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EFFECT OF SOME POST-HARVEST TREATMENTS ON CUT LEAVES OF *CHAMAEDOREA ELEGANS*

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ABSTRACT: This study was carried out at the Post-harvest Lab. of Ornamental Plants and Landscape Gardening Res. Dept., Hort. Res. Inst., Giza, Egypt during the two seasons of 2014/2015 and 2015/2016. The aim of this study is to investigate the effect of GA_3, BA, 8-HQC, CA and Sug. as preservative solution on improving the quality of the leaves, delaying leaf wilting and leaf yellowing and extending the shelf life period of cut leaves of *Chamaedorea elegans*. The results showed that, the treatment of the solution containing T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2%, followed by the solution containing the T13: GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2% significantly increased the water uptake, water balance, general appearance, vase life, concentration of chlorophyll a, b, carotenoids and total carbohydrates. It also reduced the amount of water loss in all days compared to other treatments. It can be recommended holding cut foliage of *Chamaedorea elegans* in solution containing GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2% followed by the solution containing GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2% to improve cut leaves quality and longer vase life was reached 84 days.

Key words: *Chamaedorea elegans*, post-harvest, cut leaves, vase life.

INTRODUCTION

Chamaedorea elegans, Mart. is member of Arecaceae Family, native to Guatemala and Mexico. It is known as parlor palm, neanthe bella palm and household palm, reaching 2-3 m height (6-10 feet) and 2-3 feet spread with upright, slender and usually with one single trunk. The leaves are pinnately compound with 11-20 leaflets, lanceolata, entire margins and mostly stiff, each leaflets 4-8 inches long and glossy dark green in color. The flowers are dioeciously, small yellow followed by round black fruits; it blooms periodically through the year in late winter to early spring and is propagated by seeds (Odenwald and Turner, 2006).

Growth regulators and commercially available conditioners in holding solution are recommended to prolong the postharvest longevity (Rubinowska *et al*., 2012), benzyladenine (BA) and gibberellic acid (GA_3) are pulsing regulators that delay leaf yellowing and consequently increase leaf longevity and reduce leaf chlorosis and yellowing in several cut foliage and flower species (Wouter *et al*., 2011).

Mutui *et al*. (2001) indicated that BA equivalent has the potential to be used as a commercial cut flowers preservative solution for delaying flower senescence, prolonging the vase life and enhancing postharvest quality of *Alstroemeria aurantiaca* L. cut flowers. Singh *et al*. (2008) demonstrated that the vase solution treatment combinations of gibberellic acid (GA_3) and benzyladenine (BA) with sucrose significantly increased the

vase life of cut spikes of gladiolus as compared to the sucrose treatment alone or the control. Rabiza-Swider *et al*. (2015) on hybrid lily flowers, showed that the gibberellic acid as well the mixture of GA_3 plus the standard solution preservative prolonged longevity of flowers in all the experimental variants. Gibberellic acid delayed leaf yellowing which was in turn hastened by the preservative except in leaves on decapitated shoots. Leaf senescence was the earliest in detached single leaves. Hassani and Alimirzaii (2017) stated that, the different concentrations of GA_3 and $CaCl_2$ increased the vase life of "Velvet" cut rose. The longest vase life (17.8 days) was observed in the combination of GA_3 at 1 mM with calcium chloride at 15 mM concentrations. The effect of GA_3 postharvest foliar application an increasing fresh weight of cut stem and improving of solution uptake of cut rose stem was extended by increasing calcium chloride concentrations.

