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Evaluation the effect of sucrose and GA_3 treatment on vase life carnation cut flower (*Dianthus caryophyilus* var *Yellow)*

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ABSTRACT

This study investigated the effects of sucrose and GA_3 treatments on the longevity of cut carnation flowers Dianthus caryophyilus var Yellow, respectively. The experiment was carried out in a completely randomized design (CRD) with two factors and three levels of sucrose (0, 0.5 and 1%) and GA_3 at four levels (0, 3, 6 and 9 mg/L) in three replications. Several traits such as longevity rate, diameter of flower, petals color, and relative water content, pH, and electrolyte leakage was measured. The results showed that 6 mg/L GA_3 and sucrose had a significant difference compared to the control. Longevity has increased (67.3%) than controls (1%).

Keywords: GA_3, sucrose, longevity, carnation

INTRODUCTION

Dianthus caryophillus is belonged to the Caryophyllaceae family. It is from the Mediterranean region. Native species only flower in the spring due to increasing day length (photoperiod) and temperature. Carnation is a perennial plant cut flowers which grown in greenhouses. Since the longevity of cut carnation flowers is one of the most important qualitative factors, so the long term flowers has been consider on the rate of consumer demand as well as the value of cut flowers[1].

Therefore, the best way seems to be necessary for postharvest and determine the appropriate ratio of chemicals (sucrose and GA_3) in the nutrient solution, and its impact on the longevity of cut flowers. Under cultivation area of ornamental plants are totaling over 180000 hectares, which includes greenhouse production of various agricultural products. Japan, U.S.A and Netherlands are the world's major supplier of plants. Cut flowers of carnation are in third position after *Gladioulus grandiflorus* and Roses. Carnation are sold as pot and cut flowers. Considering the fact that flowers and ornamental plants among consumers, is mentioned as luxury products, so their significant market penetration and utilization, can always be seen for these products. The first important note in production sector is traditional method. This method can reduce the cost and increase competition in the international arena which must be reviewed and will be replaced by industrial methods. The most important factor is low-temperature storage of cut flowers and cuttings. During storage of flowers temperature (close to optimal level) will reduce the speed of aging process and prolong the storage periods. Respiratory patterns in flowers, fruits and leaves, have not been investigated. However, available data indicate changes include climacteric and non-climacteric. Senescence is a biological growth process. Senescence includes a wide range of physiological processes which are controlled by hormones. Damage depends on environmental factors such as the concentration of ethylene in atmosphere, the length of time the flowers are exposed to ethylene, temperature, concentration of co2 in the atmosphere, flowers pollination by insects at different stages of flower development, and quality of flowers and the seasons[2].

Cut flowers and herbaceous plants cuttings can contain amount of water. If they are kept in a dry atmosphere through the stomata lose water caused by transpiration. Transpiration intensity, temperature, humidity and air flow are related. The salinity water is an important factor that affects on the quality and stability of cut flowers. Some ions in water affect on the vase life flowers. Desirable time to harvest depends on many factors. Harvest in the morning, according to the tenderness of stems is advantage. But wet flowers are more susceptible to fungal infections. Harvest time in the evening due to the higher concentration of carbohydrates in the stems of the flowers is better. If cut flowers are kept in soluble sugar content, harvest time would not be so important. In recent years several criteria grading are provided based on the principles of physical measurements (length, diameter, flower, stem and flower weight, etc). Pulsing treatment solution is treatment by putting the cut flowers in the solution for a short period, usually less than 24 hours and is usually performed at low temperature. In standard treatment cut flowers have been in protection solution prepared nutrient [3].

MATERIALS AND METHODS

Plant material
In this experiment yellow carnation varieties was used. It was prepared of greenhouse located in Karaj, Iran. Each of 25 packages wrapped in newspaper. The branches were transferred to the laboratory in the morning. Recut was done under water. Then they transferred to solution.

Location of the study was a laboratory, with an average temperature of 20-17 ° C. light through windows and humidity was maintained above 50%. Air conditioner was used.

This project aims to investigate the effect of sucrose and gibberellins on the lasting yellow varieties of carnation. It was carried out in the laboratory of Horticulture, Islamic Azad University, Abhar.

This study was based on a factorial experiment in CRD included three levels of sucrose and GA_3 on four levels with three replications. After data collection, traits such as lasting, diameter of flower, petals color changing, relative water content and electrolyte leakage was measured. Traits such as shelf life, diameter and color changing flower petals were not normally distributed; the data were analyzed by using the software MSTATC. Sucrose was used at concentrations of (0, 0. 5 and 1%) and GA_3 (0, 3, 6 and 9 mg /mL). Experimental period was 20 days.

Traits and methods of measurement
Longevity was evaluated based on the method proposed by Bowyer and et al (2003),[4].

