ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 45(4): 1603-1618,.(2007).

EXTENDING THE VASE LIFE OF SOLIDAGO CUT FLOWERS BY USING PRE- SHIPMENT TREATMENTS

BY

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ABSTRACT

The present investigation was carried out at Hort. Res. Inst., Giza. The spikes of *Solidago canadensis*, cv. "Tara "were harvested in two stages; viz., 10 and 30-40% of the inflorescences were opened . Four pulsing solutions were tested for 19 hours: i.e. distilled water (control), aluminum sulfate (0.4%) + 3% sucrose + 250 mg/l 8- HQC, GA_3 (300 ppm) + 250 mg/l 8- HQC + 3% sucrose and silver thiosulfate (1:4 m M) + 250 mg/l 8- HQC + 3% sucrose. After pulsing, the spikes were divided to two groups, the first group was placed in vases (control) containing distilled water whereas the second one was stored dry for 4 days at 5° C, before being placed in the vase solution (distilled water) in the laboratory. The obtained results revealed that stage II (30 – 40 % opening) gave the longest vase life and increased flower quality in stored and unstored spikes compared to stage I. The treatment of STS (1:4 m M) + 250 mg/l 8- HQC + 3% sucrose was the most effective pulsing solution in enhancing flower quality, increasing flower fresh weight percentage and chlorophyll content followed by GA_3 and aluminum sulfate descendingly in stored and unstored spikes. Harvest stage II (30 – 40 % opening) when pulsed in STS produced the highest inflorescence and leaves longevity and enhanced general appearance in stored and unstored spikes.

INTRODUCTION

The goldenrod (*Solidago canadensis*) is a rhizomatous perennial which belongs to Family Compositeae (Schwabe, 1980), and its single shoots bearing leaves and yellow inflorescences, are in demand as cut flowers. Flowering branches of goldenrod placed in water tend to show rapid leaf yellowing, even when kept in the light. The early leaf yellowing is the primary factor contributing to the loss of postproduction longevity of this cut flower. Leaf yellowing symptoms appear after only 2-3 days of vase life, while the longevity of the inflorescence varies between 5 and 9 days. One of the commonest means to retard leaf senescence and chlorophyll breakdown in cut flowers kept in darkness is by the application of growth regulators such as, cytokinins and gibberellins, the effects of which vary greatly among plant species. Gibberellins have been implicated in delaying foliar senescence of various cut flowers (D' Hont *et al.*, 1991: Han, 1995). Silver thiosulfate (STS) was used in various treatment techniques (basal, pre- treatment, pulsing and spraying) to defer senescence and to increase the vase life of cut sun flowers cv. Japanese Miniature (Eyini *et al.*, 1996).

Aluminum sulfate increased vase life as well as floret opening of cut tuberose. Aluminum sulfate exerted a dual effect in delaying the senescence of cut tuberoses by increasing the water uptake and reducing the water loss and thereby maintaining better water balance, leading to increased fresh weight and vase life (Bhaskar *et al.*, 1999). The storage of cut flowers makes it possible to adjust the supply to market demands. Moreover, storage makes it possible to accumulate large quantities of cut flowers for a single shipment or the ability to preserve seasonally produced flowers extends the period of their distribution to the market and to consumers. The storage of flowers effectively extends those sales season for such as gladiolus and snapdragons (Nowak and Rudnicki, 1990). This study examined the efficiency of GA_3, an ethylene antagonist (STS) and aluminum sulfate in retarding leaf yellowing, increasing vase life of inflorescence and test the response of solidago floret opening if floret harvested early at tight stage besides the effect of dry cold storage period on longevity of solidago cut spikes and some other characteristics were also considered.

MATERIALS AND METHODS

This research was carried out at the Ornamental Department, Horticultural Research Institute, Giza, Egypt for two successive seasons of 2006 and 2007. Spikes of *Solidago canadensis*, cv. "Tara "were freshly cut from a local nursery in two stages, when 10 and 30-40 % of the inflorescences are opened and immediately brought to the laboratory. The stem ends were trimmed to a uniform length of 80 cm and pulsed for 19 hours in the tested pulsing solutions:

1) distilled water (control).
2) STS (silver thiosulfate) 1:4 m M + 250 mg/l 8- HQC (Hydroxyquinoline citrate) + 30 g /l sucrose.
3) 300 ppm GA_3 + 250 mg /l 8- HQC + 30 g/l sucrose.
4) 0.4 % Aluminum sulfate + 250 mg /l 8- HQC + 30 g/l sucrose.