Adding chemical preservatives to the holding solution is recommended to prolong the vas life. All holding solutions must contain essentially two components; sugar and germicides. The sugar provides a respiratory substrate (Pun and Ichimura, 2003), while the germicides control harmful microorganisms (bacteria, algae, yeasts and fungi) that block the stems xylem vessels and prevent water uptake. Different types of sugar, sucrose has been found to be the most commonly used in prolonging vase life. Dineshbabu *et al*. (2002) reported that holding solutions containing 8-HQS + sucrose extended the vase life of Dendrobium flowers and improved flower quality, as suggested by improved water consumption, fresh weight and flower freshness. This treatment also reduced the respiration rate and physiological loss in weight. Asil and Roein (2012) on *Alstroemeria* indicated that, the higher concentration of sucrose (60 mM) did not improve vase life, but significantly increased pigments content in the leaves. The longevity of leaves was improved by both sucrose (3, 7 day) and trehalose (4, 7 day). Whereas, 8-hydroxyqunoline (8-HQ) is the most powerful germicide (Elgimabi and Ahmed, 2009). Moreover, sucrose was found more effective when combining it with 8-HQ. Skutnik *et al*. (2006) recorded that 8-HQC and sucrose solution doubled vase life in *Asparagus densiflorus* "Meyerii". Ibrahim *et al*. (2011) on *Gerbera* plants showed that, using solution of 8-HQS at 200 ppm or $CaCl_2$ at 1000 or 2000 ppm + 4% sucrose significantly increased both water uptake and water loss during all shelf life periods (3^{th}, 6^{th}, 9^{th} and 12^{th} days) as compared to other treatments. Elhindi (2012) showed that, all treatments improved the keeping quality and vase life of the cut flowers comparing to the control ones. Among all these treatments, the 8-HQS combined with 2% sucrose showed the best water uptake, water balance, percentage of maximum increase in fresh weight of the cut flower stems and vase life which was extended up to 17 days of *Lathyrus odoratus* L. Asrar (2012) on *Antirrhinum majus*, showed that all treatments improved the keeping quality and vase life of the cut flowers comparing to control ones. Among all these treatments, the 8-HQS plus 2% sucrose treatment showed best water uptake, water balance, percentage maximum increase in fresh weight of the cut flower stem and vase life which was extended up to 18 days. It has been concluded that 200 ppm 8-HQS combined with 2% sucrose solution has the potential to be used as a commercial cut flowers preservative solution to delay flower senescence, enhance post-harvest quality and prolong the vase life of cut snapdragon (*Antirrhinum majus* L.) flowers. Elgimabi and Sliai (2013) on *Rosa damascene* cv. Trigintipetala, reported that the vase life of cut flowers studied was prolonged by all (8-HQS) treatments. The best concentration was 200 ppm and the effect better when combined with 7% sucrose, which recorded the best vase life compared to other concentrations of sucrose. Also 8-HQS at 200 ppm with or without sucrose retarded the chlorophyll as well as carbohydrates

degradation during the postharvest life. Elshereef (2015) on carnation cut flowers, reported that carnation cut flowers were treated by 300 ppm 8-HQS + 40 g/l sucrose as prolonged the vase life and caused the maximum increase in fresh weight, the lowest percentage of weight loss at initial days, increased water uptake in cut flowers and highest level of water balance and highest value of dry weight. Using 150 ppm 8-HQS + 20 g/l sucrose gave the highest values of chlorophyll a, b and total carotenoids. Khan *et al*. (2015) on *Matthiola incana* L. "Gold cut series", reported that 8-HQS had significant effect on postharvest life, in the holding solution having 7.7 days vas life. The most effective treatments were 200 mg l^{-1} 8-HQS plus 15% sucrose.

Citric acid enhance vas life by reducing the risk of vascular blockage in cut flower through its anti-embolism (Bhattacharjee *et al*., 1993).

Abou El-Ghait *et al*. (2012) on chrysanthemum (*Dendranthema grandiflorum* Kitam) found that, all tested holding solution treatments increased vase life, florets opening % and change percentage in fresh weight of cut flower spike, decreased contamination in vase solution, improved water balance for cut flower spikes and increased total sugars content in florets, with superiority for the treatment of sucrose at 2% + 8-hydroxyquinoline sulfate at 100 ppm + citric acid at 100 ppm. El-Quesni *et al*. (2012) showed that using a solution of either citric acid (100 or 200 ppm) or aluminum sulfate at 200 ppm combined with sucrose 4% significantly increased both water uptake and water loss during all shelf life periods (3^{rd}, 6^{th}, 9^{th} and 12^{th} days), as compared to other treatments. Using aluminum sulfate + citric acid (100 or 200 ppm) with sucrose significantly lowered weight loss of *Schefflera* foliage and increased dry weight percentage and vase life (days) i.e. longevity of *Schefflera* foliage to highest values and resulted in the highest content of chlorophyll a, b and total soluble sugars. El-Ebrashi (2014) concluded that holding *Asparagus densiflorus, Strlitizia reginae and Nephrolepis exaltata* in all tested vase solutions directly after harvest, also, Suc. + SA + 8-HQC as a holding solution in *Asparagus densiflorus* and *Nephrolepis exaltata* followed by Suc. + Methanol at 4% increased the longevity, water uptake, percentage of both fresh weight and total carbohydrates, in addition to improving the general appearance. Moreover, these treatments decreased the carotenoids content and the degradation of chlorophyll a and b as compared to the control. Sakr *et al*. (2014) indicated that it is recommended to hold the cut flowering stem of *Limonium sinuatum* cv. "Velvet Wings" in a solution containing 2% sucrose + 200 mg/l 8-hydroxquinoline citrate + 150 mg/l citric acid + 150 mg/l 6-benzyladenine + 0.5 m/l Tween 20 under room temperature (21 ± 1^{o}C) for prolonging their longevity and improving quality of flowers. Heider (2015) on *Fatsia japonica* and *Rumohra adiantiformis*, found that the water loss increased during the vase life of *F. japonica* and *R. adiantiformis* to the end of the study; (sucrose at 20 g/l + BA at 10 mg/l + citric acid at 200 mg/l + Clorox at 2 ml/l) was the significantly effective treatment giving the less water loss compared to Ca EDTA at 1 g/l + sucrose at 20 g/l and it increased the percentage of total carbohydrates compared to holding in distilled water (control) under room temperature in both seasons.

