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Response of Asiatic Hybrid Lily Orange Tycoon Cut Flowering Stems to Some Pulsing and Holding Solutions, Storage Temperature and Their Interactions

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Abstract: A trial was consummated at Postharvest Lab. of Floriculture Res. Dept. Hort. Res. Inst. ARC, Giza, Egypt during 2011 and 2012 seasons to study the effect of pulsing in distilled water (D.W.), silver thiosulfate (STS) at 1:4 mM, gibberellic acid (GA_3) at 100 ppm and 100 ppm GA_3 + 5% sucrose (Suc) solutions for 30 minutes, holding in D.W. 2% Suc and 2% Suc + 200 ppm 8- hydroxyquinoline citrate (8-HQC) + 100 ppm GA_3 solutions till the end of vase life and storage under either the room temperature (21±1°C) or the cold storage at 0 and 2°C for 2 weeks, as well as their interactions on quality and longevity of Asiatic hybrid lily (*Lilium longiflorum* L. cv. Orange Tycoon) cut flowering stems using a factorial experiment arranged in a completely randomized design with three replicates, as each riplicate contained three cut flowering stems. The obtained results indicated that pulsing the cut flowering stems of the used hybrid lily in 100 ppm GA_3 + 5% Suc solution for 30 min. is the best treatment before transferring them to the preservative solution. Holding solution of 2% Suc + 200 ppm 8-HQC + 100 ppm GA_3 exhibited surpass over the other holding solutions, as it was significantly improved the change % in fresh weight of inflorescences, water uptake, logevity, photosynthetic pigments content in the leaves, as well as total carbohydrates % in the leaves and petals comparing with holding in D.W. and other preservative solutions. The previous measurements were also improved when flowering stems were immediately kept in the holding solutions under room temperature (21±1°C) rather than store them for 2 weeks at 0 and 2°C. However, holding cut flowering stems in 2% Suc + 200 ppm 8-HQC + 100 ppm GA_3 preservative solution at the room temperature after pretreatment with 100 ppm GA_3 + 5% Suc gave the best results at all when compared to the various individual and combined treatments accomplished in this study. Hence, it could be recommended to pulse the cut flowering stems of Asiatic hybrid lily cv. Orange Tycoon in 100 ppm GA_3 + 5% Suc solution for 30 minutes before holding them in 2% Suc + 200 ppm 8-HQC + 100 ppm GA_3 preservative solution under room temperature (21±1°C) for the best quality and freshness till the end of vase life.

Key words: *Lilium longiflorum* · Pulsing and holding solutions · Storage temperature

INTRODUCTION

Lilium is one of the most important genera of cut flower and pot plant production. It has always played a special role in the garden design due to the great number of species that can be adapted to many environments of garden. Moreover, the flower colors, the scents and the cultivar choice can guarantee a continuous flowering from spring to autumn. The use of *Lilium* cultivars for urban decoration can also be of great interest [1]. Lilies occupy the fourth position after rose, tulip and spray chrysanthemum for total sales and are considered one of the leading geophytes. There exist two groups, viz. Asiatic and Oriental hybrids. Lily is the common English name for flowering plants of the *Lilium* genus and they are extensively being grown in greenhouses as cut flowers and potted plants, but Asiatic lilies are strongly favoured in global flower trade due to wider choice of growing periods, array of colours and everlasting quality [2].

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The main symptoms that limit the length of vase life of cut lily inflorescences are abscission of floral buds, lack of flower opening, petal wilting and leaf yellowing. Floral bud abscission is regulated by ethylene and can be prevented by treatments with inhibitors of the ethylene receptor. Lack of bud opening is also alleviated by treatment with sugars which may reduce ethylene effects or act as a source of energy. The time to petal wilting is positively correlated with the levels of endogenous sugars. Leaf yellowing is apparently not affected by ethylene and is aggravated by the inclusion of sugars in the vase solution. However, a treatment with hormones, in particular GA_{4+7} and BA can prevent or elleviate the negative effects of sugars on leaf quality [3].

In this regard, Nowak and Mynett [4] stated that a continuous supply of sucrose together with 8-HQC to cut Lilium Asiatic hybrid "Prima" inflorescences resulted in bud opening satisfactorily and increased their longevity. The best results were obtained using 30g/l sucrose. To extent the vase life of cut Asiatic hybrid lily cvs. Corderia and Avignon, Song *et al*. [5] reported that pretreatments of 1mM STS + 10% sucrose and 0.2 mM STS + 10% sucrose +100 ppm GA_3 + 1mM $MnCl_2$ effectively prolonged the vase life and increased flowering %. The preservative solutions with 150ppm 8-HQS + 2% sucrose + 50ppm $AgNO_3$ and 200ppm 8-HQS + 3% sucrose +50ppm GA_3 significantly extended vase life 1.8 times as compared to the control and improved quality of cut lily significantly as judged by flowering percentage, fresh weight and solution absorption. The preservative solution of 200ppm 8-HQS + 3% sucrose + 50ppm GA_3 after pretreatment with 0.2 mM STS + 10% sucrose + 100ppm GA_3 + 1mM $MnCl_2$ was to keep the green foliage till the end of vase life.

Similar observations were also attained by Sindhu and Pathania [2] on Asiatic hybrid lily Alaska and Vivaldi; Lee and Suh [6] on *Lilium* Mid-Century hybrid Enchantment and *Lilium longiflorum* hybrid Jinsil; Ranwala and Miller [7] on 3 Asiatic hybrid lily cvs. Vermeer, Vivaldi and Marseille; Sharma *et al*. [8] on Asiatic lily; Barbosa *et al*. [9] on *Lilium longiflorum* cv. Ace; Gandaby *et al*. [10] on Asiatic hybrid lily cv. Canova; Asil [11] on 6 cultivars of Asiatic hybrid lilies (Amarone, Orlando, Pink Superior, Polyanna, Salsa and Vignola); Karimi and Asil [12] on *Lilium longiflorum* cv. Romano and SunAe *et al*. [13] who revealed that the holding solutions containing 3% sucrose + 200ppm 8-HQC + 50ppm $AgNO_3$ + 25 ppm GA_3 or 50% soda pop (cider) + 50% tap water + 40ppm NaOCl + 25ppm GA_3 significantly increased vase life, fresh weight, flower diameter of *Lilium* Oriental hybrid Casa Blanca cut flowers as compared with the control (distilled water). These treatments maintained high water balance and high chlorophyll content compared to control during senescence of flowers. The holding solution containing 3% sucrose + 200ppm 8-HQC + 50ppm $AgNO_3$ + 25ppm GA_3 maintained high levels of sucrose, glucose, fructose and total sugars for a long time comparing with the control. These results indicate that vase life and carbohydrate supply have a strong correlation. This finding was also confirmed by Burchi *et al*. [14] who found that application of sucrose (2g/l) improved stems height, petal length and colour and inflorescence vase life of two Asiatic lily cvs. Fangio and Cavalese.

A relatively short period of cold storage often drastically increases the number of floral buds that fail to open. It also hastens petal wilting, induces or increases leaf yellowing and promotes bud abscission. Therefore, several lily hybrids seem chilling sensitive. Some negative effects of cold storage can be alleviated by sugars and others by GA_{4+7}, with or without benzyladenine (BA). In this connection, Nowak and Mynett [4] clarified that cut lilium inflorescences could be stored at 1°C for 4 weeks without a great loss in potential vase life and decorative value when the inflorescences were pretreated with STS + 100g/l sucrose for 24h before cold storage, or kept after cold storage in a solution containing 30g/l sucrose + 200ppm 8-HQC. Such treatment greatly improved bud opening, increased the diameters of individual flowers and prolonged their life. Ranwala and Miller [7] declared that cold storage of flowers stem accelerated leaf chlorosis and reduced inflorescence longrvity in Asiatic hybrid lily cvs. Vermeer and Marseille, while GA_{4+7} at 100ppm prevented leaf chlorosis and increased flower longevity of cold-stored stems in a similar fashion that was observed in non cold- stored stems. Likewise, Ranwala and Miller [15] mentioned that cold storage caused several adverse effects on postharvest quality of potted Oriental, Asiatic and LA hybrid lily cultivars, including accelerated leaf yellowing or browning, bud abortion and reduced inflorescence longevity. However, treatment with GA_{4+7} plus BA significantly reduced all previous disorders and improved the overall postharvest quality after cold storage in darkness at 3°C for 2 weeks. On the same line were those results indicated by Sindhu and Pathania [2] on Asiatic hybrid lily Alaska and Vivaldi and Burchi *et al*. [16] on Asiatic hybrid Elite and Prato. On the contrary, Karimi and Asil [12] found that the effect of 4°C temperature on longevity of cut lilium flowers cv. Romano with mean 30.6 days was significantly higher than 22°C with mean of 10.5 days. Also, 4°C temperature showed better effects on other characteristics of cut lilium flowers irrespective of the chemicals used.

The present study aims to find out the suitable method for increasing vase life and quality of Asiatic hybrid lily cv. Orange Tycoon after harvest.