After pulsing the spikes were divided to two groups, the first was placed in vases containing 500 ml distilled water in the laboratory (20-22° C, 40-50% relative humidity and 24 hours photoperiod were supplied by fluorescent lamps 1000 lux). Whereas, the second one was stored dry in horizontal carton boxes (102 x 50 x 30 cm) for 4 days at 5° C, before being placed in the vase solution (500 ml distilled water) in the laboratory.

Parameters:

1- Inflorescence longevity was defined as the number of days in vase life required for inflorescence to reach browning of up 15% of the flowers.
2- Longevity of leaves was defined as the number of days in vase life required for 50% of the leaves to reach initiation of yellowing in 25% of leaf area.
3- General appearance refers to quality of the whole spike including leaves and inflorescence. Evaluation was based on a scale ranging from 1 to 5, when 1= good quality spikes with green leaves and semi- open flowers: 2= initiation of yellowing of lower leaves, part of the inflorescence fully opened: 3= browning of lower leaves, initiation of yellowing in leaves below the last inflorescence and inflorescence fully opened: 4= initiation of yellowing in the upper leaves with

inflorescence beginning to show symptoms of senescence: 5= wilting and browning of all leaves and whole inflorescence.

4- Evaluation of flower weight loss (%) at end of storage period.
5- Flower fresh weight increase (%) was determined by weighting the flowers at the beginning of the treatment and 4 day intervals.
6- Chlorophyll content (mg/g): was determined in fresh leaves calorimetrically according to Saric *et al.* (1967), from samples of cut leaf segments (0.5 g) taken on days 5, 7 and 10 of vase life.

Layout of the experiment:

The experimental design was completely randomized design in the two experiments. Experiment I (unstored spikes) consisted of 8 treatments (2 stages x 4 pulsing solution) and general appearance consisted of 24 treatments (2 stages x 4 pulsing solution x 3 period vase life (6,8,10 day). Experiment II (stored spikes) consisted of 8 treatments (2 stages x 4 pulsing solution) and general appearance consisted of 24 treatments (2 stages x 4 pulsing solution x 3 period vase life (6,8,10 day). Each treatment was replicated three times, each replicate consisted of 4 spikes.

Statistical analysis:

All data were subjected to statistical analysis according to the procedure reported by Snedecor and Cochran (1982) and means were compared by New Less Significant Different (L.S.D) range test at the 5 % level of probability in the two seasons.

RESULTS AND DISCUSSION

Experiment I:

The effect of harvest stage, pulsing solution and their interaction on *Solidago canadensis*, cv. "Tara "were examined:

1- Inflorescence and leaves longevity:

The results of Table (1) showed that the longevity of inflorescence and leaves were decreased as the spikes were harvested at the early stage 1 and the differences were significant in the second season. Also all pulsing solutions were significantly effective in increasing inflorescence and leaves than control. The most positive effect on both inflorescence and leaves longevity was obtained by STS + sucrose +8- HQC followed by GA_3 + sucrose +8- HQC. The highest effect of STS in enhancing inflorescence and leaves longevity were attributed to the effect of silver ion on preventing ethylene action as a causing flower senescence (Beyer, 1976 and Abeles *et al.,* 1992). The application of gibberellin to isolated carnation petals delayed their senescence (Garrog and Harris, 1978).

The results of interaction between harvest stage and pulsing solutions indicated that harvest spike at any stage and using STS + sucrose +8- HQC as a pulsing solution significantly increased inflorescence and leaves longevity over than the other treatments except (GA_3 + sucrose +8- HQC) the differences was non significant in both season. Nichols and Sussex (1982) mentioned that STS treatment of carnation cut flower increased flower life, especially when applied on the day, the flowers were cut.

Table (1): Effect of harvest stage and pulsing solution on longevity of inflorescence and leaves in Solidago candensis CV."Tara "cut spikes during two seasons (2006 and 2007).

Pulsing solution	Inflorescene						Leaves					
	Stage I	Stage II	Mean	Stage I	Stage II	Mean	Stage I	Stage II	Mean	Stage I	Stage II	Mean
	2006			2007			2006			2007		
Control (distilled water)	9.30	10.17	9.76	8.70	10.00	**9.35**	6.00	6.30	6.15	6.37	6.50	**6.44**
Aluminium sulfate + sucrose + 8- HQC	10.70	11.00	10.85	10.50	11.85	**11.18**	7.00	7.60	7.30	6.80	7.75	**7.28**
GA_3 + sucrose + 8- HQC	12.17	12.67	12.42	12.00	12.90	**12.45**	9.20	10.50	9.85	10.12	11.50	**10.81**
STS + sucrose + 8- HQC	13.33	13.80	13.57	13.00	14.00	**13.50**	10.25	11.25	10.75	11.00	12.37	**11.69**
Mean	**11.39**	**11.91**		**11.05**	**12.19**		**8.11**	**8.91**		**8.57**	**9.53**	