The aim of this study is to investigate the effect of GA_3, BA, 8-HQC, CA and Sug. as preservative solutions on improving the quality of the leaves, delaying leaf wilting and leaf yellowing and extending the shelf life period of cut leaves of *Chamaedorea elegans*.

MATERIALS AND METHODS

This study was carried out at the Post-harvest Lab. of Ornamental Plants and Landscape Gardening Res. Dept., Hort. Res. Inst., Giza, Egypt, during the two seasons of 2014/2015 and 2015/2016. The aim of this study is to investigate the effect of

Gibberellic acid (GA_3), 6-benzyladenine (BA), 8-hydroxyqunoline citrate (8-HQC), citric acid (CA) and sugar (Sug.) preservative solution to enhance the quality of the leaves, delaying leaf wilting and leaf yellowing and extending the shelf life period of cut leaves of *Chamaedorea elegans*.

Plant material:

Chamaedorea elegans was harvested in 1st December at fully mature, healthy, undamaged and uniform leaves from local commercial ornamental farm. Cut leaves of *Chamaedorea* were evergreen and 35-40 cm length.

Holding solution treatments:

T1: Sterilized distilled water (DW) which was used as a control.

T2: GA_3 at 50 ppm.

T3: BA at 20 ppm.

T4: 8-HQC at 300 ppm.

T5: CA at 300 ppm.

T6: Sug. at 2%.

T7: GA_3 at 50 ppm + Sug. at 2%.

T8: BA at 20ppm + Sug. at 2%.

T9: GA_3 at 50 ppm + 8-HQC at 300 ppm + Sug. at 2%.

T10: BA at 20 ppm + 8-HQC at 300 ppm + Sug. at 2%.

T11: GA_3 at 50 ppm + CA at 300 ppm + Sug. at 2%.

T12: BA at 20 ppm + CA at 300 ppm + Sug. at 2%.

T13: GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2%.

T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2%.

The leaves of *Chamaedorea* were placed in glass bottles containing 500 ml/3 leaves of the previous mentioned chemical preservative solutions as well as distilled water as control treatment and kept in the laboratory at room temperature at 16±2°C and 50-60% relative humidity and continuous lighting with fluorescent lamps 1000 Lux for 24h.

Data recorded:

The data were recorded at the end of the shelf life periods:

1. Water relation: (a) water uptake (g/leaf), (b) water loos (g/leaf), (c) water balance (g/leaf), were recorded at 2, 14, 28 and 42 days during the shelf life periods.
2. General appearance, the quality of cut foliage was evaluated based a scale ranging, 1= bad (25%) [greenish yellow], 2= moderate (25% to >50%) [yellowish green], 3= good (50% to >75%) (slightly yellowish) and 4= excellent (75% to 100%) [Completely healthy leaves no wilting] as described by Sangwangkul *et al*. (2008).
3. The changing of fresh weight (%) during the shelf life period, were recorded at 2, 14, 28 and 42 days during the shelf life periods.
4. Vase life (84 days), were recorded at the end of shelf life periods.
5. Dry weight of leaves (g).

Chemical composition:

1. Pigments contents (mg/g Fresh Weight) in the leaves after two weeks of the starting of the experiment (chlorophyll a, b and carotenoids) according by Moran and Porath (1980).
2. Total carbohydrates content (% of dry weight) in the leaves at the end of shelf life, according to the methods described by Herbert *et al*. (2005).

Layout and statistical analysis:

The layout of the experiment was a complete randomized design with one factor, with 14 treatments, each treatment contained 3 replicates and each replicate contained 3 leaves of *Chamaedorea*. (14 treatments ×3 replicates× 3 leaves = 126 leaves, according to Snedecor and Cochran (1989). The

obtained data were statistically analyzed using Duncan's Multiple Range Test at 5% (Duncan., 1955).