MATERIALS AND METHODS

A study was conducted at Postharvest Lab. of Floriculture Res. Dept. Hort. Res. Inst. ARC, Giza, Egypt during the two successive seasons of 2011 and 2012 to elicite the response of Asiatic hybrid lily cv. Orange Tycoon to pulsing solutions and holding in preservatives ones under either room temperature or pre-cooling treatment.

Cut flowering stems of Asiatic hybrid lily (*Lilium longiflorum* L.) cv. Orange Tycoon were freshly obtained on March, 1st for each season from the local commercial green houses of Floramix Farm (El-Mansouria, Giza). The flowering stems were picked in the early morning when the largest flower bud showed full colour. Flowering stems were cut at similar lengths of 60cm and directly wrapped in groups inside kraft paper and transported quickly to the laboratory within 2h. As soon as arrival to the Lab. the cut stems were firstly precooled by placing them in a cool water (5-7°C) for half an hour to remove the field heat. Then, stem bases were recut under water by removing about 3 cm and leaves up to 15 cm from the cut end were also removed to be away from surface of pulsing or holding solution.

Thereafter, the flowering stems were divided into similar and equal four groups (81 flowering stems per each group) and were pulsed for 30 minutes at about 20°C in one of the following solutions:

- Pulsing in distilled water, D.W. (referred to as control).
- Pulsing in silver thiosulphate (STS) solution at 1:4mM (prepared according to the method of Reid *et al.* [17]).
- Pulsing in gibberellic acid (GA_3) solution at 100ppm.
- Pulsing in 100ppm GA_3 + 5% sucrose (Suc) solution.

The percent of hydrogen (pH) in the previous pulsed solutions were evaluated and averaged in Table 1.

Table 1: pH value of pulsing solutions used in the two seasons

Pulsing solution composition	pH value
Distilled water (D.W.)	6.65
Silver thiosulphate, STS (1:4mM)	3.55
Gibberellic acid (GA_3) at 100ppm	3.40
100ppm GA_3 + 5% sucrose (Suc)	4.55

Table 2: pH value of holding solutions used in the two seasons

No.	Holding solution composition	pH value
1	Distilled water (D.W.)	6.65
2	2% sucrose (Suc) solution	6.28
3	2% Suc +200ppm 8-HQC + 100ppm GA_3 solution	3.57

At the end of pulsing period, the flowering stems of each group (81) were divided into 3 sets (27 flowering stems per each set). The first set from each pulsing treatment was transferred to hold in one of the following three preservative solutions for postharvest evaluation till the end of experiment under the room temperature (21±1°C,15 u mol m^{-2} S^{-1} fluorescent light for 12h/day) :

- Holding in distilled water (D.W.) as control.
- Holding in 2% sucrose (Suc) solution.
- Holding in 2% Suc + 200ppm 8-hydroxyquinoline citrate (8-HQC) + 100ppm GA_3.

A drop of xylene was added on the surfaces of the previous solutions to prevent evaporation throughout the vase life period. The percent of hydrogen (pH) in holding solutions were determined and illustrated in Table 2.

The second and third sets from each pulsing treatment were put into polyethylene bag of 13mM thickness (72×20 cm). The polyethylene bags were seald tightly and were packed in cardboard boxes (125×33×33 cm) which finally stored at either 0 or 2°C for 2 weeks at 80-85% relative humidity. After the end of cold-storage period, boxes with flowering stems inside were kept at 8-10°C for 3h, as preconditioning treatment to avoid temperature stress of the room. Then, each set (27 flowering stems) from each pulsing treatment was held in one of the three preservative solutions mentioned above.

The 27 flowering stems of each set were separated into 3 groups (9 flowering stems/group) and each group was subdivided into another 3 subgroups, each one of them was put in a clear glass jar to represent one replicate (3 flowering stems/replicate). Hence, the experimental layout in the two seasons was a completely randomized design in factorial experiment with 3 factors; pulsing solutions, holding solutions and the different storage temperatures [18].

The effect of different treatments on longevity and quality of cut lily inflorescences used in this work were determined through recording the following data every 4 days for 6 times in the first season and 7 times in the second one: the change percentage in inflorescence fresh weight, water uptake (g/ inflorescence) as the jars weighed every 4 days and the inflorescence longevity (number of days to wilting of the last open flower of the inflorescence). In ethanolic extracts, the content of chlorophyll a, b, total chlorophylls and carotenoids (mg/100g f.w.) in fresh leaf samples were measured according to Saric *et al*. [19], while in dry leaf and petal samples, total carbohydrates content (%) was colorimetrically assessed as described by Dubois *et al*. [20].

Data were tabulated and subjected to analysis of variance as a factorial experiment using MSTAT-C statistical software [21] and the means of various treatments were compared by Duncan's Multiple Range Test at 5% level as indicated by Waller and Duncan [22].

RESULTS AND DISCUSSION

Effect of Pulsing and Holding Solutions, Storage Temperature and Their Interactions On: The Change in Inflorescence Fresh Weight: Data in Table 3 show that all pulsing solutions caused a positive increment in fresh weight change percentage till the fifth day from cut in the first season, while till the ninth day in the second one with significant differences when compared to pulsing in D.W. in both seasons. A negative decremrnt was observed afterwards till the end of shelf life in the two seasons (after 21 and 25 days from cut in the first and second seasons, respectively). The differences among various pulsing solutions after the two first days; the thirteenth and the seventeenth day from cut were non-significant in the two seasons. In general, the highest increase in this trait in both seasons was gained by pulsing in 100ppm GA_3+5% Suc solution, followed by STS (1:4mM) solution and GA_3 alone at 100ppm concentration.

Increasing fresh weight of inflorescence in presence of GA_3 in the pulsing solution may be attributed to acceleration of cell elongation and maintenance of structural integrity of chloroplast membrane system, as well as stimulate photosynthesis [23]. Sucrose reduces stomatal opening and hence water loss which may lead to increase fresh weight of cut flowers [24]. In this concern, Marousky [25] declared that sucrose-treated roses absorbed less solution, but gained more weight than roses held in tap water due to induced stomatal closure and increased moisture retention.

On the other hand, data in Table 3 indicated that 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution was the most effective holding solution in improving the percent of change in fresh weight of inflorecences comparing with the other holding solutions throughout the different stages of vase life period in the two seasons. This may be ascribed to the synergistic effect of both GA_3 as promoter for cell elongation and photosynthesis and sucrose as a regulator for the water flux into the xylem vessels by controlling transpiration, as well as 8-HQC which decreases vascular blockage in stems, increases water absorption and stomata closure [24]. Sucrose alone at 2% concentration gave the least records in both seasons, even when compared to holding in D.W.

Cold storage for two weeks, either at 0 or 2°C significantly decreased the percent of change in fresh weight of inflorescences in comparison to storage at room temperature (21±1°C) that registered the highest change % in the two seasons (Table 3). Storage at 2°C was the worst treatment, as it led to wilting of the open flowers after 10 days from holding and failing the tight buds to open. Depletion of carbohydrate reserves and oxidative stress caused by cold storage were suggested mechanisms for the decrease in fresh weight of stored flowers and for rapid flower senescence in hybrid lilies [15]. In this concern, Van Doorn and Han [3] noted that cold storage often increases the number of floral buds that fail to open, hastens petal wilting, insreases leaf yellowing and promotes bud abscission. Similar results were also revealed by Sindhu and Pathania [2] on Asiatic lily hybrids of Alaska and Vivaldi ; Ranwala and Miller [7] on Asiatic lily cvs. Vermeer and Marseille and Burchi *et al*. [16] on Asiatic hybrid Elite and Prato.

As for interaction treatments, data in Tables 4 and 5 show that the change percentage in fresh weight of inflorescences was positive till the fifth day from cut under the various storage temperatures, while after the ninth and thirteenth day that was only true for the inflorescences stored under room temperature. The values of such parameter were negative afterwards till the end of vase period, which were the first two and twenty fifth days after cut in the first and second seasons, respectively. Inflorescences stored at 2°C wilted after the ninth day from cut irrespective of the pulsing or holding solution

Table 3: Effect of pulsing and holding solutions and storage temperature on the change percentage in fresh weight of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2011 and 2012 seasons

