

**EFFECT OF CERTAIN CHEMICAL PRESERVATIVE SOLUTIONS ON VASE LIFE
AND POSTHARVEST CHARACTERISTICS OF CARNATION
Dianthus caryophyllus cv. Felice CUT FLOWERS**

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By

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ABSTRACT

This experiment was carried out in the laboratory of Ornamental Plants and Woody Trees Department at the National Research Center, Dokki, Giza, Egypt, during two successive seasons (2008 and 2009) to investigate the effect of some chemical preservative solutions such as 8-hydroxyquinoline sulphate (8-HQS) alone or with sucrose or benzyl adenine (BA), or gibberellic acid (GA_3), citric acid, alone or with sucrose and silver thiosulphate (STS) alone or with sucrose. Also, aluminum sulphate [$Al_2(SO_4)_3$] alone or with BA or GA_3 , in addition to the control (distilled water) on vase life. and maximum increase in fresh weight *i.e* as keeping quality and change in fresh weight and water balance of carnation *Dianthus caryophyllus* cv."Felice" cut flowers. Using solution of (300 ppm 8-HQS+40g/l sucrose) and (0.4mM STS +50 g/l sucrose) significantly increased vase life and maximum increase in fresh weight compared with control (distilled water). Pulsing carnation cut flowers in 50 ppm GA_3 for 24h. then placed in 200 ppm $Al_2(SO_4)_3$ showed the highest values of increase in fresh weight % after 12 days in the 2nd season (12.63%). The highest level of water balance was recorded at 12th days by using 50 ppm of GA_3 for 24 h. then placed in $Al_2(SO_4)_3$ in the 2nd season.

Key words: *Dianthus caryophyllus*, keeping quality, 8-HQS, STS, $Al_2(SO_4)_3$, sucrose, vase life.

1. INTRODUCTION

About 20% of fresh flowers lose their quality while passing through the market (harvest, packing, transportation and sale) and a large percentage of the remaining flowers are sold at low quality conditions 'dissatisfying the consumer (Asfarani *et al.*, 2008) due to physiological problems during the post-harvest handling. Under normal conditions, cut flowers last only for a few days maintaining their beauty and attractiveness. However, most of the people like to enjoy them in their natural beauty and appearances for a longer period of time (Zamani *et al.*, 2011). Thus, using appropriate preservatives could help to extend the vase life of the harvested produce for consumer satisfaction and exploitation of the business.

Dianthus caryophyllus L. (carnation) fam. Caryophyllaceae is one of the most important cut flower nowadays. Therefore, it is important to ensure the longest vase life of the flowers. Various factors influence the postharvest performance and the vase life of cut flowers (Mayak *et al.*, 1974 and Ichimura *et al.*, 2002).

Vase life is influenced by genetics, the growing conditions, flower handling (Pizano, 2009), carbohydrate content, block-age of xylem vessels, ethylene, the composition of the atmosphere, and the chemical solutions of the preservatives. After harvest, the longevity of flowers is limited by rapid petal wilting. Floral preservatives have been found to delay the senescence by suppressing the microbial growth and promoting solution uptake due to reduction in vascular blockage (Asrar, 2012 and Elhindi, 2012). Silver thiosulphate (STS) allow for a better adjustment of flower supply to the requirements of the market and to a greater extent eliminates the postharvest losses. Some chemical preservatives increased vase life of cut flowers, *i.e*. citric acid with sucrose 2% (Patil and Reddy 2005) on *Solidago canadensis*, or aluminum sulphate as biocide alone or with sucrose were used to prolong vase life (Chen *et al.*, 2004) on *Gerbera hybrida* and (Mohamed *et al.*,2012) on roses, and increased fresh weight. The influence of mineral salts such as $Al_2(SO_4)_3$ on the physiological and biochemical changes of