RESULTS AND DISCUSSION

Water relation (g/day):

The data concerning the effect of different solutions on water relations of cut leaves of *Chamaedorea elegans* are presented in Tables (1-3) as show that the rate of water uptake and water loss increased to 14th day and then began to increase decreasing until the end of the period. The highest water uptake and water loss were with T14: GA_3 at 50ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2% and T13: GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2%. These solutions enhanced water balance compared to the other treatments. Whereas, the sugar gave the lowest rate of water uptake and water balance, and it increased water loss. The less treatment was T1: control and T6: sugar, in the first and second seasons. Similar results were reported by Gendy and Mahmoud (2012) who showed that, holding solutions containing (50 g/l sucrose + 200 g/l 8-HQS + 150 mg/l citric acid) highly significantly increased the water relations characters (water balance) of bird of paradise cut flower comparison with control (D.W.).

The change in fresh weight (%):

The results presented in Table (4) recorded that the change of fresh weight increased to 28th day and decreased from 42th day to the end period, in the first season and the increasing in the change of fresh weight was to 42nd day and then began to increase decreasing until the end of the period, in the second season. The best treatment was T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2%. The similar results were obtained by Asrar (2012) on *Antirrhinum majus*, showed that all treatments improved the keeping quality and vase life of the cut flowers comparing to control ones.

Vase life (day) and dry weight (g):

The results in Table (5) show the vase life (days) cut leaves of *Chamaedorea elegans*. All holding solutions producing the longest shelf life period (except of Sug. and GA_3 + Sug.) compared to the control. The most effective holding solutions were T13: GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2% and T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2% (73, 84 and 84,84 days, in the first and second seasons, respectively) compared to the other treatments. On the other hand, using a solutions T6: Sug. at 2% and T7: GA_3 at 50 ppm + Sug. at 2% decreased the number of days and resulted in the shortest shelf life periods in both seasons compared to the control (35.30 and 38.30 days in the first and second seasons, respectively).

Using T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2% gave the heaviest dry weight followed by T13: GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2% and T10: BA at 20 ppm + 8-HQC at 300 ppm + Sug. at 2%. Whereas, T6: Sug. at 2% gave the lowest dry weight. Similar results were observed by Abou EL-Ghait (2012) on Chrysanthemum, Thorat *et al.* (2008) on carnation cut flowers and Singh *et al.* (2008) on gladiolus

General appearance:

Data in Table (5) showed that, quality of cut leaves in all treatments were excellent to 14th day and began in reduce to the end vase-life. The treatment containing T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. 2% gave the best result compared to the other treatments, and the sugar gave the lowest result. A similar trend was obtained on *Fatsia japonica* and *Rumohra adiantiformis* by Heider (2015) showed that, regarding the effect of holding solutions, the combination of 20 g/l sucrose + 10 mg/l BA+ 200 mg/l CA + 2 ml/l Clorox helped in enhancing the general appearance compared with the

Table 1. Effect of some chemicals holding solutions on water uptake during the shelf life periods (days) of *Chamaedorea elegans* leaves in the two seasons.

Treatments	Water uptake (g/leaf)							
	First season				Second season			
	2 days	14 days	28 days	42 days	2 days	14 days	28 days	42 days
Distilled water (control)	2.21 ij	7.82 l	12.26 l	15.77 m	2.11 j	10.67 k	16.43 l	19.61 i
GA_3	2.45 f	10.21 g	14.97 g	20.97 g	2.65 g	11.67 f	19.27 g	24.17 e
BA	2.37 g	10.05 h	14.73 h	19.66 h	2.63 g	11.62 f	18.83 h	23.23 f
8-HQC	2.27 h	9.72 i	14.19 i	18.48 i	2.46 h	11.37 g	18.80 h	21.42 g
CA	2.24 hi	7.93 k	12.56 k	16.44 l	2.13 j	10.90 j	16.79 k	20.11 h
Sug.	2.17 j	7.12 m	11.80 m	15.72 m	2.01 k	10.19 l	16.11 m	17.50 j
GA_3 + Sug.	2.26 hi	7.93 k	13.93 j	16.92 k	2.33 i	11.07 i	17.29 j	20.13 h
BA + Sug.	2.27 h	8.73 j	14.18 i	17.54 j	2.37 i	11.25 h	17.79 i	21.30 g
GA_3 + 8-HQC + Sug.	2.86 d	11.28 d	18.11 d	23.20 d	3.07 d	14.49 c	19.96 d	28.23 c
BA + 8-HQC + Sug.	2.92 c	14.97 c	23.10 c	28.13 c	3.17 c	14.50 c	22.32 c	28.30 c
GA_3 + CA + Sug.	2.77 e	10.42 f	16.63 f	22.00 f	2.84 f	11.76 e	19.67 f	24.46 e
BA + CA + Sug.	2.82 de	10.65 e	17.39 e	22.88 e	3.00 e	13.16 d	19.83 e	27.13 d
GA_3 + BA + CA + Sug.	3.49 b	16.00 b	23.55 b	28.35 b	3.25 b	14.77 b	23.25 b	29.46 b
GA_3 + BA + 8-HQC + CA + Sug.	3.69 a	17.73 a	26.10 a	29.85 a	3.32 a	16.93 a	25.27 a	30.61 a

Values have the same letter are not significantly different at 5% level using Duncan's Test.

