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THE INFLUENCE OF SPARING WITH SEED FENUGREEK EXTRACTS, WILLOW BARK EXTRACTS AND CISSLEIN ON FRUITS OF SOURS ORANGE (*CITRUS AURANTIUM* L.) PRE AND POST STORAGE

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Abstract

This study was carried out in a private orchard at AL-Abbasyia , Najaf Governorate during the growing of season 2016 on the local sours orange trees . The trees were spraying with two concentration of Fenugreek (30 and 40 %) , **Willow** bark extracts (30 %) and Cisslein (250) mg /L each other in single way or in combination at 15 / 10 and 15/11 / 2016 . The fruits of this treatment stored 3 months from 1/12 / 2016 to 1/3/ 2017 in $5C^0$ and 80- 85 R.H. The experiment included 12 treatments with three replicates . It is adopted according to Randomized Complete Block Design (RCBD) , and the results were statistically analyzed according to Duncan test at the probability level of 5%.The results indicated that spraying trees with treatments caused a significant increasing in the, length, diameter , weight of fruit, volume of fruit, Total soluble solids(T.S.S) , percentage of titratable acidity (TA) and percentage of T.S.S / TA ratio , percentage weight of juice pre storage and significant redaction percentage of weight loss , physiological (RS+SERB) and fungi decay ,total decay and increase percentage of total soluble sold , vitamin C and Antioxidant capacity at the end of storage period . Treatment of spraying (seed fenugreek extracts+ Willow bark extracts + Cisslein) at concentration(40% +30% +250 mg/L) gave a significant effect and the best results for the year of experiment .

Key words : Seed Fenugreek extracts , Willow bark extracts, Cisslein, sours orange.

Introduction

Sours orange trees were planted in Iraq as fruit trees because loading height temperatures and gave total yield more than any citrus trees. Physiological disorders significantly influence the quality of citrus fruits in markets and postharvest factors after the occurrence of physiological disorders of fruits (Mitra, 1997). AL-Shemmeryi *et al.* (2010) found that, treated fruit of local orange with Salix bark extracts at percentage of (20, 30 and 40%) and stored fruits three months (1-12 -2008 to 1-3-2009) at 5°C temperature and relative humidity of 80-85% gave a significant decries percentage of weight loss, physiological and fungi decay ,total decay T.S.S, total acidity, vitamin C, carotene pigment in peels and percentage of juice. Spraying gibberellic acid on the properties and behavior of the fruits of Egypt lime through some cold storage treatments during the 2003-2004 seasons after fruit set plus gibberellic acid (20 ppm) sprayed 2 weeks before harvest date induced the highest weight, volume, rag weight and decreasing weight loss%, gave the lowest percentage of unmarketable fruits weight, resulted in the highest level of juice weight %, the highest level of TSS%, the lowest level of TA%, the highest value in vitamin C content in juice of stored fruit, keep good fruit quality and prolong cold storage period (Gihan *et al.*, (2017). AL- Rahem (2012) noticed that, spraying local tress of orange with Grofalcs at conc. (100, 150 mg / L) caused significant increase of fruit length, diameter, weight of fruit, volume of fruit, Total soluble solids (T.S.S), percentage of titratable acidity and vitamin C of fruits compared to control treatment . AL – Hmeedawi and AL –Malikshah (2016) observed that when local sours orange trees sprayed at 1 / 10 / and 1 / 11 / 2014 with three concentrations of Grofalcs (200,300 and 400 mg/ L) and stored fruit of its trees at 5^0C and 80- 85 RH ,the treatments had significant effect in terms of redaction weight loss percentage, physiological decay (RS+SERB),

fungi decay and total decay and increase percentage of total soluble sold, acidity, vitamin C and Antioxidant capacity at the end of storage period. Khan *et al.* (2010) noticed that, some roots of grapes containing material of auxins, cytokines and Gibberellins. Willow bark containing calycine that inhibition growth bacteria and fungi (Abo – Zaid, 2000). AL-Mohammedi *et al.* (2010) mentioned that, using seed fenugreek extracts have been dipping fruits domestic orange for 10 and 20 minutes and immersed and stored in refrigerated storage on 6±1ºC and humidity of 80-85% for a period of two months the results showed superiority of the treatment extracts immersion time at 20 minutes and focus all effective in preventing the occurrence of any damage to the fruits and less the percentage of weight lost of after 60 days of storage. AL-Rawi and Chacravarty (1988) noticed that, the seed of fenugreek containing (Alkaloids, phosphor, diosgenine, gitogenine, organic matter, tigogenine, digitigogenine, sterols, choline, bitaine, some minerals). The main objective of this investigation is to study of the effect of spraying with seed fenugreek extracts, Willow bark extracts and Cisslein on trees of sours orange physical and chemical characteristics of fruits pre storage and improving storability of fruits that stored 3 months at 5C and 80- 85 R.H.

