10.26	80.71	81.11	80.91	10.42	10.08	10.25
$S_1 H_1$	9.63	9.42	9.53	85.25	84.19	84.72	10.93	10.65	10.79
$S_1 H_2$	10.74	9.77	10.28	84.60	84.22	84.41	11.50	11.22	11.36
$S_1 H_3$	11.80	9.58	10.69	89.69	88.96	89.33	11.98	10.73	11.36
$S_2 H_1$	10.82	10.88	10.83	92.88	92.37	92.62	12.13	12.28	12.21
$S_2 H_2$	11.75	10.71	11.23	91.20	89.48	90.34	13.03	13.33	13.18
$S_2 H_3$	10.65	11.09	11.04	89.20	91.44	90.32	11.75	11.66	11.71
$S_3 H_1$	12.38	12.22	11.94	95.19	95.23	95.21	12.80	10.92	11.86
$S_3 H_2$	9.70	10.74	10.22	90.69	88.54	89.62	11.72	12.39	12.05
$S_3 H_3$	9.20	11.35	10.27	90.03	92.79	91.41	11.34	11.26	11.30
$S_4 H_1$	10.40	10.89	10.65	94.95	94.34	94.65	11.13	10.45	10.79
$S_4 H_2$	11.37	11.48	11.45	91.06	93.57	92.32	11.52	12.03	11.78
$S_4 H_3$	12.35	10.77	11.59	92.59	92.09	92.34	12.39	11.87	12.13
S.Em(±)	0.28	0.61	0.34	0.46	0.71	0.71	0.42	0.41	0.35
C.D. at 5%	0.83	ns	1.00	1.36	2.07	2.17	1.22	ns	ns

Table: 2: Effect of pulsing and holding solutions in Water uptake, Water loss and Water balance of cut spike of Gladiolus (*Gladiolus grandiflorus* L.) cv. american beauty

Treatments	**Water uptake (ml)**			**Water loss (ml)**			**Water balance**		
	Year 1	Year 2	**Pooled**	Year 1	Year 2	**Pooled**	Year 1	Year 2	**Pooled**
Factor-A									
S_0	58.27	58.18	58.23	62.41	66.31	61.91	1.073	1.057	1.063
S_1	57.97	58.91	58.44	61.37	64.84	61.53	1.059	1.049	1.053
S_2	60.20	60.78	60.49	60.54	65.66	61.73	1.004	1.037	1.023
S_3	60.40	61.96	61.18	59.01	65.67	60.86	0.970	1.013	0.996
S_4	60.07	61.35	60.71	60.61	65.72	61.69	1.008	1.024	1.018
S.Em(±)	0.41	0.43	0.28	0.33	0.31	0.24	0.010	0.008	0.008
C.D. at 5%	1.20	1.26	0.83	0.97	0.90	ns	0.030	0.024	0.023
Factor-B									
H_1	58.71	58.98	58.85	61.49	64.71	61.82	1.049	1.055	1.051
H_2	60.05	60.42	60.24	61.13	64.73	61.81	1.018	1.037	1.028
H_3	59.38	61.30	60.35	59.74	64.81	60.99	1.008	1.016	1.013
S.Em(±)	0.32	0.33	0.22	0.26	0.24	0.19	0.008	0.006	0.006
C.D. at 5%	0.93	0.97	0.64	0.75	ns	0.55	0.024	0.019	0.018
Interaction AXB									
$S_0 H_1$	56.30	56.33	56.32	63.45	61.66	62.56	1.127	1.095	1.111
$S_0 H_2$	59.37	59.35	59.36	63.22	62.43	62.82	1.066	1.052	1.059
$S_0 H_3$	59.17	58.88	59.03	60.58	60.13	60.36	1.025	1.022	1.023
$S_1 H_1$	55.78	56.75	56.26	61.97	60.39	61.18	1.112	1.064	1.088
$S_1 H_2$	60.10	60.59	60.35	62.55	62.28	62.42	1.041	1.028	1.034
$S_1 H_3$	58.05	59.40	58.73	59.59	62.38	60.99	1.027	1.050	1.038
$S_2 H_1$	60.44	61.33	60.89	61.67	63.18	62.43	1.020	1.030	1.025
$S_2 H_2$	60.28	57.68	58.98	59.38	62.20	60.79	0.985	1.079	1.032
$S_2 H_3$	59.88	63.34	61.61	60.57	63.37	61.97	1.012	1.001	1.006
$S_3 H_1$	60.59	60.21	60.40	58.70	62.58	60.64	0.969	1.040	1.004
$S_3 H_2$	60.65	62.23	61.44	60.06	62.74	61.40	0.991	1.009	1.000
$S_3 H_3$	59.96	63.45	61.70	58.29	62.80	60.55	0.972	0.990	0.981
$S_4 H_1$	60.46	60.31	60.39	61.69	62.94	62.32	1.020	1.044	1.032
$S_4 H_2$	59.89	62.28	61.09	60.46	62.83	61.64	1.010	1.009	1.010
$S_4 H_3$	59.88	61.47	60.68	59.71	62.52	61.12	0.998	1.017	1.008
S.Em(±)	0.72	0.75	0.49	0.58	0.54	0.42	0.018	0.014	0.014
C.D. at 5%	2.09	2.18	1.43	1.69	1.56	1.24	ns	0.043	ns

References

1. Azizi S, Onsinejad R. Effect of Citric Acid on Vase Life, Solution Uptake and Chlorophyll Content of Cut Lisianthus (*Eustoma grandiflorum* L.) flowers. Journal of Agricultural and Biological Science. 2015; 10 (11).
2. Danai B, Yongyout K. Effect of storage time, varieties and chemicals on quality of cut gladiolus. Journal of Agriculture. 1989; 5(2):115-122.
3. Everett TH. New York Botanical Garden Illustrated Encyclopedia of Hort. 5 Gar.land N. Y. 1981, 1485-1490.
4. Gowda JVN, Gowda VN. Effect of calcium, aluminum and sucrose on vase life of gladiolus. Journal of Crop Research 1990; 3(1):105-106.
5. Kumar R. Studies on postharvest handling of cut spike of gladiolus. M.Sc. (Ag.) Thesis submitted to Punjab Agriculture University, Ludhiana, Punjab, India, 2005.
6. Mukhopadhyay A. Effect of chemicals on the floral development and vase life of tuberose (*Polianthes tuberose*). South Indian Horticulture. 1980; 28:281-284.
7. Namita J, Ramesh K, Kushal S. Response of vase solution on keeping quality of cut spikes of gladiolus. Journal of Ornamental Horticulture. 2006; 9(4):296-297.
8. Pal A, Kumar S, Srivastava R. Effect of floral preservatives on post harvest management in gladiolus spikes. Journal of Ornamental Horticulture. 2003; 6(4):367-371.
9. Reddy BS, Singh K. Effect of aluminium sulphate and sucrose on vase life of Tuberose. Journal of Maharashtra Agriculture University. 1996; 21(2):201- 203.
10. Schnabl H. Aluminous als Friischaltenitted fur Schnittblumen deutsch. Gartenban. 1976; 30:859-860.
11. Singh K, P Singh, JS Arora, RPS Mann. Studies on postharvest management of gladiolus. Journal of Ornamental. Horticulture. 2000; 3:107:23-25.
12. Talukdar MC, Barooah L. Effect of Pulsing and Different Holding Solutions on Flower quality and Vase life of Tuberose (*Polianthes tuberose* Linn) cv. Calcutta Double. Indian Journal of Hill Farming. 2011; 24(1):31-33.