GA_3= gibberellic acid at 50 ppm, BA= 6-benzyl adenine at 20 ppm, 8-HQC= 8-hydroxyquinoline citrate at 300 ppm, CA= citric acid at 300 ppm, Sug.= sugar at 2%.

Table 2. Effect of some chemicals holding solutions on water loss during the shelf life periods (days) of *Chamaedorea elegans* leaves in the two seasons.

Treatments	Water loss (g/leaf)							
	First season				Second season			
	2 days	14 days	28 days	42 days	2 days	14 days	28 days	42 days
Distilled water (control)	2.91 a	14.46 a	22.15 b	28.17 b	2.90 ab	14.66 b	22.24 b	30.57 b
GA_3	2.17 f	9.93 e	15.25 g	21.75 h	2.37 e	11.50 g	18.63 h	23.27 h
BA	2.50 e	10.51 cd	15.40 f	22.49 g	2.37 e	11.53 g	18.87 g	24.36 g
8-HQC	2.51 e	10.51 cd	16.93 e	22.63 f	2.55 d	11.83 f	19.36 f	25.98 f
CA	2.78 c	11.33 b	18.58 c	27.25 c	2.84 b	14.15 c	21.74 c	27.92 c
Sug.	3.44 a	14.60 a	22.37 a	30.19 a	2.96 a	16.39 a	24.30 a	30.77 a
GA_3 + Sug.	2.59 d	10.27 de	17.38 d	24.04 d	2.68 c	13.95 d	20.72 d	27.09 d
BA + Sug.	2.57 d	10.86 c	16.93 e	23.69 e	2.61 cd	12.83 e	19.71 e	26.82 e
GA_3 + 8-HQC + Sug.	2.10 g	8.44 g	14.13 j	18.07 k	1.86 h	10.73 i	16.98 k	21.19 k
BA + 8-HQC + Sug.	2.03 h	7.83 h	13.00 k	17.31 l	1.80 hi	10.41 j	16.91 l	20.52 l
GA_3 + CA + Sug.	2.14 fg	9.84 e	15.13 h	20.86 i	2.16 f	11.34 h	18.40 i	22.03 i
BA + CA + Sug.	2.12 fg	9.05 f	14.86 i	19.43 j	2.07 g	11.30 h	17.66 j	21.63 j
GA_3 + BA + CA + Sug.	1.85 i	7.66 h	12.38 l	16.69 m	1.74 ij	10.21 k	16.75 m	20.43 m
GA_3 + BA + 8-HQC + CA + Sug.	1.84 i	7.47 h	12.28 m	16.63 n	1.72 j	10.00 l	15.94 n	20.42 m

Values have the same letter are not significantly different at 5% level using Duncan's Test.

GA_3= gibberellic acid at 50 ppm, BA= 6-benzyl adenine at 20 ppm, 8-HQC= 8-hydroxyquinoline citrate at 300 ppm, CA= citric acid at 300 ppm, Sug.= sugar at 2%.

Table 3. Effect of some chemicals holding solutions on water balance during the shelf life periods (days) of *Chamaedorea elegans* leaves in the two seasons.