L.S.D at 5%

	Inflorescence						Leaves					
	2006			2007			2006			2007		
Factor	(A)	(B)	(A XB)	(A)	(B)	(AXB)	(A)	(B)	(AXB)	(A)	(B)	(A XB)
Value	0.85	1.20	1.70	0.86	1.21	1.73	0.86	1.22	1.71	0.88	1.25	1.77

(A) = Harvest stage, (B) = Pulsing solution, (AxB) = Harvest stage x Pulsing solutio

2- General appearance:

Results in Table (2 a, b) indicated that stage II showed the higher value of general appearance than stage I in both season.

The pulsing solutions STS + sucrose +8- HQC and GA_3 + sucrose +8- HQC retarded leaf yellowing. These two treatments were also the best ones in maintaining the quality of the whole spikes, which reached quality scores of 3.44 or 3.35 and 3.60 or 3.53, after 10 day of vase life in the first and second season, respectively.

Treatment GA_3 + sucrose +8- HQC was the most effective in enhancing general appearance as compared to other treatments. The results of interaction proved that stage II was the best combined with GA_3 + sucrose +8- HQC and STS + sucrose +8- HQC as a pulsing solution in both season. In this regard, Hadas *et al.*, (1996) on *Solidago Canadensis* mentioned that STS and BA both considerably delayed leaf yellowing and inhibited flower senescence in cut spikes during vase life.

3- The percentage of flower fresh weight increase in vases: Table (3) the results indicate that stage II showed higher value of increase in spike fresh weight than stage I in both season. Also all pulsing solutions were significantly effective when compared to control in both season.

The interaction (harvest stage x pulsing solutions) show that the most effective treatment in this regard was stage II x STS + sucrose + 8- HQC as a pulsing solutions in both seasons. El Saka (1992) pointed out an increase in fresh weight of cut tuberose spike up to 8 days when pulsed by STS or GA_3 in both season.

4-Chlorophyll content in leaf:

Data in Fig. (1 a.b) show that stage II increased the chlorophyll content as compared to stage I in both season. All pulsing solution increased chlorophyll content during vase life compared to control in both season.

The interaction between harvest stages and pulsing solution showed that stage II with all pulsing solution surpassed stage I and the highest chlorophyll content was recorded in the combination between stage II and STS or GA_3 treatments in both season. In general, chlorophyll loss is delayed by auxins, cytokinins and gibberellins (Nooden, 1988).

Experiment II:

Effect of dry cold storage period on the keeping quality of solidago spikes:

1- Spikes weight loss percentage during dry cold storage at 5° C:

The data in Table (4) clearly indicate that stage I exhibited more loss in weight than stage II in both season. The highest weight loss in either two stages was achieved with control followed by Aluminum sulfate, Gibberelin and STS were nearly similar in both season.

The results of interaction proved that stage II and pulsed with either STS or gibberellin was the best treatment in both season. The loss in fresh weight during storage period was originally due to loss of water and may very slightly to some consumption of respired materials.

Table (2 a): Effect of harvest stage, pulsing solution and vase life (6,8,10 day) on general appearance of *Solidago candensis* cv. "Tara" cut spikes during season (2006).

Treatment	Control (distilled water)				Aluminium sulfate + sucrose + 8- HQC				GA3 + sucrose + 8- HQC				STS + sucrose + 8- HQC				
	Vase life																
	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Means
Stage I	3.67	4.50	5.00	**4.39**	2.90	3.83	4.60	**3.78**	2.20	2.50	3.50	**2.73**	2.30	2.70	3.60	**2.87**	**3.44**
Stage II	3.00	4.00	5.00	**4.00**	2.20	3.33	4.00	**3.18**	1.90	2.33	3.20	**2.48**	1.98	2.40	3.28	**2.55**	**3.05**
Means	**3.33**	**4.25**	**5.00**	**4.20**	**2.55**	**3.58**	**4.30**	**3.48**	**2.05**	**2.42**	**3.35**	**2.61**	**2.14**	**2.55**	**3.44**	**2.71**	

On a scale of 1= bud stage to 5= senescence (see materials and methods).