Rating was done by using on a scale of one to four, and was expressed as a percentage.

According to the method used by Mortazavi et al (2007) RWC was calculated by the following formula [5]: 100 × (dry weight - saturated weight / dry weight - fresh weight) = percentage RWC

In this experiment fresh weight of approximately one gram of tissue of petal was measured.

With regard to the method Pin (2003) Flower diameter was measured by using a ruler [6].

Saturated weight was gained by one gram of the tissue which was divided into 1 cm pieces. Then Petri dishes containing distilled water were placed in a dark place for 24 hours.

Their weights were measured again. The resulting number is the weight of the saturated tissue.

Petals of each treatment were put into Petri dish and transferred into the oven for 48 h at 80 ° C. The dried petals were weighed twice.

Electrolyte leakage was measured according to Mortazavi et al (2007) and Lim and et al (1998) by Using the water bath, autoclave and EC meters. Following formula was expressed as a percentage [5,7].

EC2 – (EC1/EC2) * 100 =EL

pH was determined by manual pH meters .

RESULTS AND DISCUSSION

Effect of sucrose
The results of the analysis of variance (Table 1) show that sucrose had significantly effect on relative water content, pH, electrolyte leakage at 5% level. There was no significant difference in the traits, so that the mean comparisons table (Table 2), relative water content and pH increased and electrolyte leakage decreased. Also according to the mean comparison table, the best levels of sucrose1% not only increased longevity but also had positive effect on all traits, although no significant difference was observed. Sugar effect on further increasing the osmotic pressure increases is relative to water content in stems and flowers and thus improves the ability to absorb water; this result corresponded to Van Doorn and et al (1997) cut flowers of roses and Acock, (1979) the carnation cut flowers [8,9].

On the other hand sucrose stabilized wall and cell membrane and reduced electrolyte leakage. These results are similar Estepnokous and et al (1976) in cut flowers roses [10].

(Table 1) analysis of variance (mean squares MS)

pH	EL	RWC	petal change color	flower diameter	longevity	degree of freedom	source of variance
*1.35	*39.98	*373.29	ns325.69	ns0.52	ns0.33	2	A(sucrose)
ns0.05	ns43.54	**495.67	ns39.82	ns0.11	ns0.96	3	B (GA3)
ns0.06	**90.92	*139.14	*71.07	*0.18	ns2.19	6	A*B
0.12	21.23	50.28	30.79	0.07	0.53	18	error
6.72	46.30	23.02	32.86	3.8	36.62	-	CV

*or ** indicates statistically significant differences between sample means based on F test at $P \leq 0.05$, $P \leq 0.01$, or $P \leq 0.001$, respectively. NS (not significant)*

(Table 2) comparison of mean in interactions between sucrose and GA3 ($p \leq 0.05$)

pH	EL (%)	RWC (%)	petal color (%)	flower diameter (mm)	longevity (%)	sucrose (%)
4.77 a	10.6 b	25.2 b	18.75 b	76.71 b	2.17 a	a1=0
5.42 b	11.70 b	30.8 ab	20 b	6.87 b	2 a	a2=0.05
5.25b	8.1 a	36.4 a	10.42 a	7.12 a	2.51 a	a3=1

(Table 3) comparison of mean at different levels of GA_3($p \leq 5\%$)

pH	EL (%)	RWC (%)	petal color change (%)	flower diameter (mm)	longevity (%)	GA3 (mg/L)
5.09 a	13.07 b	21.49 c	16.7a	6.93ab	1.67 b	b1=0
5.22 a	9.92 ab	28.33 b	17.8a	6.74b	1.89 ab	b2=3
5.07 a	8.59. a	30.48 a	17.8a	6.93ab	2.44 a	b3=6
5.19 a	8.23 a	37.91 a	13.3a	6.99a	2 ab	b4=9

** Means with the same letter are not significantly different at ($P \leq 0.05$).*

Higher pH is probably due to the absorption of sucrose that reduced cations in solution. It should be noted that the pH decreased by sucrose consumption continues. The pH reduction prevented the buildup of bacteria in end of the stem and improved high-flow water. Resulting in better absorption of nutrients is corresponding with Mortazavi et al (2007) in roses [7].

Effect of gibberellic acid
According to the analysis of variance (Table 1) using different amounts of GA_3content showed significant differences acid only on relative water at 1% level and the other traits were not significant. Also, according to the mean comparison (Table 3) GA_3 increased relative water content more than the control. The best treatment3b, 6 mg / L that could increase the longevity and make a significant difference, and the lowest was related to the control.
Gibberellins increased relative water content may be due to the hydrolysis of starch and polysaccharides into glucose and fructose which decreased the water potential in the stem and flower. And therefore more water increased relative water content, the result is agree with Emongor (2004) at Gerbera cut flowers [11].