cut rose (*Rosa hybrida*) in addition to the extension of vase life, was attributed to their effects in increasing the permeability of cell membrane and keeping the peroxidative changes at a minimum rate (Bhaskar *et al.*, 2003). Sucrose was the kind of sugar mostly used in floral preservatives; the increase of vase life due to sucrose may result from a decreased moisture stress and improved water balance (El Zohairy 1999) on some cut flowers. Gue *et al.* (2004) stated that BA and GA₃ both prolonged vase life, while BA inhibited ethylene production, and that BA is the main factor regarding senescence of cut chrysanthemum. Using the floral preservative solution 8-hydroxy quinolone sulphate (8-HQS) as ethylene antagonist, Elgimabi and Sliai, (2013) reported that 200 ppm 8-HQS combined with 7% sucrose increased vase life of *Rosa damascena* cv. Trigintipetala and retarded the chlorophyll as well as carbohydrate degradation.

2. MATERIALS AND METHODS

The present study was conducted at the laboratory of Ornamental Plants and Woody Trees Department, National Research Center during two successive seasons (2008 and 2009). The aim of this study was to investigate the effect of using some chemical preservative solutions on the vase life of carnation cut flowers (*Dianthus caryophyllus*) cv. Felice. The cut flowers were obtained directly from a commercial growing farm "Floramix Farm". The flowers were cut early in the morning kept in ice box collar (precooled) and transported to the laboratory within one hour. The leaves from the third lower part of the stem and five cm from the base of the stem were removed under running water to prevent air bubbles getting into the cut end, then placed in cold water for 15 min. The all stems were trimmed to uniform length of 50 cm for carnation cut flowers. The details of the treatments of chemical solutions used were as follows:

1. Distilled water, as control.
2. 300 ppm 8-HQS.
3. 300 ppm 8-HQS+40gm/l sucrose.
4. 150 ppm 8-HQS.
5. 150 ppm 8-HQS +20gm/l sucrose.
6. 0.4 mM STS for 6h.
7. 0.4 mM STS for 6h. +50 gm/l sucrose.
8. 150 ppm citric acid.
9. 150 ppm citric acid +20 gm/l sucrose.
10. 200 ppm Aluminum sulphate

11. 50 ppm GA₃ for 24h. then placed in 200 ppm Al₂(SO₄)₃
12. 50 ppm BA for 24h. then placed in 200 ppm Al₂(SO₄)₃
13. 50 ppm GA₃ for 24h. then placed in 200ppm 8-HQS.
14. 50 ppm BA for 24h. then placed in 200ppm 8-HQS.

The recorded data were:

- * Vase life (days).
- * Maximum increase in fresh weight%:

Fresh weights of carnation cut flowers were measured daily during vase life. The original fresh weight was measured immediately after cutting flowers and before the immersing in keeping solutions. The flowers were weighted every 2 days until the end of the vase life. The fresh weight of each cut flower was expressed relative to their initial weights to represent the percentage of weight loss for each cut flower stem (He *et al.*, 2006).

- * Change in fresh weight% was recorded just before the beginning of the treatment then every two days, *i.e.* 2, 4, 6, 8, 10 and 12 days.
- * Water balance: During shelf life period The rate of water balance = the rate of water uptake - the rate of water loss.
- * Water uptake: The weight of absorbed preservative solutions (g) was recorded every two days *i.e.* "2, 4, 6, 8, 10 and 12 days."
- * Water loss: (g/flower) was measured as a difference between the weight of the jars with the flowers, every two days (2, 4, 6, 8, 10 and 12 days) and the weight of the jars with flowers at the beginning of the experiment.

3. RESULTS AND DISCUSSION

3.1. Effect of different vase solutions on vase life (days) of carnation flowers

The data recorded in Table (1) indicated showed that all the tested vase solutions significantly prolonged the longevity on vase life (days) of carnation cut flowers as compared with the control (distilled water), in both seasons. The best treatment was 300 ppm 8-HQS + 40 g/l sucrose, which gave 12.90 and 13.03 days in 1st and 2nd seasons compared to 7.87 and 7.07 days for the untreated control, respectively. STS treatment improved the vase life of carnation cut flowers. The longest vase life was obtained by the treatment of 0.4 mM STS for 6 hours + 50 g/l sucrose, with a significant increase which

gave 13.33 and 13.0 days in the 1st and the 2nd seasons, respectively, compared with the untreated control (distilled water).

