تفوق الزيوت والمستخلصات النباتية على المعاملات الكيميائية في تحسين الجودة وإطالة فترة الصلاحية لثمار الجوافة

SUPERIORITY OF ESSENTIAL OILS AND PLANT EXTRACTS OVER CHEMICAL TREATMENTS IN IMPROVING QUALITY AND PROLONGING SHELF LIFE OF GUAVA (Psidium guajava L.)

By

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المستخلص:

المشكلة الرئيسية التى تواجه تخزين و تسويق محصول الجوافة هو قصر فترة صلاحية الثمار الذى ينتج عنه فقد كبير فى المحصول. أجريت الدراسة الحالية في مزرعة البرامون التجريبية التابعة لمعهد بحوث البساتين بمحافظة الدقهلية ، مصر ، لدراسة تأثير بعض معاملات ما قبل و بعد الحصاد على إطالة فترة الصلاحية لثمار الجوافة. عدد ٥٦ شجرة قسمت إلى ٧ مجموعات، رشت كل مجموعة بأحد المحاليل التالية: ماء الصنبور (كنترول) ، كلوريد الكالسيوم بنسبة ١٪ ، حامض الستريك بنسبة ١٪ ، زيت إكليل الجبل بتركيز ٤%، زيت المورينجا بتركيز ٤٪ ،زيت جوز الهند بتركيز ٤٪ ،مستخلص أوراق النعناع بتركيز ٤%. تم أخذ عينة عشوائية مكونة من ٢٠ ثمرة فى مرحلة النضج (لون اصفر فاتح) من كل مجموعة. تم غمس ثمار كل محموعة على حده في نفس المحاليل السابقة لمدة دقيقتين ، وتخزينهم في ظروف الغرفة لمدة ٩ أيام. تم إجراء تحليل لصفات الجودة للثمار قبل وبعد ٩ أيام من التخزين. أشارت النتائج المتحصل عليها إلى وجود فروق معنوية احصائياً بين المعاملات. المعاملات التى استخدم فيها محاليل من زيوت و مستخلصات النباتات الطبية والعطرية أدت إلى إطالة فترة الصلاحية لثمار الجوافة لمدة ٩ أيام ،وذلك لأنها أدت إلى تقليل الفقد في صفات الجودة الفيزيائية والكيميائية للثمار مقارنةً بالمعاملات الأخرى.من بين المعاملات المعاملة T5 (الرش قبل الحصاد بمحلول من زيت المورينجا ٤٪ وغمس الثماربعد الحصاد في نفس المحلول)

هى التى حصلت على أفضل النتائج (الفقد فى الوزن الطازج للثمرة ١٤,٠٠٪ ، الفقد فى صلابة الثمرة ١,٣٠ كجم / سم ^{٢} ،الزيادة فى محتوى المواد الصلبة الذائبة الكلية ٠,١٠ درجة ، الفقد فى محتوى حمض الأسكوربيك ١,٦٧ مجم / ١٠٠ جرام والزيادة فى الحموضة (١,٠٠ ملل ٠,١ هيدروكسيد الصوديوم / ١٠٠ جم).

الكلمات المفتاحية: جوافة؛ نباتات طبية و عطرية؛ مستخلصات؛ الزيت؛ فترة الصلاحية

Abstract

Short shelf life is a key problem facing guava storage and marketing, it causes massive loss of yield. The current study was carried out in the Baramoon Experimental Farm of the Horticulture Research Institute, Dakahlia Governorate, Egypt, to evaluate the effect of some pre- and postharvest treatments to extend the marketability and shelf life of guava fruits. Fifty-six trees were selected, divided in to 7 groups and each group was sprayed with one of the following solutions: Tap water (Control), CaCl2 at 1%, Citric Acid at 1%, Rosemary oil at 4%, Moringa oil at 4%, Coconet oil at 4% and Extract of Peppermint at 4%. From each group, random samples of 20 light yellow color stage fruits were taken and immersed in the same solution, separately each for 2 minutes, and stored at ambient conditions for 9 days. Quality attributes of fruits were analyzed before and after 9 days storage. The obtained results indicated that there were significant differences between treatments. Treatments medicinal and ornamental plant extracts or oils solutions resulted in extending the shelf life of guava for 9 days by minimized the loss in physical and chemical quality attributes. Among different treatments T5 (Spray preharvest with Moringa oil 4% and dipping postharvest into the same solution) could be recommended, as it was the best in teams of loss of fruit weight 14.00%, loss of fruit firmness 1.30 Kg/cm2, increases of TSS content 0.10 OBrix, loss of ascorbic acid content 1.67 mg/100g and increases of acidity 1.00 ml0.1N NaOH/100g.