Mean of days				
Treatment	**Day 6**	**Day 8**	**Day 10**	**Means**
Stage I	2.77	3.38	4.18	**3.44**
Stage II	2.27	3.02	3.87	**3.05**
Means	**2.52**	**3.20**	**4.02**	

L.S.D at 5%

Factor	**Stages (A)**	**Pulsing solution (B)**	**AxB**	**Vase life C)**	**AxC**	**BxC**	**AxBxC**
Value	**0.47**	**0.66**	**0.94**	**0.58**	**0.81**	**1.15**	**1.63**

Table (2 b): Effect of harvest stage, pulsing solution and vase life (6,8,10 day) on general appearance of *Solidago candensis* cv. "Tara" cut spikes during season (2007).

Treatment	Control (distilled water)				Aluminium sulfate + sucrose + 8- HQC				GA3 + sucrose + 8- HQC				STS + sucrose + 8- HQC				
	Vase life																
	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Means
Stage I	3.70	4.20	5.00	**4.30**	2.85	3.70	4.50	**3.68**	2.62	2.70	3.70	**3.01**	2.70	2.80	3.80	**3.10**	**3.52**
Stage II	3.00	3.96	5.00	**3.99**	2.35	3.15	4.20	**3.23**	2.00	2.50	3.35	**2.62**	2.37	2.55	3.40	**2.78**	**3.15**
Means	**3.35**	**4.08**	**5.00**	**4.14**	**2.60**	**3.43**	**4.35**	**3.46**	**2.31**	**2.60**	**3.53**	**2.81**	**2.54**	**2.68**	**3.60**	**2.94**	

On a scale of 1= bud stage to 5= senescence (see materials and methods).

Mean of days

Treatment	Day 6	Day 8	Day 10	Means
Stage I	2.79	3.35	4.25	**3.46**
Stage II	2.43	3.04	3.99	**3.15**
Means	**2.70**	**3.20**	**4.12**	

L.S.D at 5%

Factor	Stages (A)	Pulsing solution (B)	AxB	Vase life C)	AxC	BxC	AxBxC
Value	**0.47**	**0.66**	**0.94**	**0.58**	**0.81**	**1.15**	**1.63**

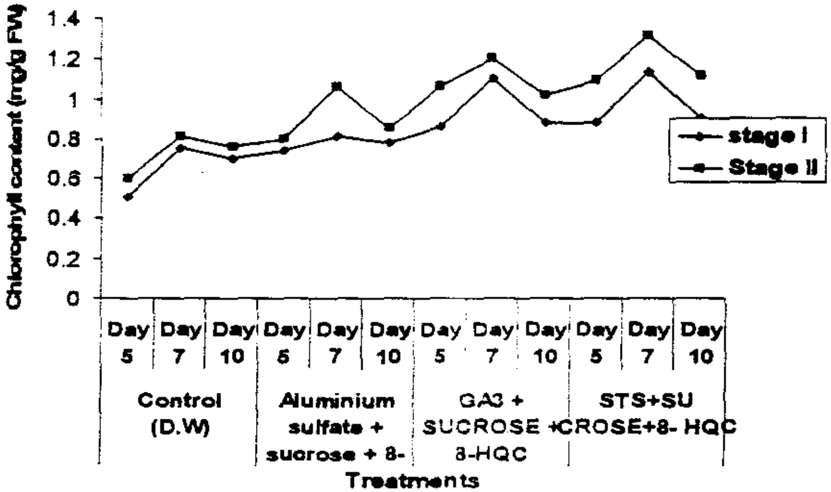

Fig (1 a): Effect of harvest stage and pulsing solution on chlorophyll content (mg /g FW) of Solidago candensis cv. (Tara) cut spike during vase life in season (2006).