Pulsing carnation cut flowers in 50 ppm GA₃ for 24 h., then placed in 200 ppm Al₂(SO₄)₃ and 50 ppm BA for 24 h., then placed in 200 ppm 8-HQS significantly increased vase life which recorded (12.50 and 14.00 days) and (11.07 and 12.00 days) in the 1st and the 2nd seasons, respectively.

Pulsing carnation cut flowers in 50 ppm gibberellic acid + 200 ppm Al₂(SO₄)₃ or 50 ppm BA for 24h +200 ppm 8-HQS treatments slightly enhanced flower longevity in carnation cut flowers. These results agreed with those obtained by Gue *et al.* (2004) on *P. tuberosa*, who found that BA and GA3 both prolonged vase life and delayed premature wilting, in addition to BA inhibiting ethylene production. BA is the main factor retarding the senescence of cut chrysanthemum flowers, (Patil and Reddy, 2005) on *Solidago canadensis* and Skutnik *et al.* (2006) on asparagus.

The active role of 8-HQS could be explained also by maintaining flower turgidity, by keeping fresh weight and chlorophyll as well as carbohydrates losses by 8-HQS to a minimum. These results are in agreement with the findings of Knee (2000) on rose, Kim and Lee (2002) and Samaneh *et al.*, (2013) on gerbera flowers.

The results indicate the importance of 8-HQS

in increasing the vase life of cut flowers, where 8-HQS prevented the accumulation of microorganisms in xylem vessels and suppressed xylem occlusion. These results may be due to the role of 8-HQS as antimicrobial agent and it might be reducing stem plugging and increasing vase life, (El-gimabi and Sliai 2013).

The effective role of STS in prolonging vase life of cut flowers may be due to the percentage of weight loss, and chlorophyll degradation minimized, and as consequence the vase life was extended. These results are in harmony with the results of Asrar (2012) on *Antirrhinum majus* L. and Elhinidi (2012) on sweet pea cut flowers and Samaneh *et al.* (2013) on gerbera cut flowers.

3.2. Maximum increase of fresh weight%

From the data in Table (1), it is obvious that these treatments significantly increased the maximum increase of fresh weight % in most treated carnation cut flowers with preservative solutions in both seasons than distilled water, as control.

It should be mentioned that the highest values of significant increases of fresh weight were (18.31 and 19.76%) when 300 ppm 8-HQS +40 g/l sucrose was used on carnation cut flowers in the first and second seasons, respectively. However the lowest values of this parameter were (9.77 and 9.04%) when carnation cut flowers were held in preservative solution containing 200 ppm aluminum sulphate in both

Table (1):Effect of the preservative solution treatments on vase life (days) and maximum increase of fresh weight % of *Dianthus caryophyllus* cv. "Felice"cut flowers in 2008 and 2009 seasons.

	Treatments	Vase life (days)		Maximum increase of fresh weight %	
		2008	2009	2008	2009
1.	Distilled water	7.87	7.07	10.01	7.75
2.	300 ppm 8-HQS	10.22	11.01	9.96	14.54
3.	300 ppm 8-HQS + 40 g/l sucrose	12.90	13.03	18.31	19.67
4.	150 ppm 8-HQS	11.00	11.90	12.48	4.38
5.	150 ppm 8-HQS+20 g/l sucrose	11.50	10.00	13.02	13.77
6.	0.4 mM STS for 6 h.	12.50	12.03	11.15	9.89
7.	0.4 mM STS for 6 h. + 50 g/l sucrose	13.33	13.00	18.97	12.07
8.	150 ppm Citric acid	8.00	10.00	15.07	8.64
9.	150 ppm Citric acid + 20 g/l sucrose	10.00	8.00	11.71	17.31
10.	200 ppm Aluminum sulphate	11.00	11.20	9.77	9.04
11.	50 ppm GA3 for 24 h. then placed in 200 ppm Aluminum sulphate	12.50	14.00	10.15	7.65
12.	50 ppm BA for 24 h. then placed in 200 ppm Aluminum sulphate	9.51	8.90	11.25	11.49
13.	50 ppm GA3 for 24 h. then placed in 200ppm 8-HQS	9.72	9.95	10.52	8.06
14.	50 ppm BA for 24 h. then placed in 200 ppm 8-HQS	11.07	12.00	11.75	7.96
	L.S.D _{0.05}	1.587	1.932	1.577	2.194

