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Impact of certain chemicals on vase-life of different cultivars of China aster and gladioli

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ABSTRACT

Two set of experiments were carried out to investigate the effect of vase solution made of different chemicals on vase-life and quality of cut flowers of gladiolus and China aster cultivars. Out of the four vase solutions applied, the treatment with 200 ppm citric acid, 200 ppm $AgNO_3$, 5% sucrose and 0.02% Tween-20 was observed to be the best followed by 200 ppm citric acid, 200ppm $CoNO_3$, 5% sucrose and 0.02% Tween-20, resulting in the longest vase-life and maximum weight gain at third day and total solution uptake. Correlation revealed that floret diameter had a strong positive correlation with loss in weight of vase solution up to ninth day, total weight loss of vase solution, floret opening per cent and vase-life in various cultivars of both crops.

Key words: Preservatives, vase solution, vase-life, China aster, gladioli.

INTRODUCTION

Gladiolus is an important florist crop popular as cut flower in the domestic and international market. The spikes are highly perishable and need to send market immediately after harvest. China aster is one of the most popular of all garden annuals grown throughout the world. The vase-life of China aster cut flowers is in general more other than that of other annuals grown for cut flowers.

Post harvest treatments are aimed at preferentially encouraging the process under quality traits, including flower size, flower opening, shape, colour and longevity. Use of floral preservatives at all stages of flower handling and marketing is known to improve the flower quality, longevity and better consumer acceptability. According to concentration and time of application, preservative solutions may be classified into three groups *viz.*, pulsing solution, vase solution and bud opening solution (Bhattacharjee, 2). Vase solutions are meant to hold flowers continuously till the termination of their vase-life. The main constituents of floral preservatives are water, sugar and biocides. Besides mineral nutrients, acidifying agents, anti-ethylene compounds and growth regulators are also used in floral preservatives. It has been shown that antimicrobial compounds in the vase solution prolong the vase-life. Singh *et al*. (8) conducted trial on various biocides in vase solution and found that biocides effectively controlled bacterial growth but did not increase vase-life appreciably. Their efficacy increased only when used along with sucrose. Prolonging the vase-life depends on water balance and retardation of senescence which can be achieved by the use of sucrose and certain chemicals (Beura and Singh, 1). Since, ethylene plays critical roles in flower senescence; it is desirable to inhibit the ethylene action. The inhibitors used for such action are CO_2, silver ions and cyclic olefins (Nowak, 6). Although, the involvement of plant growth hormones in senescence process of flowers has been thoroughly investigated, however, the actual mechanism of action still is not clear (Bhattacharjee, 2). Therefore, present investigation was planned to study the relative impact of certain chemicals on vase-life of different cultivars of China aster and gladioli.

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MATERIALS AND METHODS

The two cultivars of gladiolus (White Friendship and Nova Lux) and two cultivars of China aster (Kamini and Shashank) were used for this investigation. The flowers were harvested in the afternoon using sharp knives. Gladiolus spikes were cut when basal floret just showed colour whereas, China aster flowers were cut at paint brush stage and immediately put in the bucket containing cold water. The basal portion of stems was re-cut at 2 cm from the point of previous cut. Selected three cut flowers of all cultivars were put in the each graduated conical flask having 4% sucrose, 200 ppm citric acid, 0.02% Tween-20 plus 200 ppm of various chemical compounds like $AgNO_3$, $CoNO_3$, ABA and 2,4-D. Distilled water with 4% sugar, 200 ppm citric acid and 0.02% Tween-20 was treated as control. The treatments were replicated five times in completely randomized design at ambient temperature of 21-22°C coupled with 80% humidity. The fresh weight and changes in weight of each flower was recorded using digital analytical balance. Observations were recorded for, weight loss of solution, flower diameter and vase-life after two days interval till the end of experiments. The above experiment was conducted during August-September 2006, at floriculture laboratories of VCSG College of Horticulture, G.B. Pant Univ. Agric. Tech., Bharsar, Pauri Garhwal. Correlation analysis was carried out as per the formulae suggested by Fisher (5).

RESULTS AND DISCUSSION

The data presented in Table 1 showed that maximum diameter of first florets of White Friendship cultivar was in $AgNO_3$ followed by control, $CoNO_3$, ABA and 2,4-D whereas Nova Lux cultivar had the maximum floret diameter in $AgNO_3$ which was *at par* with control. The minimum flower diameter was recorded in control for both cultivars. This fact was also in agreement with Nelofar and Paul (7). Positive correlation exists in floret diameter and among various parameters such as loss in weight of vase solution at sixth day, ninth day, total weight loss of vase solution, floret opening per cent and also on vase-life whereas, negative correlation were found in weight loss in vase solution at third day and unopened florets per cent.