Keywords: Guava; Medicinal and Ornamental plant; Extracts; Oil; Shelf life.

Introduction

Postharvest losses represent a big problem facing fruits production, as it causes massive loss in the yield around the world yearly. Guava (*Psidium guajava* L.) is a fruit with high respiration rates and a very short shelf life, which limits transportation and storage period. In guava, the post harvest loss in roughly 23,1 % in Ethiopia (Kasso and Bekele, 2018), 26 % in Egypt (Sahar, 2014), and 18,05 % in India (Nanda et al., 2012). Several pre- and postharvest applications have been tested on guavas and the results were efficient in extending the shelf life and preserving the fruit quality. However, some pre- and postharvest treatments interfere with the sensory characteristics of the fruit while others extend the shelf life in an economically insignificant way, and leave chemical residues.

Natural plant-based products are generally used for extending the shelf life and preserving the fruit quality. Its advantageous properties such as its edibility, non-toxic nature and cost effective as compared to other pre- and postharvest treatments (Gulhane et al., 2018). Several investigators reported that the positive effects of medicinal and ornamental plant extracts or oils solutions in extending the shelf life and maintaining the quality parameters of fruits (Shaaban and Hussein 2017, EL-Eryan et al 2017, Malik et al., 2015 and Sabah et al., 2020, Sabah et al., 2020 on guava fruits, (Shirzadeh and Kazemi 2012 and Anushka et al., 2020) on apple, (Tesfaya and Magwaza, 2017) on avocado and (Nasrin et al., 2020) on lemon. Malik et al., (2015) and Sabah et al., (2020), found that application of Moringa oil and leaf extracts of Neem, Chinaberry and Marigold kept fruits more marketable and appealing by

minimized the loss in physical and chemical quality attributes for 9 days at room temperature. Hence the present study was aimed to evaluate the efficacy of medicinal and ornamental plant extracts or oils solutions to extend the marketable and shelf life of guava fruits.

Materials and methods

The research study was conducted during the two years (2015 and 2016) on 22 years old Guava (*Psidium guajava* L.) trees, cv. Montakhab- Elsabaheya, Trees were grown in the Baramoon Experimental Farm of the Horticulture Research Institute located at Dakahlia Governorate, Egypt, planted at 3 x 3 meters and subjected to the same agricultural practices that recommended by Agriculture Ministry.

Fifty-six trees uniform in growth, free from disease and pests were selected, divided in to 7 groups and each group was sprayed (10 days before harvest date) with one of the following solutions: Tap water (Control), $CaCl_2$ at 1%, Citric Acid at 1%, Rosemary oil (*Rosemarinus officinalis* L.) at 4%, Moringa oil (*Moringa oleifera* L.) at 4%, Coconet oil (*Cocos nucifera* L.) at 4% and Extract of Peppermint (*Mentha piperita* L.) at 4%. Tween-20 (0.1 %) as surfactant was added to all spraying solutions and applied directly for the trees with a handheld sprayer (type AGRICO 20L) until runoff in the early morning.

From each pre-harvest treatment, random samples of 20 light yellow color stage fruits according to Mercado-Silva et al., (1998) were taken and transported to the Laboratory of Mansoura Horticulture Research Station. The fruits were rinsed with distilled water, dried outdoors. Fruits of each group were immersed in the same solution, separately each for 2 minutes, dried outdoors.

The studied treatments were as the following:

T1 = Spray preharvest with water and dipping postharvest into water (Control).

T2= Spray preharvest with $CaCl_2$ at 1% and dipping postharvest into $CaCl_2$ at 1%.
T3= Spray preharvest with Citric Acid at 1% and dipping postharvest into Citric Acid at 1%.
T4= Spray preharvest with Rosemary oil 4% and dipping postharvest into Rosemary oil 4%.
T5= Spray preharvest with Moringa oil 4% and dipping postharvest into Moringa oil 4%.
T6= Spray preharvest with Coconet oil 4% and dipping postharvest into Coconet oil 4%.
T7= Spray preharvest with extract of Peppermint 4% and dipping postharvest into extract of Peppermint 4%.
The treated fruits of seven treatments were packed in one layer into two carton boxes/replicate, 10 fruits per box, and stored in room conditions at 25-30˚C and 65±5% RH. The initial fruit quality characteristics before storage were measured (zero time). After 9 days storage, fruit of each treatment were analyzed to evaluate the physical and chemical quality measurements.