seasons, respectively. These results coincided with the results obtained by Taha and Soad (2010) on sterlitzia, who mentioned that preservative vase solutions recorded higher daily increase of fresh weight percentage, where, the flower weight, expressed the flower freshness, flower longevity and senescence. Steinitz (1982) pointed out that addition of sucrose to the solution increased the mechanical turgidity of stem by inducing cell wall thickening and lignification of vascular tissues. Sucrose or its combination with biocides is a main limiting factor in postharvest life of cut flowers (Kazemi *et al.*, 2011) and improved postharvest performance on tuberose (Gul and Tahir 2013).

3.3.The change of fresh weight % of carnation cut flowers during shelf life period

From the recorded data in Tables (2 and 3), it can be concluded that the change of fresh weight (%) of carnation cut flowers gained an increase gradually by increasing the number of days during the shelf life period, and this increase differ according to the treatments of preservative solutions. The data revealed that the fresh weight gain decrease in 300 ppm 8-HQS (2.53 from 1.59 %), and the highest value was found after 6 days after that. The increase in fresh weight started to decrease in the 1st season, while in the 2nd season 300 ppm 8-HQS + 40 g/l sucrose treatment gain significant increased to 6.61%. This was found after 8 days compared to the control (-4.03%) and after that, the increase in fresh weight started to decrease.

The same observation was also noticed in 0.4 mM STS for 6h. +50 g/l sucrose which resulted in a significant increase in fresh weight from 2.53 to 10.87% after 6 days during shelf life period in the 1st season, and in the 2nd season the same treatment gained increase in fresh weight from 7.65 to 9.90% compared with distilled water (7.65%) after 6 days during shelf life period, then gained significant increase in fresh weight from (-8.07 to 16.20%) after 12 days during shelf life period, then decreased after that until the end of the shelf life period. However, 50 ppm GA3 for 24h. then placed in 200 ppm Al₂(SO₄)₃ exhibited the highest values of increase in fresh weight % after 12 days in the 2nd season (12.63%). These results are in agreement with those obtained by Patil and Reddy (2001) and Patil *et al.* (2003) on solidago, they mentioned that flower stalks in sucrose solutions with 8-HQS maintained higher rates of fresh weight in solidago, morosely Mohamed *et al.* (2012) mentioned that Al₂(SO₄)₃ increased vase life and fresh weight. It seems that antimicrobial effect of the applied beneficial treatments led to the declined vascular blockage, higher solution uptake and fresh weight in treated cut flowers, by which the senescence process was delayed (Kazemi *et al.*, 2011).

3.4.Effect of the different vase solution treatments on water balance of carnation cut flowers

Data presented in Tables (4 and 5) showed that treated flowers with different preservative

Table (2): Effect of different vase solutions on the change in fresh weight % of carnation, *Dianthus caryophyllus* cv."Felice" cut flowers, in the first season (2008).