In both cultivars of gladiolus the maximum opening per cent of the florets were recorded with $AgNO_3$ followed by $CoNO_3$, and control (Figs. 1 & 2). However, minimum opening per cent in both cultivars were observed with 2,4-D followed by ABA and $CoNO_3$. The increase in diameter and floret opening by mineral salts such as $AgNO_3$ might be due to the fact that mineral salts increased the osmotic concentration and the pressure potential of the petal cells thus improving their water balance and quality of cut flower spikes (Beura and Singh,1).

In White Friendship cultivar, the maximum weight loss of vase solution at third day was found in 2,4-D solution, whereas, it was minimum in ABA solution which was *at par* with $AgNO_3$. $AgNO_3$ resulted in

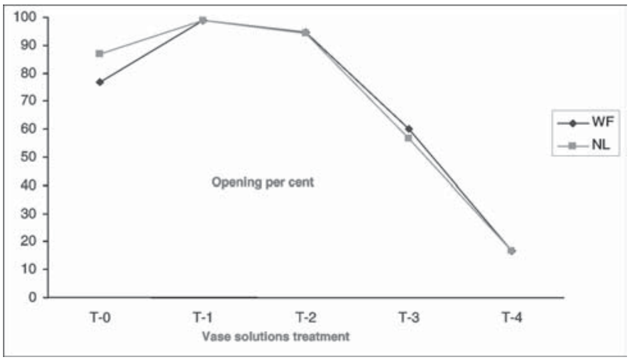

Fig. 1. Impact of vase solutions on perfect florets opening in gladiolus cultivars.

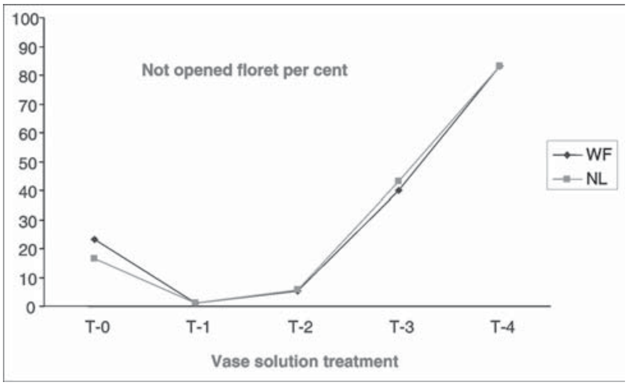

Fig. 2. Impact of vase solutions on non-opened florets in gladiolus cultivars.

maximum weight loss in vase solution at third day in Nova Lux cultivar. Least weight loss was observed in the control of same cultivar. At sixth day both cultivars absorbed maximum solution from treatment of $AgNO_3$ and 2,4-D. The minimum solution was absorbed by cut flowers of White Friendship treated with ABA solution. Whereas, least solution was absorbed by Nova Lux cultivar in control at same day. At ninth day regarding the weight loss of $AgNO_3$ solution with both the cultivars were found to be similar as recorded at sixth day and minimum weight loss was with ABA of White Friendship and control of Nova Lux cultivars. In both cultivars the final weight loss of vase solutions was maximum in $AgNO_3$ and minimum with 2,4-D and control of white Friendship and Nova Lux, respectively.

Spike's vase-life was maximum with $AgNO_3$ and minimum with 2,4-D treatment in both cultivars. The decrease in vase-life might be due to promotion of ethylene production by 2,4-D. Preservatives act primarily by improving solution uptake thereby enhancing vase-life (Nelofar and Paul, 7).

In both the cultivars of China aster, the fresh weight increased to the maximum level at third day and then gradually decreased. The maximum weight gain at third in both cultivars were observed with $AgNO_3$ treatment which was *at par* with $CoNO_3$ in Kamini, whereas it was minimum in 2,4-D treatment for both the cultivars. Weight gain was statistically similar in 2,4-D, ABA and control at third day of both cultivars. The similar findings were reported by Sivasamy and Bhattacharjee (9), Tiwari and Singh (10), and Dixit *et al*. (4) on rose cut flowers to initial increment of fresh weight. The decrease in fresh weight at petal senescence might be due to the reduced level of starch, cell wall polysaccharides, proteins and nucleic acid. Ethylene induces rapid hydrolysis of storage materials due to which heavy weight loss and senescence was noticed in flowers held in distilled water (Tiwari and Singh, 10).

Table 1. Impact of various chemicals on vase-life of two gladiolis cultivars.

