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Effect of Temporary and Permanent Treatments of Extracts of Thyme and Stevia on Postharvest Quality of Gerbera Cut Flowers.

Shima Amini, Mehrdad Jafarpour and Kamran Asgari

Faculty of Agriculture, Department of horticulture, Khorasgan Branch, Islamic Azad University, Isfahan, Iran.

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ABSTRACT

In this experiment, Temporary treatments (pulsing) with distilled water or calcium chloride, 4% + sucrose 3% and permanent treatment with medical extract of Stevia and thyme (at 0.1 and 0.2 mg/liter of fresh weight changes), flower diameter, bent neck flowers, amount of carotenoid pigments in petals and Gerbera vase life were studied. Thyme (0.2 mg/liter) in pulsing with distilled water treatment showed the best results for preventing more weight loss in the extract of medicine plant. For reduction of diameter of the flower and the curvature of the flower's neck, thyme (0.1 mg/liter) in pulsing with calcium chloride + sucrose achieved the best result. The longest vase life got because of treating the flower with thyme 1(0.1 mg/liter) in pulsing of water distilled treatment comparing with control treatment.

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INTRODUCTION

Gerbera (*Gerbera jamesonii*) is one of the Asteraceae family, that are well known in the world with large variation in color and shape and one of top ten of the world in terms of economic and commercial goals (Choudhary, 2002). The main abnormalities after harvesting the Gerbera cut flower beside flowers wilt are stem curvature, which is occurs ten centimeters down capitulum (Wilberg, 1973), the broken stem and the stem sudden bending in many varieties of Gerbera flower (Meetern, 1987). Reasons of bending of the stem are still not clearly understood. However, the important factors have effects on this complication after harvest are: genetic factors, some phytohormones, mineral elements, water imbalance before harvest which is stepped up activities of bacterial in vessel timber, and storage temperature (Mencarelli *et al.*1997, Botondi *et al.*1989, Gerasopoulos and Chebli, 1999).

Treatments to prevent bacterial growth may be help to reduce side curvature (Kader and Rogers 1986; Accati and Jona, 1989; Gerasopoulos and Chebli, 1999). In fact, Bacteria in vase water may freeze the vessels in the surface of cut stems (Ferrante *et al.*, 2007) and as a result, water absorption and stems turgidity are reduced (Meetern, 1978; Meetern, 1980, Doorn and De-Witte, 1994). Totally, cut flower is very sensitive to microbial accumulation in the end of stem or sustenance solution (Solgi *et al.*, 2008). Pulsing is a short-term treatment before packing which is doing by manufacturers and it helps to flowering after warehouse period. (Arora, 2002).

Abdel-khader and Rogers (1986) reported flowers you can survive longer in dry conditions with uses temporary treatments. Increase in water absorption by short-term sucrose treatment, may be due to displacement of accumulated sucrose in the flowers, which increases the osmotic potential and absorption of water by the flower as well (Reddy and Singh, 1996).

Short-term treatment with 4% sucrose or 250 mg/l silver nitrate for 24 hours increase maintaining life of Gerbera flowers for 3 days compared to controls (7 days) (Nagaraja *et al.*, 2000). The study showed that the use of 5 mg/l Nano-silver with 4% sucrose and 2.5 mg giberlic acid increase maintaining life of Gerbera (Ansari *et al.*, 2011).

Godarzi (2006) reported that the extract obtained from dried leaves of Stevia in acetone has stronger antibacterial properties than the aqueous extract of it.

The main objective of this study are reviews and introduces extracts of medicinal plants thyme (*Thymus vulgaris*) and Stevia (*Estevia rebaudiana*), which are known to have strong antibacterial effects on the vase life of Gerbera cut flowers.

MATERIAL AND METHODS

The Gerbera cut flowers (Dune variety) were harvested by pulling the end of stems during morning from the research greenhouse of Faculty of Agriculture, Islamic Azad University and immediately transferred to the

Corresponding Author: Shima Amini, Faculty of Agriculture, Department of horticulture, Khorasgan Branch, Islamic Azad University, Isfahan, Iran
E-mail: shimaamini828@gmail.com

laboratory. Half of the flowers were put in a bucket containing distilled water and the other half in buckets containing calcium chloride (4%) + sucrose (3%) for 24 hours.

In the next day (after 24 hours), flowers transferred to plastic containers with 500 ml maintenance solution (0.1 or 0.2 mg/l leaf extracts of Stevia or 0.1 or 0.2 mg/l leaf extracts of thyme). Color change and aging of petal at the end of curvature of flowering was determined as the end of life. An average temperature of laboratory was 22°C and light conditions were 12 h light.

Extracts preparation:

For the preparation of the leaf extract of thyme, 100 grams of dried leaves was mixed with 1000 ml 85% ethanol and shaken for 72 hours. After that, the mixture was smooth using the filter paper. The extract transferred into the vacuum distillation unit with 80°C temperature. The solvent was slowly evaporated and condensed. The extract was concentrated in the oven with 70 °C for 72 hours. As a result, dry and uniform powder is obtained (Godarzi *et al*, 2006). For the preparing the extract of Stevia, 150 g dried leaf of Stevia was mixed with in 500 mL of acetone (100% purity) and 500 mL distilled water and shaken for 72 hours on the machine. The mixture was smooth with filter paper and the transferred to oven with 70°C temperature for 72 h to obtain uniform powders.