Vase solutions		Days after treatments					
		2	4	6	8	10	12
1	Distilled water	3.87	3.06	2.53	-8.44	-6.63	-5.99
2	300 ppm 8-HQS	6.48	1.17	1.59	-2.86	-3.62	-3.75
3	300 ppm 8-HQS + 40 g sucrose	5.49	4.05	4.35	2.60	-2.94	-1.46
4	150 ppm 8-HQS	3.99	3.36	4.17	-3.32	-11.33	-10.11
5	150 ppm 8-HQS+20 g sucrose	3.39	2.04	6.51	-6.07	-6.60	-10.77
6	0.4 mμ STS for 6 h.	1.78	4.80	2.89	0.95	-7.47	-7.26
7	0.4 mμ STS for 6 h. + 50 g sucrose	3.08	2.68	10.87	4.54	5.13	-1.11
8	150ppm Citric acid	5.49	3.17	3.45	1.66	-3.12	-1.38
9	150ppm Citric acid + 20 g sucrose	3.97	6.34	5.96	2.46	1.44	-1.31
10	200ppm Aluminum sulphate	2.70	3.75	2.75	-0.74	-11.78	-16.55
11	50 ppm GA3 for 24 h. then placed in 200 ppm Aluminum sulphate	2.78	1.75	3.44	1.56	-1.14	-1.61
12	50 ppm BA for 24 h. then placed in 200 ppm Aluminum sulphate	3.31	3.87	3.31	-2.53	-13.89	-13.75
13	50 ppm GA3 for 24 h. then placed in 200 ppm 8-HQS	1.93	1.67	2.41	-1.06	-4.67	-5.41
14	50 ppm BA for 24 h. then placed in 200 ppm 8-HQS	2.95	4.29	3.71	-1.35	-8.79	-13.28

Table (3): Effect of different vase solutions on the change in fresh weight % of carnation *Dianthus caryophyllus*, cv."Felice" cut flowers, in the second season (2009).

Vase solutions		Days after treatments					
		2	4	6	8	10	12
1.	Distilled water	-2.39	1.74	7.65	-4.03	-6.99	-8.06
2.	300 ppm 8-HQS	1.65	0.18	2.03	-1.92	-2.88	-2.52
3.	300 ppm 8-HQS + 40 g/l sucrose	2.34	-11.37	4.43	6.61	-11.99	-1.23
4.	150 m 8-HQS	4.93	-0.55	-0.41	-14.09	-1.98	-8.57
5.	150 ppm 8-HQS+20 g/l sucrose	-0.24	6.22	-0.15	6.47	-11.78	-10.43
6.	0.4 mμ STS for 6 h.	-19.31	23.25	0.06	-0.90	-4.02	-1.96
7.	0.4 mμ STS for 6 h. + 50 g/l sucrose	-4.00	13.91	9.90	-13.23	0.39	16.20
8.	150 ppm Citric acid	12.77	-8.35	2.07	18.17	-21.73	-5.56
9.	150 ppm Citric acid + 20 g/l sucrose	8.42	0.62	7.00	-0.79	-3.82	-0.29
10.	200 ppm Aluminum sulphate	6.27	-2.56	4.32	-2.49	-12.29	-10.97
11.	50 ppm GA3 for 24 h. then placed in 200 ppm Aluminum sulphate	-1.83	-2.09	10.21	0.40	-29.53	12.63
12.	50 ppm BA for 24 h. then placed in 200 ppm Aluminum sulphate	2.31	4.20	0.30	3.71	-9.69	-11.81
13.	50 ppm GA3 for 24 h. then placed in 200 ppm 8-HQS	0.95	-0.91	-2.35	4.23	-7.66	-10.01
14.	50 ppm BA for 24 h. then placed in 200 ppm 8-HQS	3.00	0.36	1.32	2.86	-17.01	-15.16

solutions recorded the highest level of water balance by 300ppm 8-HQS + 40 g/l sucrose which gave (0.71 g/flower) on the 10th day in the 1st season, 0.4 mM STS for 6 h. +50 g/l sucrose gave (1.56 g/flower) on the 10th day and 150 ppm citric acid +20 g/l sucrose gave (0.69 g/flower) on the 8th day in the 1st season compared to other treatments and the control cut flowers. However, in the second season, the highest level of water balance was (8.61 g/flower) at the 12th day by using 50 ppm GA3 for 24 h. then placed in 200 ppm AL₂(SO₄)₃. Using 0.4 mM STS for 6h. + 50 g/l sucrose up to the 10th day gave (1.31 and 3.98 g/flower) in the 1st and the 2nd seasons, respectively. While, 150 ppm citric acid +20 g/l sucrose at the 6th day gave (1.63 and 1.81 g/flower) in the 1st and the 2nd seasons, respectively, and 300 ppm 8-HQS + 40 g/l sucrose up to the 8th day gave (1.71 g/flower) in the 2nd season compared to other treatments. Cut flowers turgidity is the result of the balance between the level of water uptake and water loss. Sugars improve the water balance in cut flowers and this was attributed to the effect of sucrose on the closure of stomata and reduction of water loss, (Halevy and Mayak,