Treatment	Flower diameter (first floret)		Loss in weight of solution (g) at								Vase-life (days)	
			third day		sixth day		ninth day		Total solution			
	WF	NL	WF	NL	WF	NL	WF	NL	WF	NL	WF	NL
Control (T_0)	9.06^{b}	9.06^{ab}	22.33^{b}	9.50^{b}	28.58^{b}	9.46^{b}	27.00^{b}	5.25^{b}	109.74^{b}	38.42^{b}	10.00^{b}	11.66^{b}
$AgNO_3$ (T_1)	10.16^{a}	9.90^{a}	15.79^{a}	3s6.11^{a}	47.40^{a}	54.28^{a}	56.69^{a}	63.36^{a}	197.88^{a}	228.73^{a}	14.00^{a}	14.66^{a}
$CoNO_3$ (T_2)	8.86^{b}	8.80^{b}	20.46^{c}	24.51^{c}	20.36^{b}	38.08^{c}	37.32^{c}	56.18^{c}	128.50^{c}	180.23^{c}	12.33^{c}	14.00^{a}
ABA (T_3)	8.66^{b}	8.33^{c}	15.38^{a}	13.13^{d}	14.68^{b}	16.18^{d}	19.26^{d}	22.89^{d}	105.71^{d}	127.95^{d}	7.33^{d}	7.00^{c}
2,4-D (T_4)	8.16^{c}	7.83^{d}	33.20^{d}	21.83^{e}	41.16^{a}	35.54^{e}	28.99^{e}	36.85^{e}	103.80^{d}	82.21^{c}	5.00^{e}	5.00^{d}
CD at 5%	0.48	0.42	1.28	2.59	9.45	0.7152	2.68	1.90	4.09	1.75	1.55	1.936

i) Same letter in each column means differences are non-significant at 5% level of significance.
ii) Basal solution consisting of 4% sugar, 200 ppm citric acid and 0.02% Tween-20.
WF : White Friendship NL : Nova Lux .

Table 2. Impact of various chemicals on vase-life of two different China aster cultivars.

Treatment	Weight gain in cut flower at third day		Loss in wt. (g) of cut flower at senescence		Flower dia. (cm)		Loss in weight of solution (g)								Vase-life (days)	
							At third day		At sixth day		At ninth day		Total solution			
	Kamini	Shashank	Kamini	Shashank	Kamini	Shashank	Kamini	Shashank	Kamini	Shashank	Kamini	Shashank	Kamini	Shashank	Kamini	Shashank
Control (T_0)	1.92^{b}	1.88^{b}	2.30^{a}	2.23^{b}	4.00^{a}	4.18	5.71^{b}	6.54^{a}	2.656^{ab}	2.993	12.46^{b}	13.71	4.50^{a}	2.66^{a}	19.00^{a}	19.00^{b}
$AgNO_3$ (T_1)	2.45^{a}	2.46^{a}	1.85^{ab}	1.85^{a}	4.77^{a}	4.09	7.00^{a}	6.53^{b}	3.940^{a}	3.846	21.16^{a}	14.45	5.10^{a}	3.26^{a}	20.33^{a}	21.66^{a}
$CoNO_3$ (T_2)	2.24^{a}	2.23^{c}	2.22^{a}	2.23^{b}	5.84^{a}	4.06	8.50^{c}	7.05^{a}	2.550^{b}	2.580	17.78^{a}	13.70	3.20^{b}	2.90^{a}	13.33^{b}	13.00^{c}
ABA (T_3)	1.90^{b}	1.88^{b}	1.64^{b}	1.73^{c}	3.33^{b}	3.22	4.46^{b}	4.73^{b}	1.576^{b}	2.600	9.08^{b}	10.51	2.96^{b}	2.16^{ab}	12.33^{b}	10.66^{d}
2,4-D (T_4)	1.79^{b}	1.86^{b}	1.79^{b}	1.76^{c}	5.23^{a}	3.59	4.82^{b}	4.67^{b}	2.376^{b}	2.296	12.41^{b}	10.56	2.06b	1.31^{b}	8.00^{c}	9.66^{d}
CD at 5%	0.26	0.21	0.42	0.30	1.62	NS	1.44	1.37	1.36	NS	4.67	NS	1.25	1.10	3.25	1.40

Same letter in each column means differences are non-significant at 5% level of significance

The diameter of flowers of cultivars Kamini and Shashank China aster was found to be maximum with $AgNO_3$ which was almost similar to that of control However, it was minimum with 2,4-D. The maximum vase-life was found with $AgNO_3$ treatment but it did not differ significantly over control. However, it was minimum in 2,4-D solution. Beyer (2) suggested that ability of silver to block specifically to action of ethylene is due to silver substitution for copper in a metallic receptor site for ethylene. Since, silver nitrate is relatively immobile in stems of flowers (Veen and Vande, 11), it could increase cut flower longevity only by reducing bacterial contamination or to some extent by acting as an anti-ethylene action agent in the wound on the cut surface due to which longest vase-life of both cultivars of China aster and gladiolus held in $AgNO_3$ solutions to that of 2,4-D solutions.