Fresh weight of flowers between days 0 and 12 (0, 3, 6, 9, 12) was measured. Flowers neck Curvature of the Gerbera flowers in various articles has been checked by counting the number of flowers bent, But in this study regarding the importance of comparing different treatments in reducing the amount of curvature, measuring the curvature of the neck flowers were recorded using conveyor. Additionally, Gerbera flower diameter was measured to detect amount of water absorption with petals.

Measurement of carotenoid in petal:

0.5 g petal sample were dried using nitrogen tank and made a powder from it. After that, samples were mix by acetone (5 ml) and centrifuged with 4000 rpm for 20 minutes. After centrifugation, the clear supernatant solution using Whatman filter paper was smooth and transparent extract was obtained.

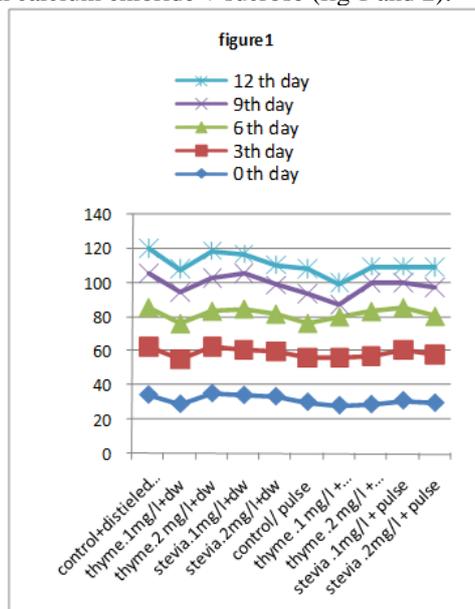
Absorption of carotenoids in extracts was read using two radial Spectrophotometer at wavelengths 480 and 510 nm and calculated in following formula

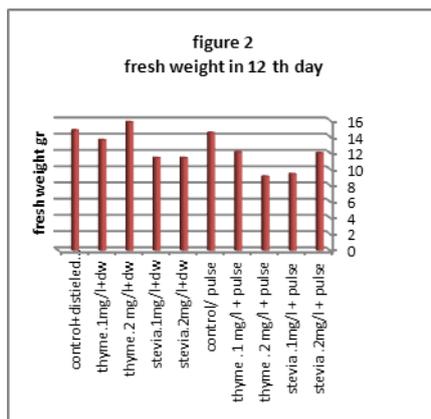
$$\text{Carotenoids mg /gr} = 7.6(A_{480}) - 1.49(A_{510}) * V / 1000 * 10:$$

This experiment was conducted in completely randomized design with three replicates. Each experimental unit has four flowers. The obtained data were analyzed using SPSS program and mean comparison was done using Duncan multiple range test at 5% probability level.

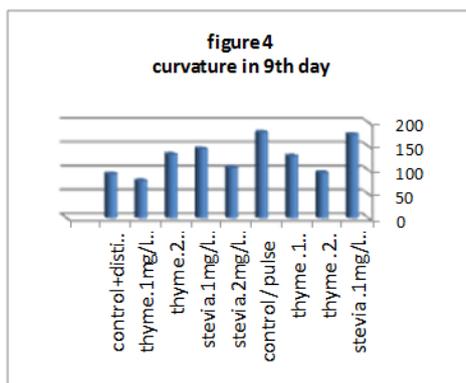
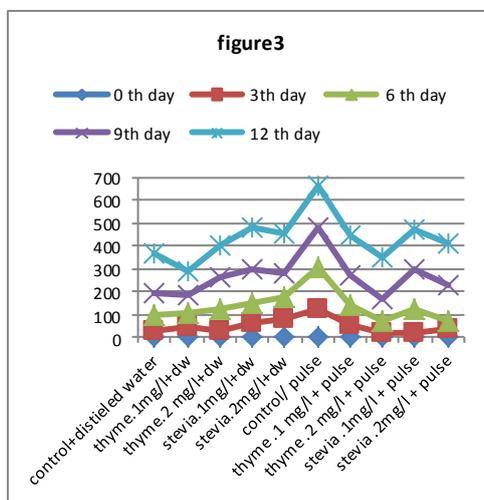
Results:

The highest wet weight in day nine and twelve were belonged to Stevia (0.1 mg/liter) in pulsing with distilled water and thyme (0.2 mg/liter) in pulsing with distilled water, respectively. The lowest weight was observed in control treatment with calcium chloride + sucrose (fig 1 and 2).