Treatments	First season:2011						
	Day						
Pulsing solution treatments	1st	5th	9th	13th	17th	21st	25th
D.W.	+0.34c	+0.56c	-5.01d	-6.84a	-8.54a	-8.77a	----
STS (1:4 mM)	+1.66ab	+3.15ab	-3.01b	-5.71a	-7.02a	-7.81a	----
100 ppm GA_3	+1.45b	+2.70b	-3.97c	-5.96a	-7.21a	-8.21a	----
100 ppm GA_3 +5%Suc.	+1.97a	+3.53a	-1.71a	-4.88a	-6.61a	-6.56a	----
Holding solution treatments							
D.W.	+1.51 a	+2.67 b	-3.94 b	-6.45 a	-7.94 a	-8.01 a	-----
2% Suc.	+0.66 b	+1.31 c	-6.98 c	-7.17 a	-9.01 a	-8.22 a	-----
2% Suc. +200ppm 8-HQC+100ppm GA_3	+1.91 a	+3.47 a	+0.66 a	-3.91 a	-5.11 a	-7.29 a	-----
Storage temperature treatments							
Room temperature	+1.70 a	+3.70 a	+4.48 a	-0.38 a	-7.13 b	-11.08 b	---
0°C (14 days)	+1.33 ab	+2.49 b	-5.31 b	-17.16 b	-14.90 c	-12.44 b	---
2°C (14 days)	+1.03 b	+1.27 c	-9.43 c	---	---	---	---
Treatments	Second season:2012						
Pulsing solution treatments							
D.W.	+2.38b	+2.83c	-0.46c	-4.46a	-7.52a	-9.94a	-5.61c
STS (1:4 mM)	+2.78ab	+4.61ab	+0.73b	-3.78a	-6.65a	-8.56a	-4.51a
100 ppm GA_3	+2.52ab	+4.03b	+0.18b	-3.98a	-7.33a	-9.40a	-5.06 b
100 ppm GA_3 +5%Suc.	+3.14a	+5.19a	+1.68a	-3.39a	-6.07a	-7.61a	-4.31a
Holding solution treatments							
D.W.	+2.67 ab	+4.23 b	+0.86 b	-3.93 a	-7.02 a	-9.36 a	-5.13 b
2% Suc.	+2.21 b	+3.26 c	-1.49 c	-4.81 a	-7.85 a	-10.11 a	-6.30 c
2% Suc. +200ppm 8-HQC+100ppm GA_3	+3.24 a	+4.99 a	+2.22 a	-2.97 a	-5.81 a	-7.17 a	-3.19 a
Storage temperature treatments							
Room temperature	+3.55 a	+5.17 a	+7.72 a	+5.02 a	-3.26 a	-7.98 a	-14.62 b
0°C (14 days)	+2.91 b	+4.44 b	-1.63 b	-16.73 c	-17.41 b	-18.66 b	---
2°C (14 days)	+1.66 c	+2.86 c	-4.50 c	---	---	---	---

Table 4: Effect of interation treatments on the change percentage in fresh weight of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2011 season

Treatments		Day								
		1st			5th			9th		
Pulsing solutions	Holding solutions	(21±1°c)	0°C	2°C	(21±1°c)	0°C	2°C	(21±1°c)	0°C	2°C
D.W.	D.W.	+0.7 f-h	+0.7 f-h	+0.4 gh	+1.7 i-m	+1.5 i-m	+1.3 j-m	+3.8 de	-9.3 n	-11.4 o-q
	2%Suc.	+0.3 h	+0.3 h	+-1.9 i	+0.6 m	+0.6 m	-5.1 n	-1.1 ij	-9.5 n	-12.9 q
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	+0.9 d-h	+0.9 e-h	+0.7 f-h	+1.7 i-m	+1.6 i-m	+1.1 lm	+4.2 d	-1.9 j	-7.1 m
STS(1:4 mM)	D.W.	+1.7 c-h	+1.5 c-h	+1.5 c-h	+4.1 b-e	+3.1 d-i	+2.1 g-m	+6.5 bc	-5.9 lm	-10.3 no
	2%Suc.	+1.2 c-h	+1.0 d-h	+0.9 e-h	+3.5 c-h	+2.0 h-m	+1.2 k-m	+2.1 fg	-9.8 n	-12.9 q
	2%Suc.+200ppm HQC + 100ppm GA_3	+3.1 ab	+2.0 b-f	+2.1 b-f	+5.6 b	+4.0 b-e	+2.9 d-i	+7.6 b	+0.1 hi	-4.5 kl
100ppm GA_3	D.W.	+1.8 b-g	+1.8 b-g	+1.6 c-h	+3.9 c-f	+2.9 d-i	+2.0 g-m	+4.0 de	-9.4 n	-9.8 n
	2%Suc.	+1.4 c-h	+0.8 e-h	+0.7 f-h	+2.8 d-k	+1.6 i-m	+1.1 lm	+1.9 fg	-10.7 n-p	-11.5 o-q
	2%Suc.+200ppm 8HQC + 100ppm GA_3	+1.9 b-f	+1.7 c-h	+1.5 c-h	+4.2 b-e	+3.6 c-g	+2.4 f-l	+6. 1 c	+0.8 gh	-7.1 m
100ppm GA_3 + 5%Suc.	D.W.	+2.6 a-c	+1.9 b-f	+1.8 b-g	+4.9 bc	+2.8 d-j	+2.1 g-m	+7.7 b	-3.9 k	-9.5 n
	2%Suc.	+1.1 d-h	+1.1d-h	+1.1 d-h	+3.8 c-f	+2.1 h-m	+1.6 i-m	-0.6 h-j	-7.1 m	-12.0 pq
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	+3.7 a	+2.4 a-d	+2.2 b-e	+7.7 a	+4.3 b-d	+2.6 e-l	+11.5 a	+2.6 ef	-4.1 k
		13th			17th			21st		
Pulsing solutions	Holding solutions	(21±1°c)	0°C	2°C	(21±1°c)	0°C	2°C	(21±1°c)	0°C	2°C
D.W.	D.W.	+0.3 a-c	-16.8 e-i	-----	+0.3 a-c	-16.8 e-i	-----	+0.3 a-c	-16.8 e-i	-----
	2%Suc.	-6.4 a-g	-25.2 hi	-----	-6.4 a-g	-25.2 hi	-----	-6.4 a-g	-25.2 hi	-----
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	+2.5 ab	-15.9 d-h	-----	+2.5 ab	-15.9 d-h	-----	+2.5 ab	-15.9 d-h	-----
STS(1:4 mM)	D.W.	-0.9 a-e	-16.7 e-i	-----	-0.9 a-e	-16.7 e-i	-----	-0.9 a-e	-16.7 e-i	-----
	2%Suc.	-6.4 a-g	-17.1 f-i	-----	-6.4 a-g	-17.1 f-i	-----	-6.4 a-g	-17.1 f-i	-----
	2%Suc.+200ppm HQC + 100ppm GA_3	+5.6 a	-15.9 d-h	-----	+5.6 a	-15.9 d-h	-----	+5.6 a	-15.9 d-h	-----
100ppm GA_3	D.W.	-2.5 a-f	-32.1 i	-----	-2.5 a-f	-32.1 i	-----	-2.5 a-f	-32.1 i	-----
	2%Suc.	-3.4 a-f	-----	-----	-3.4 a-f	-----	-----	-3.4 a-f	-----	-----
	2%Suc.+200ppm 8HQC + 100ppm GA_3	+2.8 ab	-18.5 f-i	-----	+2.8 ab	-18.5 f-i	-----	+2.8 ab	-18.5 f-i	-----
100ppm GA_3 + 5%Suc.	D.W.	+5.1 a	-13.8 c-h	-----	+5.1 a	-13.8 c-h	-----	+5.1 a	-13.8 c-h	-----
	2%Suc.	-6.6 a-g	-21.0 g-i	-----	-6.6 a-g	-21.0 g-i	-----	-6.6 a-g	-21.0 g-i	-----
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	+5.5 a	-13.0 b-h	-----	+5.5 a	-13.0 b-h	-----	+5.5 a	-13.0 b-h	-----

Table 5: Effect of interaction treatments on the change percentage in fresh weight of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2012 season

Treatments		Day											
		1st			5th			9th			13th		
Pulsing solutions	Holding solutions	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C
D.W.	D.W.	+3.3 a-h	+2.6 a-j	+1.3 h-j	+3.8 e-k	+3.5 f-k	+2.1 k	+7.3 b-e	-2.1 i-l	-5.1 pq	+5.0 a	-18.3 b	-----
	2%Suc.	+2.9 a-j	+2.0 d-j	+1.1 j	+3.5 f-k	+3.1 i-k	-1.4 l	+5.6 e	-4.1 m-p	-9.3 s	+3.1 a	-19.4 b	-----
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	+3.7 a-f	+3.1 a-j	+1.6 f-j	+4.1 d-j	+4.1 d-j	+3.1 h-k	+8.6 a-c	-0.7 g-i	-4.5 n-p	+5.9 a	-16.5 b	-----
STS(1:4 mM)	D.W.	+3.6 a-g	+2.7 a-j	+1.8 d-j	+5.7 b-e	+5.1 b-i	+3.3 g-k	+7.9 a-d	-1.2 h-j	3.9 l-p	+4.9 a	-17.1 b	-----
	2%Suc.	+2.7 a-j	+2.3 c-j	+1.6 e-j	+4.7 b-i	+4.1 d-j	+3.1 i-k	+6.6 de	-3.8 k-p	-6.7 qr	+3.9 a	-17.1 b	-----
	2%Suc.+200ppm HQC + 100ppm GA_3	+4.6 ab	+3.7 a-e	+2.1 c-j	+6.6 ab	+5.4 b-f	+3.8 e-k	+9.1 ab	+1.2 f	-2.5 j-m	+6.5 a	-15.2 b	-----
100ppm GA_3	D.W.	+3.4 a-h	+2.5 b-j	+1.5 g-j	+4.9 b-i	+4.3 d-j	+3.1 h-k	+8.1 a-d	-2.0 i-k	-4.2 m-p	+5.2 a	-16.3 b	-----
	2%Suc.	+2.9 a-j	+2.2 c-j	+1.2 ij	+4.2 d-j	+3.1 h-k	+2.6 jk	+5.5 e	-3.9 l-p	-7.3 r	+3.5 a	-18.9 b	-----
	2%Suc.+200ppm 8HQC + 100ppm GA_3	+3.8 a-d	+3.4 a-h	+1.8 d-j	+5.6 b-e	+5.0 b-h	+3.5 f-k	+8.6 a-c	-0.1 f-h	-3.1 k-o	+5.8 a	-15.1 b	-----
100ppm GA_3+5%Suc.	D.W.	+3.9 a-d	+3.3 a-h	+2.1 c-j	+6.1 a-d	+5.3 b-g	+4.1d-k	+9.1 ab	-1.2 h-j	-2.1 i-l	+5.4 a	-16.0 b	-----
	2%Suc.	+3.2 a-i	+3.1 a-j	+1.6 e-j	+5.5 b-f	+4.0 d-j	+3.1 h-k	+7.0 c-e	-2.8 j-n	-4.9 o-q	+4.2 a	-17.1 b	-----
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	+4.7 a	+4.1 a-c	+2.4 c-j	+7.8 a	+6.5 a-c	+4.5 c-j	+9.4 a	+1.1 fg	-0.3 f-i	+6.8 a	-13.9 b	-----