At third day maximum weight loss was recorded in the $AgNO_3$, $CoNO_3$ and control of both the cultivars and the significant differences of same trait was noticed at sixth day in cultivar Kamini in $CoNO_3$ solution over control. At ninth day $AgNO_3$ enhanced the maximum weight loss of solution holding flowers of cv. Kamini and minimum with ABA and 2,4-D. The total solution loss was maximum in $AgNO_3$ and $CoNO_3$. In solutions for holding Shashank cultivar of China aster,there was weight loss of solutions at third day, ninth day and total loss of solutions were non-significant, whereas at sixth day maximum loss was noticed with $AgNO_3$ treatment and minimum was with $CoNO_3$. Positive correlation were recorded among various post-harvest parameters such as weight gain at third day, loss in weight of cut flower, flower diameter loss in weight of vase solution and vase-life of flowers of both cultivars of China aster.

Thus, it is quite clear that in spite of different mode of actions each chemical significantly affected the vase life of China aster and gladiolus flowers. $AgNO_3$ @ 200 ppm alongwith 4% sugar, 200 ppm citric acid and 0.02% Tween-20 performed better than other chemicals in increasing the vase-life.

Table 3. Correlation among various parameters of post-harvest life as affected by various vase solutions in White Friendship gladiolus.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_2	-0.663						
X_3	0.426	0.337					
X_4	0.819	-0.259	0.690				
X_5	0.919	-0.489	0.598	0.955			
X_6	0.870	-0.640	0.163	0.780	0.799		
X_7	0.798	-0.779	-0.101	0.580	0.649	0.958	
X_8	-0.799	0.778	0.100	-0.581	-0.649	-0.959	-1

X_1 = Flower diameter; X_2 = loss in weight of solution at third day; X_3 = loss in weight of solution at sixth day; X_4 = loss in weight of solution at ninth day; X_5 = Total solution loss; X_6 = Vase life of White Friendship cultivar; X_7 = perfect florets opened per cent, X_8 = un opened florets per cent

Table 4. Correlation among various parameters of post-harvest life as affected by various vase solutions in gladiolus cultivar Nova Lux.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_2	0.507	1					
X_3	0.401	0.991	1				
X_4	0.369	0.947	0.957	1			
X_5	0.559	0.853	0.814	0.902	1		
X_6	0.886	0.474	0.400	0.465	0.578	1	
X_7	0.877	0.273	0.179	0.274	0.492	0.959	1
X_8	-0.878	-0.303	-0.210	-0.309	-0.527	-0.962	-0.999

X_1 = flower diameter; X_2 = loss in weight of solution at third day; X_3 = loss in weight of solution at sixth day; X_4 = loss in weight of solution at ninth day; X_5 = total solution loss; X_6 = vase-life of Nova Lux cultivar; X_7 = perfect florets opened per cent, X_8 = un-opened florets per cent.

Table 5. Correlation among various parameters of post harvest life as affected by various vase solutions in Kamini cultivar of China aster.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_2	0.898	1					
X_3	0.838	0.828	1				
X_4	0.901	0.868	0.892	1			
X_5	0.734	0.588	0.637	0.713	1		
X_6	0.863	0.709	0.822	0.906	0.922	1	
X_7	0.780	0.707	0.444	0.689	0.829	0.763	1
X_8	0.819	0.770	0.488	0.723	0.795	0.756	0.993

X_1 = Weight gain of cut flower at third day; X_2 = loss in weight of cut flower at senescence; X_3 = Flower diameter; X_4 = loss in weight of solution at third day; X_5 = loss in weight of solution at sixth day X_6 = loss in weight of solution at ninth day, X_7 = total solution loss, X_8 = Vase-life of Kamini cultivar.

Table 6. Correlation among various parameters of post harvest life as affected by various vase solutions in Shashank china aster.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_2	0.127	1					
X_3	0.535	0.770	1				
X_4	0.650	0.828	0.904	1			
X_5	0.738	0.040	0.538	0.512	1		
X_6	0.735	0.674	0.927	0.953	0.734	1	
X_7	0.784	0.506	0.675	0.857	0.778	0.899	1
X_8	0.603	0.354	0.761	0.681	0.926	0.861	0.794

X_1 = Weight gain of cut flower at third day; X_2 = loss in weight of cut flower at senescence; X_3 = flower diameter of Shashank; X_4 = loss in weight of solution at third day X_5 = Loss in weight of solution at sixth day; X_6 = loss in weight of solution at ninth day, X_7 = total solution loss, X_8 = Vase life of Shashank cultivar.

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