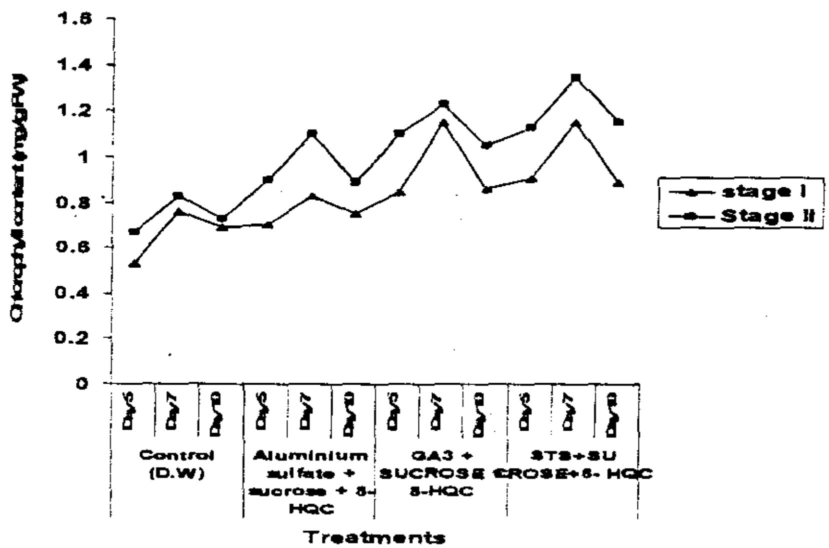

Fig (1 b): Effect of harvest stage and pulsing solution on chlorophyll content (mg /g FW) of Solidago candensis cv.(Tara)cut spike during vase life in season (2007).

2- The fresh weight increase percentage of spikes in vases following of storage period:

Data in Table (5) state that harvest stage II surpassed harvest stage I, in gaining increase in the fresh weight of spikes placed in vases. The increment percentage of harvest stage II ranged between 6.37- 6.16 %, where harvest stage I ranged between 5.24 – 5.53 % during the two season, respectively and the differences were significant only at the first season. The effect of pulsing solution proved that all pulsing solution significantly enhanced the fresh weight of spikes placed in vases after storage period than those pulsed in distilled water (control) in both season. However STS or GA_3 pulsing gained more weight increase than Aluminum sulfate and the differences were significant in both season.

The results of interaction (harvest stage x pulsing solution) show that all pulsing solution with harvest stage II resulted in more increase in fresh weight % than harvest stage I.

Table (3): Effect of harvest stage and pulsing solution on flower fresh weight % of Solidago candensis cv. "Tara" cut spikes during two seasons (2006 and 2007).

Treatment	Control (DW)	Aluminum sulfate + sucrose + 8- HQC	GA_3 + sucrose + 8- HQC	STS + sucrose + 8- HQC	Mean
2006					
Stage I	3.85	6.24	7.07	8.73	6.47
Stage II	4.25	7.00	8.57	9.30	7.28
Mean	4.05	6.62	7.82	9.02	
2007					
Stage I	3.65	6.00	8.05	9.00	6.68
Stage II	4.80	7.21	9.00	10.25	7.82
Mean	4.23	6.61	8.53	9.63	

L.S.D at 5%	2006			2007		
Factor	(A)	(B)	(A x B)	(A)	(B)	(AxB)
Value	0.85	1.20	1.70	0.86	1.22	1.72

(A) = Harvest stage, (B)= Pulsing solution, (AxB)= Harvest stage x Pulsing solution

Table (4): Effect of harvest stage and pulsing solution on weight loss % of Solidago candensis cv. "Tara" cut spikes after storage for 4 day at 5°C during two season (2006 and 2007).

Treatment	Weight loss %					
	Stage I	Stage II	Mean	Stage I	Stage II	Mean
	2006			2007		
Control (distilled water)	2.20	2.00	2.1	2.80	2.23	2.52
Aluminum sulfate + sucrose + 8- HQC	1.56	1.38	1.47	1.30	1.20	1.25
GA_3 + sucrose + 8- HQC	1.07	1.00	1.04	1.00	0.85	0.93
STS + sucrose + 8- HQC	1.04	0.83	0.94	0.90	0.57	0.74
Mean	1.47	1.30	1.39	1.50	1.21	1.36

However, the best treatment in this regard, the treatment of harvest stage II x pulsing in STS in vases following of storage period in both season. In this regard El – Saka and Auda (1997) on *Hippeastrum vittatum* pointed out that the spikes stored 5 – 6 weeks deteriorated in their feature and lost more weight.

Table (5): Effect of harvest stage and pulsing solution on the fresh weight increase % of Solidago candensis cv. "Tara" cut spikes after storage for 4 day at 5 °C during two season (2006 and 2007).

Treatment	Fresh weight increase %					
	Stage I	Stage II	Mean	Stage I	Stage II	Mean
	2006			2007		
Control (distilled water)	3.00	3.55	**3.28**	2.85	3.40	**3.13**
Aluminum sulfate + sucrose + 8- HQ C	5.00	5.91	**5.46**	5.37	5.80	**5.59**
GA3 + sucrose + 8- HQC	6.26	7.82	7.04	6.88	7.45	7.17
STS + sucrose + 8- HQC	6.69	8.18	7.44	7.00	8.00	7.50
Mean	**5.24**	**6.37**		**5.53**	**6.16**	

L.S.D at 5%	2006			2007		
Factor	(A)	(B)	(Ax B)	(A)	(B)	(AxB)
Value	0.86	1.22	1.72	0.91	1.29	1.83

(A) = Harvest stage, (B)= Pulsing solution, (AxB)= Harvest stage x Pulsing solution

3- Inflorescence and leaves longevity (days):

Results presented in Table (6) show that harvest stage II exhibited more inflorescence and leaves longevity than stage I but the difference was non significant in both season.