Physical quality measurements

Fresh weight loss of fruit (FWL %); calculated according to the following equation:

Fresh weight loss % =Wi-Ws/Wi×100

Where:

Wi = fruit weight at initial period

Ws = fruit weight at 9 days storage.

Firmness; determined by using a hand-held fruit firmness tester ("Penetrometer" (Model FT 327, QA Supplies, Norfolk, VA, USA), and data were expressed as kg/m2 (Chawla et al., 2018).

Chemical quality measurements

Total soluble solid (TSS); determined by using a hand refractometer, 0-32 scale (ATAGO N-1E, Japan) and expressed

in standard °Brix unit after making the temperature correction at 20°C (Chawla et al.,2018).

Titratable acidity; Guava pulp (10g) was homogenized in 40 ml distilled water and filtered to extract the juice. Two to five drops of 2, 6-dichlorophenol endophenol blue dye was added in this juice. A 10 ml juice was taken in a titration flask and titrated against 0.1N NaOH till permanent light pink color appeared. Three consecutive readings were taken from each replication of a treatment and percent acidity as citric acid was calculated by using the following formula: %TA = ml NaOH used) (Normality of NaOH) (Equivalent wt. of citric acid)/ (wt. of sample) (vol. of guava juice taken) (El-Sisy, 2013).

Ascorbic acid content of fruit; determined with the help of the method of (El-Sisy, 2013), and expressed as mg ascorbic acid/100 ml juice.

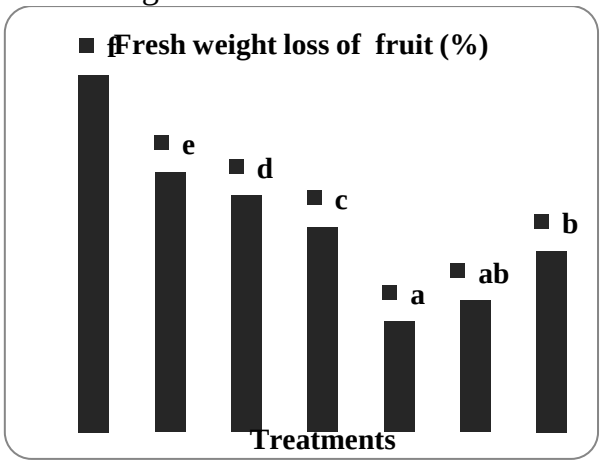
Statistical analysis; the data were statistically treated by analysis of variance (ANOVA) and means for various treatments were compared using "Duncans Multiple Range Test" (Duncan, 1955)

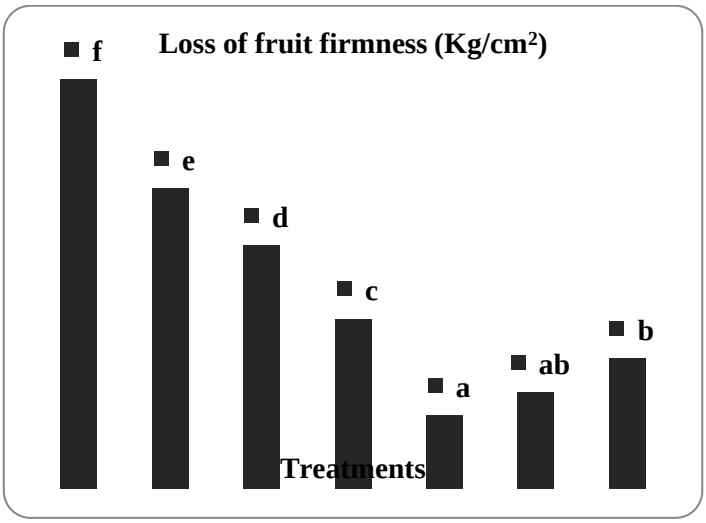
Results and discussion

Results showed significant difference between the treatments regarding various quality attributes (loss of fruit weight, loss of fruit firmness, increases of TSS content, loss of ascorbic acid content and increases of titratable acidity). The control had 100% decayed after 9 days storage. The results are in agreement with those obtained by Malik et al., 2015 and Sabah et al., 2020.

Fruits treated with medicinal and ornamental plant extracts or oils solutions [T4, T5, T6 and T7] were significantly superior to calcium chloride 1% and citric acid 1% (are nowadays the common postharvest treatment used to increase the shelf life of fruits) (Figure 1).