Treatments	Water balance (g/leaf)							
	First season				Second season			
	2 days	14 days	28 days	42 days	2 days	14 days	28 days	42 days
Distilled water (control)	-0.70 k	-6.64 m	-9.89 l	-12.40 m	-0.79 l	-3.99 m	-5.81 m	-10.96 m
GA_3	0.28 f	0.28 g	-0.28 g	-0.77 g	0.28 g	0.17 g	0.64 g	0.90 g
BA	-0.13 g	-0.46 h	-0.67 h	-2.83 h	0.26 g	0.09 h	-0.04 h	-1.13 h
8-HQC	-0.24 h	-0.79 i	-2.74 i	-4.15 i	-0.09 h	-0.46 i	-0.56 i	-4.56 i
CA	-0.54 j	-3.40 l	-6.02 k	-10.80 l	-0.71 k	-3.25 l	-4.95 l	-7.81 l
Sug.	-1.27 l	-7.48 n	-10.57 m	-14.47 n	-0.95 m	-6.20 n	-8.19 n	-13.27 n
GA_3 + Sug.	-0.33 i	-3.01 k	-3.45 j	-7.12 k	-0.35 j	2.88 k	-3.31 k	-6.96 k
BA + Sug.	-0.30 hi	-2.13 j	-2.75 i	-6.15 j	-0.24 i	-1.58 j	-1.92 j	-5.52 j
GA_3 + 8-HQC + Sug.	0.76 d	2.84 d	3.98 d	5.13 d	1.21 d	3.76 d	2.98 d	7.04 d
BA + 8-HQC + Sug.	0.89 c	7.14 c	10.10 c	10.82 c	1.34 c	4.09 c	5.41 c	7.78 c
GA_3 + CA + Sug.	0.63 e	0.58 f	1.58 f	1.14 f	0.68 f	0.42 f	1.27 f	2.43 f
BA + CA + Sug.	0.70de	1.60 e	2.53 e	3.45 e	0.93 e	1.86 e	2.17 e	5.50 e
GA_3 + BA + CA + Sug.	1.64 b	8.34 b	11.17 b	11.66 b	1.51 b	4.56 b	6.50 b	9.03 b
GA_3 + BA + 8-HQC + CA + Sug.	1.85 a	10.26 a	13.82 a	13.22 a	1.60 a	6.93 a	9.33 a	10.19 a

Values have the same letter are not significantly different at 5% level using Duncan's Test.

GA_3= gibberellic acid at 50 ppm, BA= 6-benzyl adenine at 20 ppm, 8-HQC= 8-hydroxyquinoline citrate at 300 ppm, CA= citric acid at 300 ppm, Sug.= sugar at 2%.

Table 4. Effect of some chemicals holding solutions on the changing of leaves fresh weight during the shelf life periods (days) of *Chamaedorea elegans* leaves in the two seasons.

Treatments	The changing of leaves fresh weight (%)							
	First season				Second season			
	2 days	14 days	28 days	42 days	2 days	14 days	28 days	42 days
Distilled water (control)	-2.78 b	3.98 b	11.50 b	7.78 b	-3.01 b	3.37 b	6.79 b	11.00 b
GA_3	-3.26 c	2.23 h	6.26 f	3.00 gh	-3.75 ef	1.99 h	2.86 h	6.65 f
BA	-3.25 c	2.30 g	6.85 e	3.05 g	-3.69 e	2.39 g	3.18 g	6.93 e
8-HQC	-3.00 bc	2.64 f	6.88 e	3.17 f	-3.37 d	2.47 f	3.84 f	7.17 e
CA	-2.86 b	3.91 c	9.98 c	5.74 c	-3.06 bc	3.09 c	6.11 c	9.41 c
Sug.	-2.38 a	4.11 a	12.60 a	10.06 a	-2.62 a	3.79 a	8.27 a	12.47 a
GA_3 + Sug.	-2.86 b	3.25 d	7.65 d	4.88 d	-3.13 c	2.95 d	5.41 d	9.16 c
BA + Sug.	-2.91 b	3.00 e	6.88 e	3.25 e	-3.28 d	2.53 e	4.59 e	7.80 d
GA_3 + 8-HQC + Sug.	-4.02 e	0.44 j	3.22 i	2.66 j	-3.98 g	0.39 k	2.29 i	5.98 h
BA + 8-HQC + Sug.	-3.84 de	-0.71 k	2.61 j	2.56 k	-4.36 h	-0.80 l	1.84 j	5.24 i
GA_3 + CA + Sug.	-3.71 d	2.23 h	4.45 g	2.97 h	-3.75 ef	1.74 i	2.75 h	6.34 g
BA + CA + Sug.	-3.71 d	1.67 i	4.14 h	2.81 i	-3.80 f	1.16 j	2.01 j	6.13 gh
GA_3 + BA + CA + Sug.	-5.16 f	-0.90 l	1.38 k	2.55 k	-4.44 h	-1.17 m	0.67 k	3.99 j
GA_3 + BA + 8-HQC + CA + Sug.	-6.05 g	-0.97 m	0.66 l	0.62 l	-4.56 i	-1.37 n	-9.31 l	1.65 k

Values have the same letter are not significantly different at 5% level using Duncan's Test.

GA_3= gibberellic acid at 50 ppm, BA= 6-benzyl adenine at 20 ppm, 8-HQC= 8-hydroxyquinoline citrate at 300 ppm, CA= citric acid at 300 ppm, Sug.= sugar at 2%.