		17th			21st			25th		
Pulsing solutions	Holding solutions	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C
D.W.	D.W.	-4.8 a	-18.6 a	-----	-10.8 a	-20.6 a	-----	-16.7 g	-----	-----
	2%Suc.	-6.2 a	-18.8 a	-----	-13.2 a	-21.0 a	-----	-23.1 i	-----	-----
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	-1.9 a	-17.3 a	-----	-6.1 a	-17.8 a	-----	-10.6 d	-----	-----
STS(1:4 mM)	D.W.	-2.3 a	-17.1 a	-----	-7.4 a	-19.3 a	-----	-14.4 f	-----	-----
	2%Suc.	-4.8 a	-17.8 a	-----	-9.8 a	-19.6 a	-----	-18.8 h	-----	-----
	2%Suc.+200ppm HQC + 100ppm GA_3	-1.1 a	-16.8 a	-----	-4.1 a	-17.0 a	-----	-7.4 b	-----	-----
100ppm GA_3	D.W.	-4.3 a	-18.8 a	-----	-10.6 a	-19.7 a	-----	-17.3 g	-----	-----
	2%Suc.	-5.7 a	-19.1 a	-----	-11.7 a	-20.1 a	-----	-19.2 h	-----	-----
	2%Suc.+200ppm 8HQC + 100ppm GA_3	-1.5 a	-16.7 a	-----	-5.2 a	-17.5 a	-----	-9.2 c	-----	-----
100ppm GA_3 + 5%Suc.	D.W.	-2.0 a	-16.3 a	-----	-6.6 a	-17.3 a	-----	-13.2 e	-----	-----
	2%Suc.	-4.4a	-17.3 a	-----	-8.4 a	-17.7 a	-----	-14.5 f	-----	-----
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	-0.2 a	-14.3 a	-----	-2.1 a	-16.4 a	-----	-11.1 d	-----	-----

they were pulsed or held in. This may be ascribed to the deleterious effects of cold storage on postharvest quality which included the reduction of inflorescence weight and longevity [15]. On the other side, storage under room temperature gave the best results during the various steges of shelf life as compared to the treatments of cold storage (0 and 2°C). In this concern, Karimi and Asil [12] reported that increased ethylene production and increased tissue sensitivity have been observed after cold storage of cut lily inflorescences. However, treatment with GA_{4+7} partially prevented the effects of ethylene [15].

Generally, combining between pulsing in 100ppm GA_3 and 5% Suc solution and holding in 2%Suc + 200ppm 8-HQC + 100ppm GA_3 solution gave the highest percent of change in fresh weight of inflorescences through the different vase life stages, especially under storage at room temperature comparing with other combinations in the two seasons. Furthermore, joining between the previous holding solution and pulsing in 1:4mM STS gave to some extent good results in both seasons, but they were in the second rank to those scored by the former combination. This may be due to the beneficial effects of various chemicals used in both pulsing and holding solutions.

The aforementioned results are in well agreement with those manifested by Nowak and Mynett [4] who found that the highest initial fresh weight of cut lily inflorescences was related to GA_3 treatment at 75ppm. Likewise, Ranwala and Miller [15] indicated that treatment of lily potted plants with GA_{4+7} and BA improved fresh weight of inflorescences, even after cold storage. The holding solution containing 3% sucrose + 200ppm 8-HQC + 50ppm $AgNo_3$ +25ppm GA_3 greatly increased fresh weight and diameter of lily hybrid Casa Blanca cut flowers [13].

Water Uptake (G/inflorescence): From data averaged in Table 6, it is clear that all pulsing solutions used in this study raised the amount of water uptaken by flowering stems throughout the various stages of vase period with various significant differences as compared to the amount uptaken by flowering stems pulsed in D.W. in the two seasons. The prevalence however was for 100ppm GA_3 + 5% Suc solution that recorded the utmost high amount of water uptake in both seasons. This may indicate the role

Table 6: Effect of pulsing and holding solutions and storage temperature on water uptake (g/inflorescence) of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2011 and 2012 seasons

Treatments	First season:2011							Second season:2012						
	Day													
Pulsing solution treatments	1st	5th	9th	13th	17th	21st	25th	1st	5th	9th	13th	17th	21st	25th
D.W.	26.62 d	68.73 d	118.7 d	71.79 b	62.95 b	58.11 b	----	28.47 d	71.21 d	123.4 d	81.69 b	76.39 a	62.31 a	47.17 c
STS (1:4 mM)	35.84 b	88.74 b	136.3 b	79.89 ab	75.63 ab	64.83 ab	----	38.57 b	90.04 b	135.7 b	91.13 ab	79.41 a	68.43 a	54.24 b
100 ppm GA_3	29.43 c	78.39 c	130.5 c	75.54 ab	67.89 ab	60.64 ab	----	31.46 c	82.97 c	129.9 c	84.14 b	78.38 a	62.87 a	47.47 c
100 ppm GA_3 + 5%Suc.	42.35 a	96.98 a	146.1 a	86.01 a	81.14 a	69.38 a	----	44.67 a	95.31 a	149.4 a	97.53 a	93.06 a	72.95 a	56.87 a
Treatments	First season:2011							Second season:2012						
	Day													
Holding solution treatments	1st	5th	9th	13th	17th	21st	25th	1st	5th	9th	13th	17th	21st	25th
D.W.	34.32 b	83.82 b	134.4 b	77.38 b	71.20 b	62.09 b	-----	36.24 b	85.10 b	137.1 b	89.60 b	83.37 a	69.00 a	52.71 b
2% Suc.	28.43 c	73.57 c	114.6 c	60.49 c	59.37 b	51.47 c	-----	30.39 c	76.73 c	114.6 c	72.88 c	67.94 b	55.72 b	43.99 c
2% Suc. + 200ppm 8-HQC + 100ppm GA_3	37.92 a	92.24 a	149.7 a	97.04 a	85.14 a	76.15 a	-----	40.75 a	92.81 a	152.0 a	103.4 a	94.12 a	75.20 a	57.61 a
Treatments	First season:2011								Second season:2012					
Storage temperature	Day													
treatments	1st	5th	9th	13th	17th	21st	25th	1st	5th	9th	13th	17th	21st	25th
room temperature	44.33 a	107.0 a	152.5 a	169.5 a	177.6 a	168.8 a	---	45.94 a	108.2 a	157.7 a	175.7 a	191.5 a	173.0 a	154.3 a
0°C (14 days)	33.34 b	98.42 b	148.2 b	65.43 b	38.13 b	20.91 b	---	36.79 b	100.7 b	147.0 b	90.14 b	53.92 b	26.91 b	-----
2°C (14 days)	23.01 c	44.19 c	97.99 c	-----	-----	-----	---	24.65 c	45.74 c	99.09 c	-----	-----	-----	-----

of sucrose in regulation of the water flux into the xylem vessels by controlling transpiration, as well as the role of GA_3 in raising water content in flowers and stems, hence maintaining flower turgidity [26]. Growth regulators modify transpiration rates and hence affect water uptake [27].

It was also noticed that quantity of water uptaken by flowering stems of lily was gradually increased with increasing shelf life up to the ninth day from cut, but it was descendingly decreased afterwards up to the end of vase life in the two seasons. This may be attributed to a reduction in validity of pulsed infloescences by time.

Regarding holding solutions, data in Table 6 exhibit that sucrose solution at 2% significantly reduced water uptake during the whole vase life in comparison to control (D.W.) in the two seasons. This finding was demonstrated before by Marousky [24] who declared that sucrose reduced stomatal opening, but also reduced water absorption by rose flowers. The same author [25] mentioned that sucrose-treated roses absorbed less solution, but gained more weight than roses held in water due to induced stomatal closure and increased moisture retention.