Treatments medicinal and ornamental plant extracts or oils solutions [T4, T5, T6 and T7] increased firmness, ascorbic acid (VC). Also, it decreased fruit weight loss percentage, total soluble solids (TSS) and titratable acidity (Figure 1). Similar findings are also reported by Shaaban and Hussein (2017), EL-Eryan et al (2017), Sabah et al., 2020 in guava fruits, Shirzadeh and Kazemi (2012) and Anushka et al., 2020 in apple, Tesfaya and Magwaza, 2017 in avocado and Nasrin et al., 2020 in lemon. Treatment 5 (Spray preharvest with Moringa oil 4% and dipping postharvest into the same solution) found the most effective for fruit quality (loss of fruit weight 14.00%, loss of fruit firmness 1.30 Kg/cm^2, increases of TSS content 0.10 ^{O}Brix, loss of ascorbic acid content 1.67 mg/100g and increases of titratable acidity 1.00 ml0.1N NaOH/100g) and shelf life during storage period at room conditions 25-30˚C and 65±5% RH. (Figure 1). These results are in agreement with those of Sabah et al., (2020).




Loss of fruit firmness (Kg/cm2)
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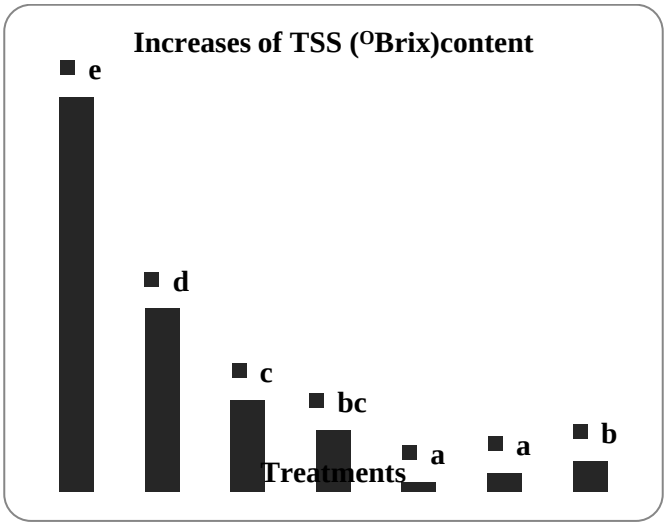
Treatments


Increases of TSS (OBrix)content
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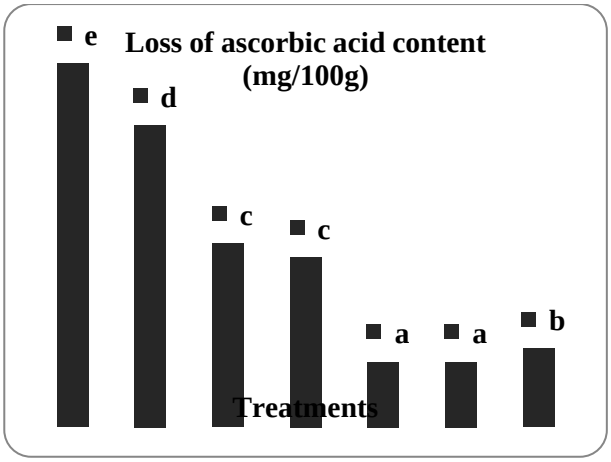

Figure 1. Physical and chemical quality measurements of fruits during 2015 and 2016 seasons. T1 = Spray preharvest with water and dipping postharvest into water (Control),T2= Spray preharvest with CaCl2 at 1% and dipping postharvest into CaCl2 at 1%,T3= Spray preharvest with Citric Acid at 1% and dipping postharvest into Citric Acid at 1%,T4= Spray preharvest with Rosemary oil 4% and dipping postharvest into Rosemary oil 4%,T5= Spray preharvest with Moringa oil 4% and dipping postharvest into Moringa oil 4%,T6= Spray preharvest with Coconet oil 4% and dipping postharvest into Coconet oil 4% and T7= Spray preharvest with extract of Peppermint 4% and dipping postharvest into extract of Peppermint 4%. Means in the bar followed by the same letter(s) are not significantly ($p \geq 0.05$) different.

Conclusion

Application of medicinal and ornamental plant extracts kept fruits more marketable and appealing by minimized the loss in physical and chemical quality attributes for 9 days storage. Treatment 5 (Spray preharvest with Moringa oil 4% and dipping into the same solution) are suggested to be a good

recommendation for improving the fresh quality assessments of guava fruits during 9 days of storage at room conditions 25-30˚C and 65±5% RH.

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