Table 5. Effect of some chemicals holding solutions on vase-life, dry weight and general appearance during the shelf life periods (days) of *Chamaedorea elegans* leaves in the two seasons.

Treatments	Vase life (day)		Dry weight (g)		General appearance			
					14 days	42 days	14 days	42 days
	First season	Second season	First season	Second season	First season		Second season	
Distilled water (control)	35.30 k	38.30 g	1.14 f	1.21 fg	4	2	4	2
GA_3	56.00 d	42.00 d	1.48 d	1.49 cd	4	3	4	3
BA	38.00 j	42.00 d	1.34 e	1.45 d	4	2	4	3
8-HQC	42.70 f	56.00 c	1.33 e	1.35 e	4	3	4	3
CA	39.70 i	40.70 e	1.15 f	1.26 e-g	4	2	4	2
Sug.	30.50 m	21.70 i	1.09 f	1.20 g	4	2	4	1
GA_3 + Sug.	33.50 l	35.50 h	1.28 e	1.30 ef	4	2	4	2
BA + Sug.	42.30 g	39.50 f	1.30 e	1.33 e	4	3	4	2
GA_3 + 8-HQC + Sug.	56.00 d	70.00 b	1.54 b-d	1.71 b	4	3	4	3
BA + 8-HQC + Sug.	45.00 e	42.00 d	1.58 a-c	1.77 ab	4	3	4	3
GA_3 + CA + Sug.	42.00 h	42.00 d	1.49 d	1.56 c	4	3	4	3
BA + CA + Sug.	70.00 c	42.00 d	1.51 cd	1.70 b	4	3	4	3
GA_3 + BA + CA + Sug.	73.00 b	84.00 a	1.59 ab	1.79 ab	4	3	4	3
GA_3 + BA + 8-HQC + CA + Sug.	84.00 a	84.00 a	1.63 a	1.81 a	4	3	4	3

Values have the same letter are not significantly different at 5% level using Duncan's Test.

GA_3= gibberellic acid at 50 ppm, BA= 6-benzyl adenine at 20 ppm, 8-HQC= 8-hydroxyquinoline citrate at 300 ppm, CA= citric acid at 300 ppm, Sug.= sugar at 2%. 4= excellent (75-100%), 3= good (50-75%), 2= moderate (25-50%), 1= bad (>25%).

control in the first and second seasons. The similar results were obtained by Sakr *et al*. (2014) on *limonium sinuatum* cv. "Velvet Wings".

Chemical composition:

Data presented in Table (6) showed that holding the *Chamaedorea* cut leaves in T3: BA at 20 ppm or T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2% increased chlorophyll a and carotenoid. While, chlorophyll b increment with T4: 8-HQC at 300 ppm and T11: GA_3 at 50 ppm + CA at 300 ppm + Sug. at 2%. The content of total carbohydrates increased with holding the cut leaves in T13: GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2% or T14: GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2%. On the other hand, T6: Sug. at 2% reduced the chlorophyll a, b, carotenoid and total carbohydrates. Hassan (2009) on *Strelitzia reginae* Ait. and *Hippeastrum vittatum* Herb. cv. Apple Blossom, found that all the treatments significantly increased the carbohydrate content compared to the control in both cut flowers crops.

Recommendation: It can be recommended that holding cut foliage of *Chamaedorea elegans* in solution containing GA_3 at 50 ppm + BA at 20 ppm + 8-HQC at 300 ppm + CA at 300 ppm + Sug. at 2% followed by the solution containing GA_3 at 50 ppm + BA at 20 ppm + CA at 300 ppm + Sug. at 2% to improve cut leaves quality and longer vase life was reached 84 days.

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Table 6. Effect of some chemicals holding solutions on chlorophyll a, b, carotenoid and total carbohydrates of *Chamaedorea elegans* leaves in the two seasons.