The opposite was the right concerning hold in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution, as it significantly elevated the water uptake till the end of vase life comparing with holding in either D.W. or 2% sucrose solution in the first and second seasons.This may be rferred to binding the beneficial effects of both 8-HQC and GA_3 on keeping the water balance of cut flowers for a longer period and delay degradation of active constituents necessary for refreshing cut flowers [5].

Storage temperature was also had a marked effect on the water uptake as shown in Table 6. Storage under room temperature recorded the highest amount of water uptaken by lily flowering stems in the two seasons comparing with either of cold storage temperature employed in such work. Storage at 2°C gave the least means in this parameter, so the inflorescences rapidly wilted after the ninth day from cut in both seasons. This may be due to increasing ethylene production and increasing petal sensitivity after cold storage, as well as depletion of carbohydrate reserves and oxidative stress caused by cold storage as mentioned before. Besides, more than one suggested that under room temperature, all vital processes, including photosynthesis are well carried out, so the turgidity and freshness of cut flowers were better.

In relation to the interaction treatments, data in Tables 7 and 8 reveal that flowering stems pulsed in 100ppm GA_3 + 5% Suc solution for 30 min and then held either in D.W. or in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution absorbed the highest amount of water through the early stages of shelf life, till the 9th. day after cut when these flowering stems were kept under room temperature, while afterwards, that was true for flowering stems pulsed either in 1:4mM STS or in 100ppm GA_3 + 5% Suc solutions and then held in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 holding one when kept also under room temperature in the two seasons. However, the superiority in both seasons was for the joining between pulsing in 100ppm GA_3 + 5% Suc solution and holding in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 one, which recorded the highest values of water uptake by cut lily flowering stems stored under room temperature in the first and second seasons. This may be reasonable because of the roles of GA_3, 8-HQC and sucrose in keeping the water balance of cut flowers for a longer period after cut.

Table 7: Effect of interaction treatments on water uptake (g/inflorescence) of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2011 season

Treatments		Day											
		1st			5th			9th			13th		
Pulsing solutions	Holding solutions	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C
D.W.	D.W.	34.4 hi	28.1 no	15.0 r	96.2 i	83.7 m	27.4 w	155.7 g	136.7 m	88.8 w	169.9 a-c	64.9 gh	-----
	2%Suc.	32.9 i-k	26.7 o	12.5 s	88.3 kl	77.3 n	25.2 x	99.7 t	93.0 v	55.1 z	123.7 d-f	40.1 hi	-----
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	40.0 f	30.0 lm	20.1 p	102.5 g	89.3 k	28.7 w	160.5 ef	170.8 b	95.0 u	178.7 a-c	68.7 gh	-----
STS(1:4 mM)	D.W.	45.0 d	40.1 f	31.5 j-l	115.6 d	105.6 f	50.0 r	153.3 h	153.3 h	105.0 s	169.6 a-c	37.0 hi	-----
	2%Suc.	41.3 ef	20.1 p	17.5 q	96.1 ij	94.3 j	45.0 s	149.7 ij	142.0 k	85.1 x	161.2 a-d	34.7 hi	-----
	2%Suc.+200ppm HQC + 100ppm GA_3	50.0 c	42.2 e	35.0 gh	119.5 c	107.6 e	65.0 p	149.7 e	159.2 f	117.5 p	198.3 a	118.1 ef	-----
100ppm GA_3	D.W.	45.0 d	31.1 kl	16.0 qr	98.2 h	101.5 g	34.4 u	150.9 i	148.0 j	85.0 x	164.6 a-d	91.0 fg	-----
	2%Suc.	33.3 h-j	29.1 mn	15.0 r	87.3 l	83.8 m	32.0 v	141.3 kl	133.0 o	76.6 y	155.0 b-e	-----	-----
	2%Suc.+200ppm 8HQC + 100ppm GA_3	45.0 d	33.3 h-j	17.0 q	120.3 c	106.0 ef	42.0 t	168.9 c	166.2 d	104.8 s	171.7 a-c	97.5 fg	-----
100ppm GA_3+5%Suc.	D.W.	55.0 b	40.7 ef	30.0 lm	122.8 b	114.7 d	55.7 q	161.4 e	160.0 ef	114.9 q	184.8 ab	46.8 h	-----
	2%Suc.	50.0 c	36.7 g	26.3 o	105.0 f	98.7 h	50.0 r	156.0 g	134.9 n	108.8 r	164.9 a-d	46.2 h	-----
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	60.0 a	42.2 e	40.3 ef	132.4 a	118.7 c	74.7 o	184.4 a	168.2 c	139.8 l	191.2 ab	140.2 c-e	-----

Treatments		Day								
		17th			21st			25th		
Pulsing solutions	Holding solutions	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C
D.W.	D.W.	179.1 ab	27.0 f-h	-----	168.8 b-d	16.7 gh	-----	179.1 ab	27.0 f-h	-----
	2%Suc.	132.5 cd	18.3 gh	-----	129.6 e	13.5 gh	-----	132.5 cd	18.3 gh	-----
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	180.2 ab	29.3 f-h	-----	174.1 b-d	20.3 gh	-----	180.2 ab	29.3 f-h	-----
STS(1:4 mM)	D.W.	174.6 a-c	31.7 f-h	-----	166.6 cd	-----	-----	174.6 a-c	31.7 f-h	-----
	2%Suc.	169.8 a-c	28.7 f-h	-----	156.5 c-e	-----	-----	169.8 a-c	28.7 f-h	-----
	2%Suc.+200ppm HQC + 100ppm GA_3	209.3 a	66.7 ef	-----	200.0 ab	60.3 f	-----	209.3 a	66.7 ef	-----
100ppm GA_3	D.W.	169.2 a-c	47.8 e-g	-----	163.5 cd	21.7 gh	-----	169.2 a-c	47.8 e-g	-----
	2%Suc.	159.3 bc	-----	-----	145.0 de	-----	-----	159.3 bc	-----	-----
	2%Suc.+200ppm 8HQC + 100ppm GA_3	183.4 ab	51.3 e-g	-----	178.6 a-c	37.0 fg	-----	183.4 ab	51.3 e-g	-----
100ppm GA_3 + 5%Suc.	D.W.	189.8 ab	35.2 f-h	-----	177.8 a-d	30.2 f-h	-----	189.8 ab	35.2 f-h	-----
	2%Suc.	169.8 a-c	34.1 f-h	-----	157.5 c-e	15.6 gh	-----	169.8 a-c	34.1 f-h	-----
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	214.0 a	87.4 de	-----	207.7 a	35.7 fg	-----	214.0 a	87.4 de	-----

Table 8: Effect of interaction treatments on water uptake (g/inflorescence) of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2012 season

Treatments		Day											
		1st			5th			9th			13th		
Pulsing solutions	Holding solutions	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C
D.W.	D.W.	36.5 j	30.2 m	16.5 q	99.3 i	85.7 l	30.3 v	167.2 d	140.8 kl	90.9 u	182.2 a-d	63.1 k	-----
	2%Suc.	33.1 l	28.8 mn	13.4 r	91.1 k	78.2 m	28.3 w	123.5 o	100.6 t	60.5 y	147.4 d-h	56.8 k	-----
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	41.9 hi	35.2 jk	20.7 o	104.3 gh	90.2 k	33.6 u	170.0 c	156.6 g	100.3 t	185.4 a-c	100.4 ij	-----
STS(1:4 mM)	D.W.	48.4 ef	42.3 h	33.4 l	107.6 e	105.8 fg	55.6 o	155.8 gh	154.6 h	100.8 t	172.7 b-d	110.2 i	-----
	2%Suc.	43.2 h	28.7 mn	20.8 o	97.4 j	95.7 j	50.3 q	136.7 m	133.9 n	82.9 w	153.7 c-g	67.1 jk	-----
	2%Suc.+200ppm HQC + 100ppm GA_3	51.4 c	43.1 h	36.0 j	125.3 a	111.9 d	60.7 n	180.0 a	166.5 de	110.5 r	195.8 ab	120.8 g-i	-----
100ppm GA_3	D.W.	45.0 g	33.6 kl	17.2 pq	110.2 d	103.7 h	37.9 t	152.8 i	143.6 j	88.4 v	170.0 b-d	70.3 jk	-----
	2%Suc.	35.2 jk	30.2 m	16.4 q	100.3 i	96.1 j	33.2 u	141.2 kl	121.2 p	80.1 x	160.1 b-f	60.6 k	-----
	2%Suc.+200ppm 8HQC + 100ppm GA_3	46.8 f	40.5 i	18.3 p	116.0 c	107.0 ef	42.5 s	170.4 c	163.6 f	107.6 s	185.6 a-c	110.7 hi	-----
100ppm GA_3+5%Suc.	D.W.	56.4 b	43.2 h	32.2 l	117.0 c	115.4 c	52.8 p	169.5 c	165.1 ef	115.8 q	181.6 a-d	125.0 f-i	-----
	2%Suc.	51.3 cd	36.2 j	27.4 n	105.0 gh	99.2 i	46.2 r	145.3 j	140.0 l	109.8 r	162.1 b-e	66.9 jk	-----
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	62.1 a	49.6 de	43.7 gh	125.2 a	119.6 b	77.5 m	179.8 a	177.4 b	141.7 k	212.1 a	130.0 e-i	-----