The effect of pulsing solution proved that all pulsing solution significantly increased inflorescence and leaves longevity over the control except Aluminum sulfate treatment on leaves longevity, the difference was non significant in both season. The spikes pulsed in STS or GA_3 were nearly similar in this regard.

The results of interaction proved that stage II and pulsed with either STS or GA_3 significantly increased inflorescence and leaves longevity over than the other treatments in both season. These results are in agreement with El – Saka and Auda (1997) stated that harvest stage I or II stored two weeks pulsed pre- storage with ancymidol or STS lasted in vases from 13.33 – 16.33 day.

4- General appearance in vases following of storage period:

Data show in Table (7a, b) reveal that stage II showed the higher value of general appearance than stage I and the difference was non – significant in both season. All pulsing solution maintained the quality of the whole spikes than control and the differences were significant in both season except with aluminum sulfate + sucrose + 8- HQC at the first season. The highest effective pulsing solution in this regard was GA_3 + sucrose + 8- HQC followed by STS + sucrose +8- HQC and aluminum sulfate + sucrose +8- HQC descendingly.

Table (6): Effect of harvest stage and pulsing solution on longevity (day) of inflorescence and leaves in *Solidago candensis* cv. "Tara" cut spikes after storage for 4 day at 5 °C during two season (2006 and 2007)

Treatment	Inflorescence			Leaves		
	Stage I	Stage II	Mean	Stage I	Stage II	Mean
	2006					
Control (distilled water)	9.00	9.80	**9.40**	5.27	5.98	**5.62**
Aluminum sulfate + sucrose + 8- HQC	10.00	10.50	**10.25**	6.20	7.00	**6.60**
GA_3 + sucrose + 8- HQC	11.00	11.60	**11.30**	8.30	9.00	**8.65**
STS + sucrose + 8- HQC	12.00	12.70	**12.35**	9.00	10.00	**9.50**
Mean	**10.50**	**11.15**		**7.19**	**7.99**	
	2007					
Control (distilled water)	8.00	9.00	**8.50**	5.50	6.00	5.75
Aluminum sulfate + sucrose + 8- HQC	10.00	11.00	**10.50**	6.00	7.00	6.50
GA_3 + sucrose + 8- HQC	11.37	12.00	**11.69**	9.00	9.95	9.48
STS + sucrose + 8- HQC	12.00	13.00	**12.50**	10.00	11.00	10.50
Mean	**10.34**	**11.25**		**7.63**	**8.49**	

L.S.D at 5%

	Inflorescence						Leaves					
	2006			2007			2006			2007		
Factor	(A)	**(B)**	(A xB)	(A)	**(B)**	(A xB)	(A)	**(B)**	(A xB)	(A)	**(B)**	(A xB)
Value	0.86	1.22	1.72	0.92	1.30	1.84	0.82	1.17	1.65	0.86	1.22	1.73

(A) = Harvest stage, (B)= Pulsing solution, (AxB)= Harvest stage x Pulsing solution

The data of interaction (harvest stage x pulsing solution) indicate that stage II combined with GA_3 + sucrose + 8- HQC was the best treatment compared to other treatments in both season.

5-Chlorophyll content in leaf following of storage period:

Data in Fig. (2 a,b) show that harvest stage II enhanced the chlorophyll content as compared to harvest stage I in both season. All pulsing solution increased chlorophyll content compared to control in both season. Treatment STS had the highest content of chlorophyll while the control had the least values in this respect.

The results of interaction state that the highest chlorophyll content was obtained by harvest stage II combined with STS and GA_3 in both season.

Table (7 a): Effect of harvest stage, pulsing solution and vase life (6,8,10 day) on general appearance of Solidago candensis cv. "Tara" cut spike storage for 4 day at 5° C during season (2006).