Interactions between sucrose and GA_3

According to analysis of variance (Table 1) interactions between sucrose and GA_3 had significant effect on longevity and electrolyte leakage at 1%. The diameter of the flower, petals color changing and relative water content caused significant at the 5% level.

Also based on the comparison of means (Table 4) treatment 3b1a (minimal level of sucrose and 6 mg/L GA_3) was significant difference in longevity than the other treatments and control. So that longevity time increased 20 days approximately (67.3%) than controls (1%), and other treatments, respectively, 3b3a, 4b3a and 4b1a. The minimum effect has seen in control.

The best treatment that could reduce electrolyte leakage is 4b1a (lowest level of sucrose with the highest level of GA_3) and minimal treatment is related to 1b2a (0.5% sucrose the lowest level of GA_3).

According to Table (4) the best treatments increase flower diameter, respectively, 3a3b, 4b3b and 1b2b. There is a significant difference compared to the other treatments showed that the smallest diameter of the flower is of the control. The best treatment that could reduce the color of the petals is 1b 3a (high-sucrose and lowest-level GA_3) and the minimum impact is related to the treatment and control 3b2a. 3b1a, 4b1 4b3a could increase relative water content than other treatments in order to make a significant difference. Minimal effect is control.

In with this issue the interaction of two factors, sucrose and GA_3 increased flower diameter and relative water content, electrolyte leakage , longevity and decrease total discoloration of petals, it may be said that the main factor is GA_3 hydrolysis of polysaccharides and possibly delaying chlorophyll degradation or structural role in the chloroplast photosynthesis . On the other hand, it not only makes carbohydrates to provide the energy and nutrients needed to develop and increase the diameter of the flower ,but also hydrolysis of sugars regulated respiration so it caused low sensitivity to ethylene or delayed natural release of ethylene in plant. Maybe using both mechanisms can prevent the effect of ethylene that causes wilting and discoloration of the petals and reduce discoloration of the petals. This result is agreed with Karimi (2007) in cut flowers lily, Nowak (1985) Lilium cut flowers, Ramanuja (1979) gladiola cut flowers, Nichols (1973) and Estepnokous carnation cut flowers (1986) and Alstroemeria cut flowers. Also mentioned as a factor, sugar resulting from hydrolysis caused water pressure or decrease in the osmotic potential of the cells in the stem of the flower [12, 13, 14, 15, and 10]..

Jones (1985) reported, electrolyte leakage maybe due to that sugar maintain cell wall and GA_3 increases calcium absorption, which not only reduced electrolyte leakage but also increased the mechanical stiffness stems through maintaining and water absorption prevents of bending the neck so longevity will be increase[16]. Results are similar to Ranwala (1998) Lilium cut flowers, Mutui, (2001) Alstroemeria cut flowers, Xiaozhong and Huang (2002) [17, 18, 19].

(Table 4) comparison of mean interactions between sucrose and GA3 ($p \leq 0.05$)

pH	EL (%)	RWC (%)	petal color change (%)	diameter flower (mm)	longevity (%)	sucrose*GA a*b
4.90^{ab}	7.67^{ab}	9.36^{d}	23.33^{d}	6.47^{c}	1^{d}	1b1a
4.88^{ab}	10.57^{ab}	25.18^{bc}	18.33^{cd}	6.65^{bc}	1.67^{bcd}	2b1a
4.67^{a}	10.80^{ab}	40.82^{a}	15^{bc}	6.63^{bc}	3.67^{a}	3b1a
4.62^{a}	5.20^{a}	40.5^{a}	18.33 cd	7.07^{ab}	2.33^{bc}	4b1a
5.27^{bc}	22.81^{c}	25.91^{bc}	$21.^{67 d}$	7.17^{a}	1.60^{bcd}	1b2a
5.42^{bc}	5.90^{ab}	29.1^{abc}	21.67^{d}	6.60^{bc}	1.67^{bcd}	2b2a
5.39^{bc}	7.63^{ab}	29.75^{abc}	25^{e}	6.95^{abc}	2^{bcd}	3b2a
5.59^{c}	10.40^{ab}	30.44 abc	11.67^{ab}	6.72^{abc}	1.43^{cd}	4b2a
5.11^{abc}	11.13^{ab}	29.7^{abc}	5^{a}	7.08^{ab}	2^{bcd}	1b3a
5.37^{bc}	13.30^{bc}	30.95^{abc}	13.13^{bc}	6.98^{abc}	1.49^{cd}	2b3a
15.5^{abc}	7.33^{ab}	35.37^{ab}	13.13^{bc}	7.21^{a}	2.43^{bc}	3b3a
5.35^{bc}	8.63^{ab}	39.8^{a}	10^{ab}	7.20^{a}	2.35^{bc}	4b3a

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