Table 8: Continue

Pulsing solutions	Holding solutions	17th			21st			25th		
		21±1°c	0°C	2°C	21±1°c	0°C	2°C	21±1°c	0°C	2°C
D.W.	D.W.	185.5 b-d	60.7 e	-----	172.2 b-e	27.37 f	-----	145.9 h	-----	-----
	2%Suc.	159.6 d	27.7 ef	-----	135.4 e	16.33 f	-----	121.3 j	-----	-----
	2%Suc.+ 200ppm 8HQC + 100ppm GA_3	189.4 b-d	64.7 e	-----	181.4 a-c	28.01 f	-----	157.3 f	-----	-----
STS(1:4 mM)	D.W.	179.6 b-d	63.6 e	-----	177.2 a-d	28.00 f	-----	167.0 d	-----	-----
	2%Suc.	161.8 cd	30.0 ef	-----	156.8 b-e	25.01 f	-----	148.0 g	-----	-----
	2%Suc.+200ppm HQC + 100ppm GA_3	211.5 a-c	68.2 e	-----	196.2 ab	32.66 f	-----	173.2 b	-----	-----
100ppm GA_3	D.W.	175.0 b-d	50.0 ef	-----	167.4 b-e	27.60 f	-----	147.5 g	-----	-----
	2%Suc.	169.1 b-d	46.6 ef	-----	139.5 de	18.66 f	-----	116.2 k	-----	-----
	2%Suc.+200ppm 8HQC + 100ppm GA_3	204.4 b-d	60.3 e	-----	184.0 a-c	28.66 f	-----	163.6 e	-----	-----
100ppm GA_3 + 5%Suc.	D.W.	214.4 ab	71.7 e	-----	198.2 ab	30.00 f	-----	172.2 c	-----	-----
	2%Suc.	190.4 b-d	30.0 ef	-----	149.6 c-e	27.23 f	-----	142.4 i	-----	-----
	2%Suc. + 200ppm 8HQC + 100ppm GA_3	257.5 a	73.5 e	-----	218.2 a	33.33 f	-----	197.2 a	-----	-----

The previous results conform with those attained by Song *et al*. [5] on Asiatic lily hybrid Corderia and Avignon, Lee and Suh [6] on lily hybrids Enchantment and jinsil, Sharma *et al*.[8] on Asiatic lily, Gandaby *et al*. [10] on Asiatic hybrid lily cv. Canova and Burchi *et al*. [14] on Asiatic lily cvs. Fangio and Cavalese.

Longevity (Day): It is evident from data presented in Table 9 that longevity of lily inflorescences used in this investigation was prolonged with significant differences in the two seasons by 100ppm GA_3 + 5% Suc pulsed solution compared to pulsing either in D.W. or in 100ppm GA_3 solution. Meanwhile, pulsing in STS (1:4mM) solution gave longevity closely near to that of 100ppm GA_3 + 5% Suc solution with non-significant differences among them in both seasons. This may be attributed to the role of GA_3 in the presence of sucrose on increasing the number of buds open and delayind petal fading and abscission [26]. Sucrose, on the other hand provides flowers with energy nacessary for fundamental cellular processes, whereas STS inhibits the action of ethylene and so improves the vase life of cut flowers through delaying its senescence [5]. Similarly, holding in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution scored the longest vase life as compared to holding either in D.W. or in 2% Suc solution (Table 9). Besides the role of both sucrose and GA_3 in prolonging longevity of cut flowers, 8-HQC amends this trend, as it keeps the water balance of cut flowers for a longer period and delay degradation of chlorophylls and carbohydrates which are considered the most important factor in protraction the vase life [5].

Cold storage at 0 or 2°C for 14 days before holding was found to induce a negative effect on longevity of lily inflorescences (Table 9), as this measurement decreased to 16.22 and 16.53 days for storage at 0°C and to 15.19 and 15.26 days for storage at 2°C againest 20.39 and 20.01 days for storage under room temperature (21±1°C) in the first and second seasons, respectively. This may be due to failling flower bud to open, hastening petal wilting and increasing leaf yellowing and bud abscission by cold storage [3]. In this regard, Michaeli *et al*. [28] observed that ethylene production and tissue sensitivity were increased after cold storage of *Ixora coccinea* plants.

In the matter of interactions effect, data in Table 10 indicate that holding in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution at the room temperature gave the longest vase life regardless of components of pulsing solution used before holding treatment. However, the mastery in both seasons was for combining between pulsing in 100ppm GA_3 + 5% Suc solution, holding in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution and storing at room temperature, where such combination gave the longest vase life in the two seasons comparing with all other interactions applied in this trial.

Analogous observations were also elicited by Sindhu and Pathania [2] on Asiatic hybrid lily Alaska and Vivaldi, Barbosa *et al*. [9] on *Lilium longiflorum* cv. Ace, Asil [11] on Asiatic hybrid lily (cvs. Amarone, Orlando, Pink Superior, Polyanna, Salsa and Vignola), as well as Burchi *et al*. [14] on cvs. Fangio and Cavalese.

Chemical Composition:

Photosynetic Pigments in the Leaves (mg/100g F.W.): According to data presented in Table 11 , it can be concluded that pulsing and holding solutions, as well as storage temperature had a slight effect on leaf content of chlorophylls a and b, total chlorophylls and carotenoids (mg/100g F.W.) in the two seasons.However, pulsing in 100ppm GA_3 + 5% Suc solution, holding in 2% Suc + 200ppm 8-HQC + 100 ppm GA_3 solution and storage at room temperature (21±1°C) gave the highest means of the previous pigments as compared to control (D.W.) or to the corresponding treatments in most instances of both seasons. A similar trend was also obtained regarding the effect of interaction treatments accomplished in the current study (Table 12), as the most interactions

Table 9: Effect of pulsing and holding solutions and storage temperature on longevity (day) of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2011 and 2012 seasons

Pulsing solution treatments	First season	Second season
D.W.	16.54 c	16.31 c
STS (1:4 mM)	17.63 ab	17.50 ab
100 ppm GA_3	16.92 bc	17.10 b
100 ppm GA_3 + 5%Suc.	17.98 a	18.14 a
Holding solution treatments	**First season**	**Second season**
D.W.	17.26 b	17.40 b
2% Suc.	16.08 c	15.59 c
2% Suc. +200ppm 8HQC +100ppm GA_3	18.46 a	18.80 a
Storage temperature treatments	**First season**	**Second season**
Under room temperature	20.39 a	20.01 a
0°C	16.22 b	16.53 b
2°C	15.19 c	15.26 c

Table 10: Effect of interaction treatments on longevity (day) of *Lilium longiflorum* cv. Orange Tycoon cut flowering stems during 2011 and 2012 seasons

		First season		
Pulsing solution	Holding solutions	(21±1°c)	0°C	2°C
D.W.	D.W.	20.50 a-c	15.67 g-k	14.00 k
	2%Suc.	17.00 f-h	15.56 g-k	11.33 l
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	20.83 a-c	17.33 e-g	16.61 f-i
STS(1:4 mM)	D.W.	21.00 a-c	16.11 g-k	16.06 g-k
	2%Suc.	19.67 b-d	15.78 g-k	14.00 k
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	21.67 ab	17.28 e-g	17.11 e-h
100 ppm GA_3	D.W.	19.20 c-e	16.11 g-k	14.67 i-k
	2%Suc.	18.33 d-f	15.72 g-k	14.33 jk
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	22.00 a	16.39 f-j	15.50 g-k
100 ppm GA_3+ 5%Suc.	D.W.	21.33 a-c	17.00 f-h	15.44 g-k
	2%Suc.	21.17 a-c	15.11 h-k	15.00 h-k
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	22.00 a	17.44 e-g	17.33 e-g
		Second season		
		(21±1°c)	0°C	2°C
D.W.	D.W.	19.33 c-g	16.67 h-l	13.00 op
	2%Suc.	16.67 h-l	13.67 n-p	11.99 p
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	20.50 b-d	17.94 e-j	17.06 h-l
STS(1:4 mM)	D.W.	19.67 b-f	17.27 g-k	15.70 k-n
	2%Suc.	18.67 d-h	16.11 j-l	13.33 op
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	21.67 ab	17.66 f-k	17.41 g-k
100 ppm GA_3	D.W.	19.83 b-e	16.67 h-l	15.66 k-n
	2%Suc.	18.25 e-i	15.00 l-o	13.11 op
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	21.33 a-c	17.06 h-l	17.00 h-l
100 ppm GA_3+ 5%Suc.	D.W.	21.17 a-c	17.44 g-k	16.39 i-l
	2%Suc.	20.33 b-d	16.00 j-m	14.00 m-p
	2%Suc.+ 200mg/L 8HQC+100ppm GA_3	22.67 a	18.00 e-j	17.28 g-k

improved pigments content in the leaves of treated flowering stems with non-significant differences in comparison to D.W. in most cases of the two seasons. However, the best pigments content was attained as a result of pulsing in 100ppm GA_3 + 5% Suc solution and holding in a solution of 2% Suc + 200ppm 8-HQC + 100ppm GA_3 at the room temperature, as such combination registered the highest means over all other interactions, with few exceptions in the two seasons.