Treatment	Control (distilled water)				Aluminium sulfate + sucrose + 8- HQC				GA_3 + sucrose + 8- HQC				STS + sucrose + 8- HQC				
	Vase life																
	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Mean s	Means
Stage I	4.00	4.90	5.00	**4.63**	3.30	4.16	5.00	**4.15**	2.50	2.80	3.90	**3.07**	2.60	2.90	4.00	**3.17**	**3.76**
StageII	3.45	4.50	5.00	**4.32**	3.00	3.52	4.80	**3.77**	2.00	2.50	3.60	**2.70**	2.37	2.65	3.85	**2.96**	**3.44**
Means	**3.73**	**4.70**	**5.00**	**4.48**	**3.15**	**3.84**	**4.90**	**3.96**	**2.25**	**2.65**	**3.75**	**2.88**	**2.49**	**2.78**	**3.93**	**3.06**	

On a scale of 1= bud stage to 5= senescence (see materials and methods).

Mean of days				
Treatment	**Day 6**	**Day 8**	**Day 10**	**Means**
Stage I	3.10	3.69	4.48	**3.76**
Stage II	2.71	3.29	4.31	**3.44**
Means	**2.90**	**3.49**	**4.39**	

L.S.D at 5%

Factor	Stages (A)	Pulsing solution (B)	AxB	Vase life C)	AxC	BxC	AxBxC
Value	0.48	0.68	0.96	0.59	0.83	1.18	1.67

Table (7 b): Effect of of harvest stage, pulsing solution and vase life (6,8,10 day) on general appearance of *Solidago candensis* cv. "Tara" cut spike storage for 4 day at 5° C during season (2007).

Treatment	Control (distilled water)				Aluminium sulfate + sucrose + 8- HQC				GA3 + sucrose + 8- HQC				STS + sucrose + 8- HQC				
	Vase life																
	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Means	Day 6	Day 8	Day 10	Mean s	Means
Stage I	4.00	5.00	5.00	**4.67**	3.25	4.00	4.90	**4.05**	2.80	3.20	4.37	**3.46**	2.85	3.35	4.15	**3.45**	**3.91**
Stage II	3.56	4.80	5.00	**4.45**	3.00	3.70	4.70	**3.80**	2.30	3.00	3.80	**3.03**	2.40	3.17	3.88	**3.15**	**3.61**
Means	**3.78**	**4.90**	**5.00**	**4.48**	**3.13**	**3.85**	**4.80**	**3.96**	**2.55**	**3.10**	**4.01**	**2.88**	**2.63**	**3.26**	**4.02**	**3.06**	

On a scale of 1= bud stage to 5= senescence (see materials and methods).

Vase life				
Treatment	**Day 6**	**Day 8**	**Day 10**	**Means**
Stage I	3.23	3.89	4.61	**3.91**
Stage II	2.82	3.67	4.35	**3.61**
Means	**3.02**	**3.78**	**4.48**	

L.S.D at 5%

Factor	**Stages (A)**	**Pulsing solution (B)**	**AxB**	**Vase life C)**	**AxC**	**BxC**	**AxBxC**
Value	**0.48**	**0.68**	**0.96**	**0.59**	**0.83**	**1.18**	**1.67**

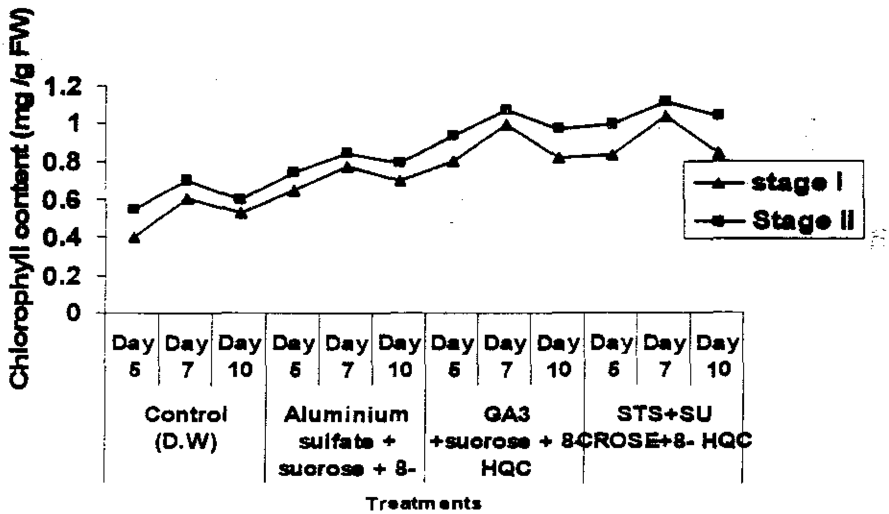

Fig. (2 a): Effect of harvest stage and pulsing solution on chlorophyll content (mg /g FW) of Solidago candensis cv. (Tara) cut spike during vase life following of 4 day simulation of transport at 5° C in season (2006).