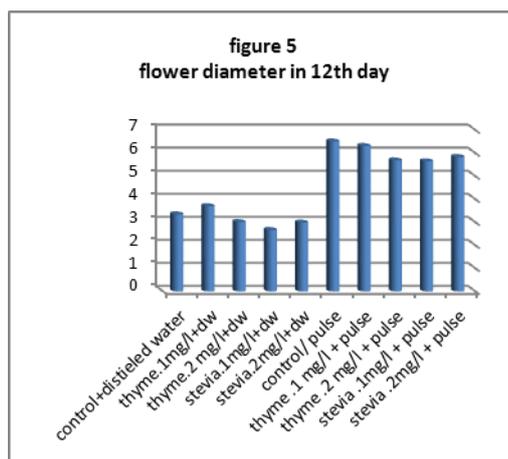




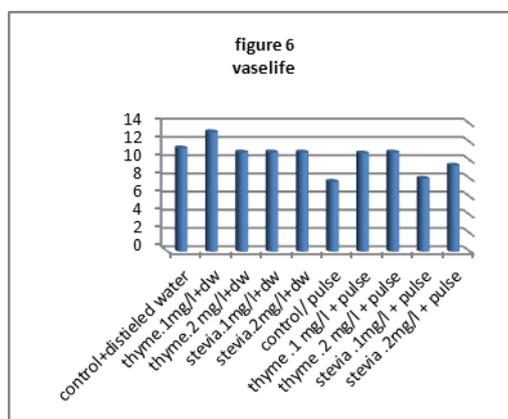
Among the interactions between pulses and treatment minimal curvature were seen in day 9 and 12 days after harvest with thyme (0.1 mg/liter) in pulsing with distilled water treatment and maximum was seen in control treatment with calcium chloride + sucrose (Fig 3 and 4).



Control treatment with calcium chloride + sucrose and thyme (0.1 mg/liter) in pulsing with distilled water treatment had maximum diameter of the flower until the end of day 12 (Fig 5).



Minimum and maximum vase life was observed in thyme (0.1 mg/liter) in pulsing with distilled water treatment and control treatment with calcium chloride + sucrose, respectively (fig 6). The discussed treatments in this experiment did not cause significant differences in changes of petal pigments.



Discussion:

Maximum wet weight belonged to thyme (0.2 mg/liter) in pulsing with distilled water treatment. Based on that, thyme extracts have antibacterial effects and also accumulation of bacteria at the end of the cut stem cause water absorb water problem which is reduce wet weight after harvest, the achieved results in this study is justifiable. This result of some studies (van Meeteren, 1978, Nair *et al.*, 2003) also prove that a closing wood vessel by the bacteria reduce rise the water in the stem and as a result curvature and broken up the flower stem. However, Soad (2011) showed that use the calcium chloride with sucrose as a bactericide has led to reduce weight loss.

Curvature changes:

The amount of the surface curvature in 0.1 mg thyme treatment up to day 12 was lower than all treatments and the increased curvature in the control of calcium chloride with sucrose was higher than other treatments. As consequences of using extract of thyme as a strong bactericide, bacterial aggregation significantly reduced and decrease curvature of stem flower. Aarts (1957) reported same result with the hypothesis that showed existence of resistance between water flow in stem and capitulum and increased resistance to water flow in stem caused by microbial activity exist in storage solution. This phenomenon causing breakage and bending of the stem of Gerbera.

The interaction between the pulse of water and thyme was better than the interaction between thyme and pulse sodium chloride + sucrose. In most cases, sucrose increase vase life if the flowers are kept in solution with antimicrobial drugs, otherwise, existence of sucrose of in flower maintenance solution increases the volume of bacteria in the end of stem and cause the greater curvature in the stem of the Gerbera. Result of this study is consistent with Meeteren (1979) results.

Flower diameter Changes:

The diameter of the flower until day three in the treatment of short-term was significant and the distilled water pulse was significantly better than the calcium chloride + sucrose pulse. Furthermore, significant difference between pharmaceutical treatments was not found.

From day 6, calcium chloride + sucrose pulse was significantly better than distilled water and flower diameter had less reduction in the short-term treatment. However, significant difference between pharmaceutical treatments was not found.

This phenomenon can be attributed to the absorption of calcium in the cell wall, it probably strengthens the cell wall cross petals and has eliminated shrinkage and sudden changes in petal diameter. Permanent treatment of thyme beside calcium chloride pulses improved flower diameter in a similar way.

Flower Life changes:

The best result was achieved from thyme treatment with distilled water pulse, which increase flower life from 7.66 days in the control treatment to 13.1 days in this treatment.

As we mentioned above, thyme extract has many antibacterial compounds such as thymol that prevent the spread of bacteria in the preservative solution. Consequently, this treatment could increase the life of flower after harvest. However, current research showed that, calcium chloride pulse with sucrose is not appropriate treatment that it can due to increase the excessive bacteria in the pulse because of using sucrose on it. Sucrose in preservative solution must be used with anti-bacterial to prevent growth of bacteria in the end of the cut flower stem.

Conclusion:

According to the results of this study, extracts of medicinal thyme in distilled water pulse has shown that best results to improve the life of Gerbera. Achieve the best results without using preservatives in the pulse is importance and valuable to produce organic production.

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