These results could be interpretted and discussed as done before in case of the change percentage in fresh weight, water uptake and longevity characters. Several reports are also in accordance with the previous gains, such as those of Ranwala and Miller [7] who postulated that GA_{4+7} at 100ppm pronouncedly prevented leaf chlorosis in 3 cultivars of Asiatic hybrid lily. Karimi and Asil [12] established that GA_3 at 50 ppm increased the chlorophyll content in the leaves of lilium cv. Romano,

Table 11: Effect of pulsing and holding solutions and storage temperature on chlorophyll a, b, total chlorophylls total and carotenoids of *Lilium longiflorum* cv. Orange Tycoon leaves during 2011 and 2012 seasons

	First season:2011				Second season:2012			
Pulsing solution treatments	Ch.a	Ch.b	T.chs	Car	Ch.a	Ch.b	T.chs	Car
D.W.	0.63 a	0.16 a	0.60 a	0.44 a	0.63 a	0.24 a	0.63 a	0.47 a
STS(1:4 mM)	0.79 a	0.25 a	0.81 a	0.61 a	0.86 a	0.28 a	0.78 a	0.61 a
100 ppm GA_3	0.77 a	0.22 a	0.77 a	0.61 a	0.78 a	0.31 a	0.72 a	0.56 a
100 ppm GA_3 + 5% Suc.	0.92 a	0.32 a	0.89 a	0.61 a	0.94 a	0.44 a	0.87 a	0.64 a
	First season:2011				Second season:2012			
Holding solution treatments	Ch.a	Ch.b	T.chs	Car	Ch.a	Ch.b	T.chs	Car
D.W.	0.74 a	0.23 a	0.73 a	0.54 a	0.77 a	0.29 a	0.75 a	0.55 a
2%Suc.	0.50 a	0.17 a	0.50 a	0.46 a	0.56 a	0.20 a	0.52 a	0.45 a
2%Suc.+200ppm 8HQC+100ppm GA_3	1.09 a	0.32 a	1.05 a	0.71 a	1.07 a	0.44 a	0.99 a	0.72 a
	First season:2011				Second season:2012			
Storage temperature	Ch.a	Ch.b	T.chs	Car	Ch.a	Ch.b	T.chs	Car
Under room temperature (21±1°C)	1.04 a	0.32 a	1.02 a	0.81 a	0.95 a	0.51 a	0.98 a	0.77 a
0°C (14 days)	0.67 a	0.22 a	0.66 a	0.51 a	0.80 a	0.23 a	0.66 a	0.55 a
2°C (14 days)	0.63 a	0.18 a	0.61 a	0.41 a	0.65 a	0.22 a	0.61 a	0.39 a

Ch. a: Chlorophyll a. Ch. b: Chlorophyll b Car.: carotene

Table 12: Effect of interaction treatments on chlorophyll a, b, total chlorophylls and carotenoids of *Lilium longiflorum* cv.Orange Tycoon leaves during 2011 and 2012 seasons

Treatments			First season				Second season			
Storage temperature	Pulsing solution	Holding solution	Ch.a	Ch.b	Ch.t	Car	Ch.a	Ch.b	Ch.t	Car
Under room conditions (21±1°c)	D.W.	D.W.	0.78 ab	0.22 a	0.74 ab	0.59 a	0.67 a	0.34 a	0.70 a	0.52 a
		2% Suc.	0.61 ab	0.16 a	0.61 ab	1.02 a	0.60 a	0.29 a	0.68 a	0.95 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.07 ab	0.35 a	1.06 ab	0.46 a	0.71 a	0.45 a	1.01 a	0.49 a
STS(1:4 mM)	D.W.	1.18 ab	0.19 a	1.11 ab	0.61 a	1.15 a	0.32 a	1.04 a	0.77 a	
		2% Suc.	0.67 ab	0.08 a	0.76 ab	1.31 a	0.50 a	0.21 a	0.86 a	1.05 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.29 ab	0.69 a	1.25 ab	0.56 a	1.46 a	0.63 a	1.15 a	0.66 a
100 ppm GA_3	D.W.	1.08 ab	0.34 a	1.17 ab	0.77 a	0.87 a	0.33 a	1.05 a	0.68 a	
		2% Suc.	0.69 ab	0.14 a	0.63 ab	0.94 a	0.62 a	0.24 a	0.73 a	1.00 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.27 ab	0.38 a	1.25 ab	0.75 a	1.41 a	0.94 a	1.08 a	0.62 a
100 ppm +5%Suc.	D.W.	0.79 ab	0.41 a	0.76 ab	0.91 a	0.71 a	0.77 a	0.86 a	0.83 a	
		2% Suc.	0.44 b	0.37 a	0.41 ab	0.97 a	0.66 a	0.55 a	0.51 a	1.04 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	2.59 a	0.45 a	2.45 a	0.70 a	1.99 a	0.87 a	2.08 a	0.67 a
0°C (14days)	D.W.	D.W.	0.52 ab	0.13 a	0.52 ab	0.39 a	0.72 a	0.17 a	0.65 a	0.33 a
		2% Suc.	0.43 b	0.12 a	0.41 ab	0.40 a	0.60 a	0.12 a	0.38 a	0.49 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.71 ab	0.17 a	0.65 ab	0.30 a	0.74 a	0.22 a	0.72 a	0.33 a
	STS(1:4 mM)	D.W.	0.76 ab	0.16 a	0.80 ab	0.56 a	0.85 a	0.22 a	0.67 a	0.59 a
		2% Suc.	0.53 ab	0.16 a	0.57 ab	0.67 a	0.79 a	0.13 a	0.39 a	0.73 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.79 ab	0.36 a	0.80 ab	0.46 a	0.89 a	0.32 a	0.95 a	0.52 a
	100 ppm GA_3	D.W.	0.59 ab	0.19 a	0.58 ab	0.66 a	0.69 a	0.21 a	0.57 a	0.59 a
		2% Suc.	0.48 ab	0.15 a	0.48 ab	0.66 a	0.42 a	0.12 a	0.55 a	0.68 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.93 ab	0.25 a	0.90 ab	0.50 a	1.00 a	0.33 a	0.72 a	0.37 a

Table 12: Continue

Treatments			First season				Second season			
Storage temperature	Pulsing solution	Holding solution	Ch.a	Ch.b	Ch.t	Car	Ch.a	Ch.b	Ch.t	Car
	100 ppm +5%Suc.	D.W.	0.79 ab	0.30 a	0.74 ab	0.44 a	0.99 a	0.34 a	0.99 a	0.67 a
		2% Suc.	0.43 b	0.27 a	0.43 ab	0.71 a	0.66 a	0.21 a	0.33 a	0.81 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.06 ab	0.37 a	1.05 ab	0.39 a	1.26 a	0.41 a	1.04 a	0.44 a
2°C (14 days)	D.W.	D.W.	0.37 b	0.11 a	0.37 ab	0.24 a	0.53 a	0.17 a	0.47 a	0.37 a
		2% Suc.	0.31 b	0.08 a	0.29 b	0.36 a	0.44 a	0.13 a	0.39 a	0.41 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.86 ab	0.13 a	0.78 ab	0.18 a	0.62 a	0.24 a	0.64 a	0.30 a
	STS(1:4 mM)	D.W.	0.61 ab	0.22 a	0.61 ab	0.43 a	0.64 a	0.20 a	0.64 a	0.41 a
		2% Suc.	0.48 ab	0.18 a	0.47 ab	0.50 a	0.51 a	0.13 a	0.58 a	0.48 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.85 ab	0.23 a	0.81 ab	0.41 a	0.92 a	0.33 a	0.77 a	0.33 a
	100 ppm GA_3	D.W.	0.68 ab	0.19 a	0.66 ab	0.42 a	0.62 a	0.21 a	0.67 a	0.35 a
		2% Suc.	0.38 b	0.14 a	0.42 ab	0.49 a	0.55 a	0.13 a	0.35 a	0.45 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.83 ab	0.21 a	0.80 ab	0.32 a	0.83 a	0.24 a	0.75 a	0.29 a
	100 ppm +5%Suc.	D.W.	0.72 ab	0.25 a	0.72 ab	0.46 a	0.86 a	0.24 a	0.67 a	0.47 a
		2% Suc.	0.58 ab	0.14 a	0.55 ab	0.50 a	0.34 a	0.21 a	0.45 a	0.53 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.86 ab	0.31 a	0.86 ab	0.45 a	0.99 a	0.35 a	0.92 a	0.33 a

Ch. a: Chlorophyll a. Ch. b: Chlorophyll b Car.: carotene

while 8-HQS increased water uptake and inhibited the vascular stopping. Furthermore, Song *et al*. [5] affirmed that the preservative solution of 200ppm 8-HQC +3% sucrose + 50ppm GA_3 after pretreatment with 0.2 mM STS + 10% sucrose + 100ppm GA_3 + 1mM Mn Cl_2 was the best way to keep the green foliage of *Lilium elegans* cvs. Corderia and Avignon till the end of vase life.

