Effect of an antitranspirant on the keeping quality of cut carnation flowers (*Dianthus caryophyllus*)

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ABSTRACT

This experiemnt was carried out in 1980 under room condition. Two stages of flower development of *Dianthus caryophyllus*, var. William Sim, namely, flower bud and fully opened flowers were used in this study. The effect of different concentrations of an antitranspirant (Vapor Gard) on the bud opening and keeping quality of the flowers were studied.

The results showed that increasing the antitranspirant concetration from zero to 4% had significantly increased the vase life, time taken to full opening stage of flowers. The total sugars at the end of the experiment were influenced significantly by the antitranspirant applications.

Flower bud stage was found more suitable than full opening stage as flowers at the former stage showed a longer vase life and a better quality.

INTRODUCTION

Carnations have been a major group of cut-flowers in many countries, and in Egypt it is one of the most important cut flower. Much attention has been given to enhancing market value of cut carnation flowers by improving the quality and prolonging the storage and vase life. The vase life of carnations often is reduced by water stress characterized by wilting of leaves and flowers. Such water stress represents the difference between the rate of water uptake and the rate of water loss. Recognized ways to reduce water loss of cut carnation are minimization of leaf surface, maintaining flowers in an environment conducive to low water loss, use of sugar in vase water, and reduction of transpiration.

Transpiration has been reduced in some plants with materials known as antitranspirants. These chemicals have been divided into 4 categories: film forming, growth regulating, stomatal regulating and reflective materials (3, 4, 7). The film forming antitranspirants are further divided into thin film and thick film types (4). The thick film type forms an impervious film on the plant surface sometimes penetrating the stomatal aperture and forming water resistant plugs (1, 2). Thick film antitranspirants applied to salable, flowering chrysanthemum plants reduced water loss as much as 40% (8).

The purpose of this experiment was to investigate the effect of an antitranspirant material on the cut bud development and fully opened flowers duration in the vase.

MATERIALS AND METHODS

This investigation was carried out under laboratory conditions during February and March 1980. Daily temperature and relative humidity were recorded at 2 p.m. Mean

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temperature during that period was 18.8°C, while the relative humidity was 75.4%. The variety William Sim was used because of its popularity locally and its potential for export.

Two stages of flower development, namely, flower buds at showing colour stage and flowers at full opening stage were harvested early in the morning and brought to the laboratory. Uniform buds with an average diameter of 2 cm and fully opened flowers of 7.6 cm diameter were selected. Petals of the selected buds were trimmed to retain equal numbers of leaves (6 pairs) and an average stem lenght of 45 cm. Clean plastic vases were used as containers for the solution. Each vase contained one liter of tap water with 5% sucrose, 0.03% KCl, 0.02% NaCl, and 0.02% of 8-hydroxyquinoline (5). The solution was not renewed until the end of the experiment. Vapor Gard (Pinolene di-I-menthene) was used as an antitranspirant. Concentrations used were zero (control), 1.0, 2.5, and 4.0 percent. The flowering stems (with their terminal flower buds or fully opened flower) of each treatment were dipped in the solution of each concentration for a few seconds to form a film of the antitranspirant on the surface of the flowering stems.

The experiment layout was set up to provide randomized complete blocks in a factorial design with 8 replicates. Each replicate contained 8 treatments of three flower buds or three fully opend flowers in one plastic vase.

The observations recorded included: the vase life (from set up of the experiment until flowers fading started), time taken by buds to full opening, flower diameter at full opening stage, flower dry weight and stalk (leaves and stems) dry weight at fading stage. Total sugars (reducing and non reducing) in the leaves at fading stage, as gram per 100 grams dry weight, were determined using the methods described by Kliewer (6).

Analysis of variance was calculated for the mean of each plot as described by Snedecor (10).

RESULTS AND DISCUSSION

It is clear from the results that the antitranspirant gave a clear effect on the keeping quality of carnation cut flowers.

Vase life: The results showed that with the increase in the antitranpirant level from zero to 4 percent, significant increase in the vase life was gained in both flower buds and fully opened flowers (Table 1). This could be due to the effect of the antitranspirant on reducing tranpiration, decreasing water loss and consequently causing delayed wilting and extended vase life. This is in agreement with the results obtained by Tracy and Lewis (11). Furthermore, the vase life of the flower buds was longer than that of the fully opened flowers when the same concentration was compared. The difference between vase life of buds and that of flowers ranged from 5.25 days (at 2.5%) to 7.87 days (at 0% antitranspirant). These results might be attributed to the simple difference in the developmental stage and chronological age that had already been passed by the fully opened flowers but not yet the flower buds.

Time to full opening stage: It is clear from the data illustrated in Table 1, that there was an increase in the length of time taken by buds to full opening stage by increasing the concentration of the antitranspirant. Four percent antitraspirant gave significant delay of flower opening as compard with the control and other treatments. This may be due to the formation of a thick film on the samples surface causing stomatal closure and consequently reducing transpiration and possibly photosynthetic rates. As a result, the development rate of such samples could be delayed and the time taken to full opening stage would be longer.