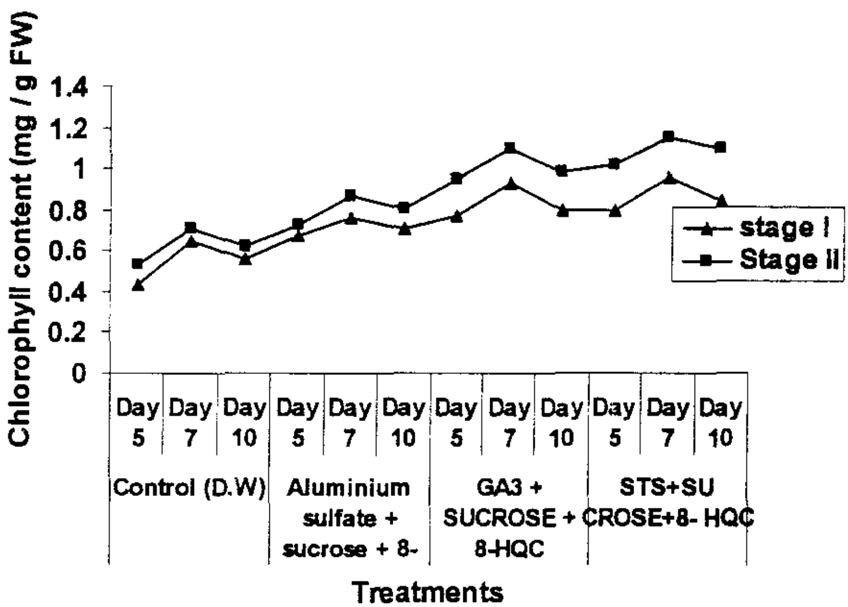

Fig (2 b): Effect of harvest stage and pulsing solution on chlorophyll content (mg /g FW) of Solidago candensis cv.(Tara) cut spike during vase life following of 4 day simulation of transport

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إطالة عمر أزهار السوليداجوالمقطوفة فى الفازات باستخدام معاملات ماقبل الشحن

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أجرى هذا البحث فى معهد بحوث البساتين بالجيزة خلال موسمى ٢٠٠٦ – ٢٠٠٧ على أزهار السوليداجوالمقطوفة صنف تارا والتى تم قطفها فى مرحلتين:

١- المرحلة الأولى: تفتح ١٠% من الزهيرات.

٢- المرحلة الثانية تفتح ٣٠ – ٤٠ % من الزهيرات.

وقد تم اختبار تأثير غمس قواعد سيقان الأزهار لمدة ١٩ ساعة فى الماء المقطر، سلفات الألومنيوم (٠,٤%) +٣ % سكروز+٢٥٠مجم/لتر ٨-هيدروسكى كينولين سترات، تيوسلفات الفضه ٤ : ١ ملليمول + ٣% سكروز + ٢٥٠ مجم/لتر ٨-هيدروكسى كينولين سترات، جبرالين ٣٠٠ جزء فى المليونَ + ٣% سكروز + ٢٥٠ مجم/لتر ٨ هيدروكسى كينولين سترات، قبل التخزين ثم قسمت الأزهار إلى مجموعتين:

المجموعة الأولى: أزهار الغرفة (بدون تخزين) وتم وضعها فى فازات بها ماء مقطر.

المجموعة الثانية: تم تخزينها تخزينا جافاً علىَ درجة ٥ °م لمدة ٤ أيام وبعد إنتهاء فترة النخزين تم وضعها فى فازات بها ماء مقطر تحت ظروف المعمل.

ومن أهم النتائج التى تم الحصول عليها:

١- كانت أزهار المرحلة الثانية (٣٠-٤٠ % تفتح) أطول عمرا وأحسن جودة من أزهار المرحلة الأولى سواء الأزهار الغير مخزنة أوالأزهار المخزنة .

٢- كانت معاملة الغمس فى ثيوسلفات الفضة أكثر تأثيراً فى زيادة عمر الأزهار وجودتها وزيادة الوزن الطازج للأزهار وكذلك محتواها من الكلوروفيل تليها المعاملة بالجبرالين ثم المعاملة بسلفات الألومنيوم سواء الأزهار الغير مخزنة أوالأزهار المخزنة .

٣- سجلت المرحلة الثانية للقطف (٣٠-٤٠ % تفتح) والتى تم معاملتها بثيوسلفات الفضة أطول عمراً لكلاً من النورات والأوراق وحسنت المظهر العام للأزهار المخزنة والغير مخزنة .