Total Carbohydrates (%) in the Leaves and Petals: It can be seen from data averaged in Table 13 that both pulsing and holding solutions used in such study slightly improved the percentage of tatal carbohydrates in the leaves of cut flowering stems with non-significant differences as compared to D.W. in both seasons, while storage at room temperature (21±1°c) significantly increased content of this constituent over that of the cold storage at either 0 or 2°c in the two seasons. This may be ascribed to that all vital processes, including photosynthesis are well achieved at the room temperature, so more carbohydrates are formed.

A similar trend was also obtained concerning the effect of interaction treatments (Table 14), where all interactions caused a slight improvement in this parameter at the various storage temperatures with non- significant differences when compared to control (D.W.) in both seasons, except for 2% sucrose holding solution that slightly decreased such trait in the two seasons compared to D.W. The best results, however were achieved in both seasons by pulsing in 100ppm GA_3 + 5% Suc solution plus holding in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution provided keeping the flowering stems at room temperature. This may be attributed to that the addition of sucrose to the preservative solution usually increases the level of glucose, fructose and total sugars in plant tissues [27]. Moreover, 8-HQC delays degradation of carbohydrates, as well as chlorophylls which is responsible for carbohydrates synthesis [5].

Analogous observations to those aforementioned were also noticed regarding total carbohydrates content in petals, as pulsing and holding solutions slightly improved the percent of this constituent in petals of lily flowers with non-significant differences in comparison to control (D.W.) in the two seasons (Table 15), whereas storage at room temperature significantly elevated content of total carbohydrates over either of cold storage treatments in both seasons (Table 15). Also, interaction treatments caused a non-significant increment in this parameter over control (D.W.) in petals of flowers, with the mastership of pulsing in 100ppm GA_3 + 5% Suc solution and holding in 2% Suc + 200ppm 8-HQC + 100ppm GA_3 solution and keeping at the room temperature (Table16), as this combined treatment recorded the highest content of total carbohydrates in petals in most cases of both seasons.

Table 13: Effect of pulsing and holding solutions and storage temperature on total carbohydrates (%) in the leaves of *Lilium longiflorum* cv. Orange Tycoon during 2011 and 2012 seasons

Pulsing solution	First season	Second season
D.W.	1.01 a	1.05 a
STS (1:4 mM)	1.29 a	1.26 a
100 ppm GA_3	1.11 a	1.09 a
100 ppm GA_3 +5% Suc.	1.31 a	1.36 a
Holding solution	**First season**	**Second season**
D.W.	1.11 a	1.14 a
2% Suc.	0.95 a	0.97 a
2% Suc. +200ppm 8HQC+100ppm GA_3	1.47 a	1.46 a
Storage temperature	**First season**	**Second season**
Under room temperature	1.79 a	1.77 a
0°C	0.94 b	1.00 b
2°C	0.81 b	0.82 b

Table 14: Effect of interaction treatments on total carbohydrates (%) in the leaves of *Lilium longiflorum* cv. Orange Tycoon" during 2011 and 2012 season

Storage temperature	Pulsing solution	Holding solution	First season	Second season
Under room conditions (21±1°c) D.W.	D.W.	1.18 a	1.20 a	
		2% Suc.	1.08 a	1.13 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	2.15 a	2.01 a
STS(1:4 mM)	D.W.	2.03 a	1.98 a	
		2% Suc.	2.01 a	1.80 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	2.11 a	2.07 a
100 ppm GA_3	D.W.	1.23 a	1.20 a	
		2% Suc.	1.21 a	1.15 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	2.16 a	2.07 a
100 ppm GA_3+ 5% Suc.	D.W.	2.10 a	2.18 a	
		2% Suc.	1.98 a	2.07 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	2.16 a	2.24 a
0°C (14days)	D.W.	D.W.	0.83 a	1.00 a
		2% Suc.	0.66 a	0.77 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.99 a	1.01 a
STS(1:4 mM)	D.W.	0.98 a	0.95 a	
		2% Suc.	0.55 a	0.57 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.45 a	1.56 a
100 ppm GA_3	D.W.	0.99 a	1.01 a	
		2% Suc.	0.71 a	0.70 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.19 a	1.26 a
100 ppm GA_3+ 5% Suc.	D.W.	0.92 a	1.03 a	
		2% Suc.	0.71 a	0.82 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.35 a	1.34 a
2°C (14 days)	D.W.	D.W.	0.73 a	0.79 a
		2% Suc.	0.53 a	0.51 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.90 a	1.00 a
STS(1:4 mM)	D.W.	0.75 a	0.73 a	
		2% Suc.	0.60 a	0.70 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.09 a	1.01 a
100 ppm GA_3	D.W.	0.85 a	0.79 a	
		2% Suc.	0.63 a	0.67 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.92 a	0.95 a
100 ppm GA_3+ 5% Suc.	D.W.	0.76 a	0.77 a	
		2% Suc.	0.68 a	0.70 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.12 a	1.06 a

Table 15: Effect of pulsing and holding solutions and storage temperature on total carbohydrate (%) in petals of *Lilium longiflorum* cv. Orange Tycoon during 2011 and 2012 seasons

Pulsing solution treatments	First season	Second season
D.W.	0.76 a	0.75 a
STS (1:4 mM)	1.23 a	1.26 a
100 ppm GA_3	0.96 a	0.99 a
100 ppm GA_3 +5%Suc.	1.42 a	1.47 a
Holding solution treatments	**First season**	**Second season**
D.W.	1.03 a	1.05 a
2% Suc.	0.93 a	0.97 a
2% Suc. + 200ppm 8HQC + 100ppm GA_3	1.32 a	1.33 a
Storage temperature treatments	**First season**	**Second season**
Room temperature (21±1°c)	1.70 a	1.73 a
0°C	0.83 b	0.85 b
2°C	0.74 b	0.77 b

Table 16: Effect of interaction treatments on total carbohydrates (%) in petals of *Lilium longiflorum* cv. Orange Tycoon inflorescence in 2011 and 2012 seasons

Storage temperature	Pulsing solution for 30 min	Holding solution	First season	Second season
Room temperature (21±1°C)	D.W.	D.W.	0.98 a	1.03 a
		2% Suc.	0.91 a	0.97 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.74 a	1.70 a
STS(1:4 mM)	D.W.	2.18 a	2.10 a	
		2% Suc.	1.86 a	2.00 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	2.21 a	2.17 a
100 ppm GA_3	D.W.	1.24 a	1.29 a	
		2% Suc.	1.21 a	1.25 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.45 a	1.49 a
100 ppm GA_3+ 5% Suc.	D.W.	2.24 a	2.22 a	
		2% Suc.	2.16 a	2.18 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	2.28 a	2.30 a
0°C (14days)	D.W.	D.W.	0.34 a	0.33 a
		2% Suc.	0.320 a	0.31 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.13 a	1.03 a
STS(1:4 mM)	D.W.	0.85 a	0.92 a	
		2% Suc.	0.78 a	0.80 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.96 a	0.98 a
100 ppm GA_3	D.W.	0.78 a	0.80 a	
		2% Suc.	0.59 a	0.64 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.17 a	1.13 a
100 ppm GA_3+ 5% Suc.	D.W.	0.95 a	1.00 a	
		2% Suc.	0.91 a	0.97 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.17 a	1.27 a
2°C (14 days)	D.W.	D.W.	0.33 a	0.33 a
		2% Suc.	0.33 a	0.20 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.79 a	0.83 a
STS(1:4 mM)	D.W.	0.73 a	0.77 a	
		2% Suc.	0.68 a	0.71 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.79 a	0.86 a
100 ppm GA_3	D.W.	0.69 a	0.71 a	
		2% Suc.	0.69 a	0.66 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	0.79 a	0.90 a
100 ppm GA_3+ 5% Suc.	D.W.	0.98 a	1.04 a	
		2% Suc.	0.76 a	0.94 a
		2% Suc.+ 200ppm 8HQC+100ppm GA_3	1.36 a	1.33 a

These findings may be discussed as previously stated in case of total carbohydrates content in the leaves. However, parallel results were also obtained by Sindhu and Pathania [2] on Asiatic hybrid Alaska and Vivaldi ; Ranwala and Miller [7] on Asiatic hybrid lily (cvs. Vermeer, Vivaldi and Marseille) ; Barbosa *et al*. [9] on *Lilium longiflorum* cv. Ace ; Karimi and Asil [12] on *Lilium* cv. Romano and Burchi *et al*. [14] on Asiatic lily cvs. Fangio and Cavalese.

From the foregoing results, it is preferable to pulsing cut flowering stems of Asiatic hybrid lily (Orange Tycoon), picked when the largest flower showed full colour in 100ppm GA_3 + 5% sucrose solution for 30 min. and then holding them in 2% sucrose + 200ppm 8-HQC + 100ppm GA_3 preservative solution at the room temperature (21±1° C) for the best quality and longest vase life.

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