1981). The sugars accumulate in the flowers, increasing their osmotic concentration and improving their ability to absorb water and maintain their turgidity. Gul and Tahir (2013) found that STS increased solution uptake on *Narcissus pseudonarcissus* which increased water balance. This is due to the carbohydrates being the main source of nutrition and energy necessary for maintaining all biochemical and physiological process after separation from the mother plant. This beneficial effect is attributed to the improvement of water relation and increase in respiration adding 8-HQS to the preservative vase solution, acts also as bactericide and reduces pH of solution, which improved the solution absorption. El-Zohairy (1999) reported that 8-HQS treatments increased water balance of *Rosa hybrida*, moreover, Kim and Lee (2001) reported that water balance values of rose cut flowers held in water changed to a negative value faster than those held in preservative solutions containing sucrose, 8-HQS in cut flowers of roses. Ali and Hassan (2014) found that treating bird of paradise flowers with 8-HQS and GA₃ increased longevity, vase life and postharvest quality.

Table (4): Effect of different vase solutions on water balance (g/ flower/ day) of carnation, *Dianthus caryophyllus*.cv Felice cut flowers in the first season (2008).

Vase solutions		Days after treatments					
		2	4	6	8	10	12
1.	Distilled water	0.95	0.77	0.65	-2.02	-1.49	-1.26
2.	300 ppm 8-HQS	1.55	0.29	0.39	0.68	-0.83	-0.84
3.	300 ppm 8-HQS + 40 g/l sucrose	1.13	0.85	0.97	0.59	0.71	-0.32
4.	150 ppm 8-HQS	0.88	0.76	0.99	-0.76	-2.62	-1.9
5.	150 ppm 8-HQS+20 g/l sucrose	0.73	0.45	1.56	1.37	0	-2.05
6.	0.4 mM STS for 6 h.	0.42	1.16	0.72	0.24	0	-1.59
7.	0.4 mM STS for 6 h. + 50 g/l sucrose	0.73	0.66	2.99	1.31	1.56	-0.68
8.	150 ppm Citric acid	1.34	0.78	0.88	0.53	-0.61	-0.35
9.	150 ppm Citric acid + 20 g/l sucrose	0.96	1.63	1.63	0.69	0.41	-0.37
10.	200 ppm Aluminum sulphate	0.65	0.94	0.72	-0.28	-2.71	-1.04
11.	50 ppm GA3 for 24 h. then placed in 200 ppm Aluminum sulphate	0.66	0.42	0.86	2.93	0.79	-0.4
12.	50 ppm BA for 24 h. then placed in 200 ppm Aluminum sulphate	0.76	0.92	0.81	-0.61	-2.92	-2.55
13.	50 ppm GA3 for 24 h. then placed in 200 ppm 8-HQS	0.47	0.41	0.6	-0.27	-1.11	-1.22
14.	50 ppm BA for 24 h. then placed in 200 ppm 8-HQS	0.68	1.05	0.94	-0.33	-0.02	-8.71

Table (5): Effect of different vase solutions on water balance (g/flower /day) of carnation, *Dianthus caryophyllus*.cv Felice cut flowers in the second season (2009).