Flower diameter: The data illustrated in Table 1, show that there was an increase in the diameter of flowers originating from buds with increasing the concentration of the antitranspirant. Four percent treatment led to highly significant increase in flower diameter as compared with the control and other treatments. These results may be attributed to the role of this antitranspirant in increasing the turgidity of the petal cells, with

Table 1 — The effect of different concentration of «Vapor Gard» on the studied characters of two stage of flower development of William Sim carnation.

Antitraspirant Conc.	Vase Life (days)		Time from bud to full	Flower diameter	Flower dry weight (g)		Stalk dry weight (g)		Total sugar g/100 g leaf dry weight	
(%)	Buds	full opened flowers	opening (days)	(cms)	Buds	full opened flowers	Buds	full opened flowers	Buds	full opened flowers
Zero	18.11	10.24	9.46	8.25	1.76	2.00	3.11	2.91	5.32	4.21
1.0	19.68	12.71	10.33	8.63	1.70	2.02	3.33	2.76	3.81	4.15
2.5	20.00	14.75	10.61	8.56	1.91	2.43	3.40	2.82	4.07	5.40
4.0	22.65	15.91	11.33	9.31	2.35	2.83	3.26	3.37	3.74	4.92
L.S.D. at										
0.05		1.85	0.94	0.45		0.32		N.S.		0.18
0.01		2.47	1.28	0.61		0.43		N.S.		0.24

L.S.D. = Least Significant Difference at 5 and 1 percent probability.
N.S. = Non Significant

the principal mechanism involved being closure of the stomata. This character is essential to prevent wilting and desiccation of the flower stem before the petals are completly expanded, therefore, the flower diameter would be increased.

Flower dry weight: Generally, the highest level of the antitranspirant (4%) led to a significant increase in the flower dry weight (Table 1). This may be due to the fact that application of the antitranspirant led to marked decrease of vapour and gases transfer through the stomata of the treated samples to the air, thus, decreasing the respiration rate, and therefore, the stored food in the plant tissues would be preserved.

Furthermore, the fully opened flowers gave more dry weight compard with flowers produced from bud stage (Table 1). This is because the fully opened flowers stayed less time in the vase than flower buds, and thus depleted less food than the flower buds.

Stalk dry weight: The results presented in Table 1 indicate that there was no significant difference in the stalk (leaves and stem) dry weight among the antitranspirant treatments and the control. These results may be due to the fact that the stems of all the different treatments were similar in lenght and number of leaves, or may be because different tissue of the stem reached maturity stage before the begining of the experiment.

Total sugars (reducing and non rducing sugars): The total sugars were determined at the beginning of the experiment and their average was 2.57 g per 100 g leaf dry weight.

The data in Table 1 show that there was an increase in the amount of total sugars at fading stage when compared with that at the beginning of the experiment. These results are in agreement with the work of Nichols (9) who found that leaves and flowers of carnation plants accumulated total sugars when their stems were placed in sucrose. Furthermore, by increasing the antitranspirant level there was a significant decrease in total sugars in the leaves of flower buds compared with the control (Table 1). These results might be because the depletion of stored foods was very much as they had to complete their flower development to reach full opening stage. On the other hand they were left for longer time in the vase.

The total sugars in the leaves of fully opened flowers were significantly increased by using the antitranspirant levels, 2.5 and 4 percent (Table 1). These results might be attributed to an accumulation of sugars in the leaves as a result of using water with sucrose in the vase, and that the application of antiranspirant at 2.5 and 4 percent led to a decrease in the respiration rate, hence, there was a higher concentration of total sugars. Thus, the fully opened flowers needed less energy for development and also they stayed for a shorter time in the vase compared with the flower buds.

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تأثير مادة مثبطة للنتح على القدرة الحفظية لازهار القرنفل المقطوفة

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المستخلص

اجرى هذا البحث تحت الظروف المعملية بكلية الزراعة ، جامعة الاسكندرية خلال عام 1981 م واختير لهذا البحث صنف من أصناف القرنفل سليم الكأس والمشهور عالميا فى تجارة الأزهار وهو William Sim ، وكان الهدف من ذلك هو دراسة تأثير اربعة تركيزات من مادة Vaor Gard المثبطة للنتج على مرحلتين من مراحل تطور الأزهار هما : براعم وازهار متفتحة من ناحية تفتح تلك البراعم الزهرية وجودة ازهارها الناتجة وكذلك مدة بقاء الأزهار صالحة للتنسيق .

ولقد وجد أن التركيز 4% من هذه المادة أدى لتفتح طبيعى للبراعم الزهرية بالاضافة الى ذلك اطالت مدة بقاء الأزهار كما ادى الى زيادة فى قطرها ووزنها الجاف كذلك وجد أن البراعم الزهرية اطالت مدة حيويتها معنويا عن الأزهار المتفتحة أما تركيزات السكريات الكلية فى الأوراق فقد انخفض تركيزها معنويا فى حالة البراعم الزهرية بينما ازداد تركيزها فى حالة الأزهار المتفتحة عند تركيز 4% من المادة المثبطة للنتج وذلك عند مقارنتها بالمعاملات الأخرى .