Treatments	First season				Second season			
	Chlo. a (mg/g F.W.)	Chlo. b (mg/g F.W.)	Carotenoids (mg/g F.W.)	Carbo. (%)	Chlo. a (mg/g F.W.)	Chlo. b (mg/g F.W.)	Carotenoids (mg/g F.W.)	Carbo. (%)
Distilled water (control)	1.19 h	0.42 b-e	0.65 de	5.21 i	0.88 h	0.28 f	0.46 f	6.29 k
GA_3	1.78 ab	0.33 fg	0.71 a-c	11.56 d	1.90 a	0.20 g	0.73 a	12.06 e
BA	1.81 a	0.40 c-f	0.69 a-d	11.05 e	1.79 b	0.39 cd	0.71ab	11.70 f
8-HQC	1.32 g	0.53 a	0.69 a-d	10.29 f	1.10ef	0.43bc	0.60 cd	10.36 g
CA	1.23 h	0.46 a-c	0.67 c-e	7.14 h	0.95gh	0.31 ef	0.46 f	7.71 j
Sug.	1.05 i	0.35 e-g	0.56 f	5.18 i	0.87 h	0.27 f	0.51 ef	6.15 l
GA_3 + Sug.	1.21 h	0.42 b-e	0.63 e	7.18 h	1.48 d	0.55 a	0.66 a-c	7.98 i
BA + Sug.	1.43 e	0.37 d-g	0.68 b-d	7.69 g	1.00 fg	0.34 de	0.56 de	10.04 h
GA_3 + 8-HQC + Sug.	1.67 c	0.36 e-g	0.73 ab	12.45 b	1.15 e	0. 41bc	0.62 b-d	12.92 b
BA + 8-HQC + Sug.	1.59 d	0.49 ab	0.69 a-d	12.70 ab	1.70 c	0.44 b	0.71ab	12.92 b
GA_3 + CA + Sug.	1.38 f	0.52 a	0.66 c-e	12.15 c	1.49 d	0.60 a	0.65 a-d	12.74 d
BA + CA + Sug.	1.24 h	0.45 b-d	0.68 c-e	12.45 b	1.75bc	0.27 f	0.74 a	12.83 c
GA_3 + BA + CA + Sug.	1.75 b	0.30 gh	0.73 ab	12.74 a	1.76bc	0.27 f	0.74 a	13.02 a
GA_3 + BA + 8-HQC + CA + Sug.	1.76ab	0.31 h	0.74 a	12.88 a	1.78 bc	0.34 de	0.72 a	13.04 a

Values have the same letter are not significantly different at 5% level using Duncan's Test.

GA_3= gibberellic acid at 50 ppm, BA= 6-benzyl adenine at 20 ppm, 8-HQC= 8-hydroxyquinoline citrate at 300 ppm, CA= citric acid at 300 ppm, Sug.= sugar at 2%.

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تأثير بعض معاملات مابعد الحصاد على الأوراق المقطوفة للشيمادوريا إليجانس

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أجريت هذه الدراسة في معمل بحوث تداول الزينة- قسم بحوث نباتات الزينة وتنسيق الحدائق- معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة – مصر خلال الموسمين ٢٠١٤/٢٠١٥ و ٢٠١٥/٢٠١٦. الهدف هو دراسة تأثير محاليل الحفظ المحتوية على حمض الجبريلليك والبنزايل أدنين و٨-هيدروكسي كينولين سترات وحمض السيتريك والسكرومقارنتها بالماء المقطرعلى تحسين جودة الأوراق المقطوفة وتأخير إصفرارها وذبولها وزيادة عمر الأوراق المقطوفة لنبات الشيمادوريا إليجانس. وأظهرت النتائج الآتى: أدت المعاملة المكونة من حمض الجبريلليك بتركيز ٥٠ جزء في المليون + بنزايل أدنين بتركيز ٢٠ جزء في المليون + ٨-هيدروكسى كينولين سترات بتركيز ٣٠٠ جزء في المليون + حمض سيتريك بتركيز ٣٠٠ جزء في المليون + سكروز ٢% ثم يليه المعاملة المكونة من حمض جبريلليك بتركيز ٥٠ جزء في المليون + بنزايل أدنين بتركيز ٢٠ جزء في المليون + حمض سيتريك بتركيز ٣٠٠ جزء في المليون + سكروز ٢% إلى زيادة معنوية في امتصاص الماء والإتزان المائى بالإضافة إلى تحسين جودة الأوراق وزيادة فترة عمرها وزيادة تركيز الكلوروفيل أ، ب والكاروتينويدات والكربوهيدرات الكلية، كما أدت إلى خفض كمية الماء المفقود، في جميع الأيام مقارنة بالمعاملات الأخرى.

التوصية: يوصى بوضع أوراق الشيمادوريا إليجانس في محلول مكون من حمض الجبريلليك بتركيز ٥٠ جزء في المليون + بنزايل أدنين بتركيز ٢٠ جزء في المليون + ٨-هيدروكسى كينولين سترات بتركيز ٣٠٠ جزء في المليون + حمض سيتريك بتركيز ٣٠٠ جزء في المليون + سكروز ٢% ويليه المعاملة المكونة من حمض الجبريلليك بتركيز ٥٠ جزء في المليون + بنزايل أدنين بتركيز ٢٠ جزء في المليون + حمض سيتريك بتركيز ٣٠٠ جزء في المليون + سكروز ٢% لتحسين جودة الأوراق وزيادة عمرها.