Vase solutions		Days after treatments					
		2	4	6	8	10	12
1.	Distilled water	-0.54	0.41	1.95	-0.99	-1.59	-1.7
2.	300 ppm 8-HQS	2.71	0.07	0.51	0.45	-0.68	-0.57
3.	300 ppm 8-HQS + 40 g/l sucrose	5.21	-2.57	1.06	1.71	0	-1.7
4.	150 ppm 8-HQS	1.28	0.11	0.11	-3.08	12.09	-1.71
5.	150 ppm 8-HQS+20 g/l sucrose	-0.05	-3.51	0.03	1.77	-2.86	-2.35
6.	0.4 mM STS for 6 h.	-3.96	6.36	0.05	0.23	1.05	-3.24
7.	0.4 mM STS for 6 h. + 50 g/l sucrose	-0.88	3.72	2.89	3.35	0.1	3.98
8.	150 ppm Citric acid	3.09	-1.86	0.5	5.07	-4.97	2.99
9.	150 ppm Citric acid + 20 g/l sucrose	2.01	0.16	1.81	-0.19	-0.93	-2.59
10.	200 ppm Aluminum sulphate	1.6	-0.57	1.1	0	-2.76	-3.75
11.	50 ppm GA3 for 24 h. then placed in 200 ppm Aluminum sulphate	-0.41	-0.46	2.55	0.1	5.82	8.61
12.	50 ppm BA for 24 h. then placed in 200 ppm Aluminum sulphate	0.57	1.1	0.09	1.03	-2.38	-13.1
13.	50 ppm GA3 for 24 h. then placed in 200 ppm 8-HQS	0.23	-0.22	-0.55	1.03	-1.73	0.65
14.	50 ppm BA for 24 h. then placed in 200 ppm 8-HQS	0.69	-0.09	0.31	0.69	-3.49	-4.35

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تأثير بعض محاليل الحفظ الكيماييه على فترة بقاء
وصفات ما بعد القطف لأزهار القرنفل *Dianthus caryophyllus* cv. Felice

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ملخص

اجريت هذه التجربه في معمل نباتات الزينه والأشجار الخشبية بالمركز القومي للبحوث بالدقي - الجيزة - جمهورية مصر العربية خلال موسمين متتاليين في عامي (2008-2009) لدراسه تأثير بعض محاليل الحفظ الكيماييه مثل :
- 8-هيدروكسي كينولين سلفات (8-HQS) بمفرده او باضافة السكروز او حمض الجبريليك (GA_3) أو البنزيل ادنين (BA).

- ثيو سلفات الفضة (STS) بمفرده أو باضافة السكروز.
- كبريتات الالومنيوم $[Al_2(SO_4)_3]$ بمفردها أو باضافة البنزيل ادنين (BA) أو حمض الجبريليك (GA_3).
- حمض الستريك بمفرده أو مع السكروز.
- بالاضافة الى الماء المقطر كمعاملة مقارنه.

وتم دراسة تأثير تلك المعاملات على كل من فترة بقاء الازهار في محاليل الحفظ واقصى زياده ممكنه في الوزن الطازج للأزهار [كدليل على احتفاظ الازهار بحيويتها] , نسبة التغير في الوزن الطازج للأزهار وأيضاً نسبة الاتزان المائي بداخل الزهرة في نبات القرنفل *Dianthus caryophyllus* cv. Felice أثبتت النتائج الاتي: استخدام كلاً من محاليل الحفظ المكونه من: (300 جزء في المليون هيدروكسي كينولين سلفات + 40 جم سكروز) و(0.4 ميكرو مول من ثيوسلفات الفضة + 50 جم سكروز) أعطت أعلى فترة لبقاء الأزهار بعد قطفها وأعلى زياده في الوزن الطازج للأزهار مقارنة بالماء المقطر. أيضاً أدى غمس قواعد الأزهار في محلول مكون 50 جزء في المليون حمض الجبريليك لمدة 24 ساعه ثم نقلها لمحلول مكون من 200 جزء في المليون من كبريتات الالومنيوم اعطت زياده في الوزن الطازج للأزهار بعد 12 يوم في الموسم الثاني (12.36%) كما ادى استخدام نفس المحلول إلى اعطاء أعلى قيمة الاتزان المائي بداخل الأزهار في اليوم الثاني عشر من التجربة مقارنة بباقي المعاملات.

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