Materials and Methods

The present study was conducted out during 2016 growing season on 12 years old of the local sours orange trees grown in an orchard located at El- Abbasiya / Najaf governorate. The trees were planted at (5 x 5) m apart and received the same horticultural management. Thirty trees similar size and growth were selected and divided into 12 treatments with three replicates . It is a doped according to Randomized Complete Block Design (RCBD) and the results were statistically analyzed according to Duncan test at the probability level of 5% (Al-Rawi and Khalf Allah (2000). Trees spraying with two concentration of extract of seed fenugreek (30 and 40%) , Willow bark extracts (30%) and Cisslein (250) mg / Leach other in single way or in combination at 15 / 10 and 15/11 / 2016 . Cisslein , it was powder from root of plant belong to genus cissus from grapes containing 10% GA_3 (It were from the production of Green river company, India). Spraying was done early morning until wetness was full addendum. Tween 20 was added at conc. of 1cm^3/L as spreader material. The experiment involved the following 12 treatments :

1. Control treatment (sprayed with tap water).
2. Fenugreek as foliar sprays at concentration of 30%.
3. Fenugreek as foliar sprays at concentration of 40%.
4. Willow bark extracts as foliar sprays at concentration of 30%.
5. Cisslein at concentration of 250 mg / L.
6. (Willow bark extracts + Cisslein) as foliar sprays at conc. of 30% +250 mg/L.
7. Fenugreek + Cisslein as foliar sprays at concentration (30% + 250 mg/L).
8. Fenugreek + Cisslein as foliar sprays at concentration (40%+ 250 mg/L).
9. Fenugreek + Willow bark extracts as foliar sprays at concentration (30% + 30%).
10. Fenugreek + Willow bark extracts as foliar sprays at concentration (40% + 30%).
11. (Fenugreek +Willow bark extracts + Cisslein) at concentration(30% +30%+250 mg/L)
12. (Fenugreek + Willow bark extracts + Cisslein) at concentration(40% +30%+250 mg/L).

In 1 /12 / 2016 harvested 240 Kg fruits similar in size and color without dieses and mechanical injures from trees of experiment. 120 Kg were taken out to measured physical and chemical parameters pre storage, physical characteristics (length, diameter, weight of fruit, volume of fruit and percentage weight of juice) according to Ibrahem (2010). Chemical fruits characteristics (Total soluble solids(T.S.S) was determined by a hand refractometer. Percentage of titratable acidity (TA) and percentage of T.S.S / TA ratio, Ascobic acid (V.C.) mg / 100 ml Juice) according to A.O.A.C (1985). Antioxidant capacity was determined to previous work (Crisosto and Crisosto, 2001). Another 120 Kg fruits were treated with Benlate at conc. of 1 gm / L to improve from postharvest pathology. Fruits were divided into 12 treatments weight 9 Kg for each treatment. The fruits of each previous treatments were divided into 3 replicates and each part weight was 3 Kg. These parts were placed in polyethylene bags with 22 holes for each bags and the diameter of the hole were 0.5 cm. The fruits were stored under $5C^0$ temperature and relative humidity 80-85 % for three months starting in 1 / 12 /2016 . The design for this treatment was similar to that of the field experiment . In 1 / 3 /2017 fruits were taken out and traits were measured. The % weight loss, % physiological decay Stem End Rind Breakdown (SERB), % physiological decay Rind Stem (RS), % fungi decay) *Penicillium italicum*, *Penicillium digitatum*, *Alternaria citri*) and % Total decay according to Lisa and Kader (2003).

Results and Discussion

Effect of spraying with seed Fenugreek extracts , Willow bark extracts and Cisslein on physical and chemical parameters of fruits local sours orange pre storage

As shown in table 1, it is clear that both of Willow bark extracts and Cisslein sprayed at 45 -15 days pre-harvest date resulted in significant increase of fruit length, diameter, weight of fruit, volume of fruit, Total soluble solids (T.S.S), percentage of titratable acidity (TA) and percentage of T.S.S / TA ratio , percentage weight of juice compared to control treatment. The treatment (Fenugreek + Willow bark extracts + Cisslein) at concentration of (40% +30%+250 mg/L) gave the highest values in fruit length, diameter, weight of fruit, volume of fruit, Total soluble solids (T.S.S), percentage of titratable acidity (TA) , percentage of T.S.S / TA ratio and weight of juice percentage they were (80.65 cm, 79.85 cm, 97.70 gm, 90.14 cm^3, 14.97 % , 2.39 %, 6.26 % and 50.82 %) in comparison to the lowest rates (66.84 cm, 67.78 cm, 90.11 gm, 77.81 cm^3, 12.30%, 2.14 a%, 5.74% and 47.70%) in control treatment. This positive influence of spraying this material might be due to improving uptake of physical and chemical parameters of fruits local sours orange pre storage led to increase in the leave aria, content of leaves from growth hormones and total chlorophyll, that increase the efficacy of photosynthesis to increase cell division and enlargement of fruit, these led to increase the physical and chemical fruits characters. Above mentioned treatments led to the root system in absorption the nutrients elements in which some of them are parts of chlorophyll, which led to increase its quantity in comparison control treatment. This process increases photosynthesis an activate plant growth which led to enhance hormones synthesis (Jundi, 2003).

Effect of spraying with seed Fenugreek extracts, Willow bark extracts and Cisslein on the percentage of weight loss of fruits

Data in table 2 shows that , spraying trees of local sours orange with seed fenugreek extracts, Willow bark extracts and Cisslein led to significantly decreased the percentage of weight loss after storage that gave the lowest percentage 2.09% in the treatment (seed fenugreek extracts 40% + Willow bark extracts 30% +

Table 1 : Effect of spraying with seed Fenugreek extracts, Willow bark extracts and Cisslein on physical and chemical parameters of fruits local sours orange pre storage for season 2016.

Treatments	Length fruit (cm)	Diameter fruit (cm)	Weight of fruit (gm)	Volume of fruit (cm^3)	% total soluble solids (T.S.S)	Titrable acidity (TA)	T.S.S/TA ratio	% weight of juice
Control	66.84f	67.78f	90.11ef	77.81g	12.30d	2.14ef	5.74c	47.70e
Seed Fenugreek extracts (SFe) 30%	68.70e	69.24e	91.65e	79.12f	12.55c	2.15de	5.83c	48.32d
Seed Fenugreek extracts (SFe) 40%	75.12cd	74.90cd	92.75de	79.87f	12.51c	2.16de	5.97bc	48.84bc
Willow bark extracts(Wbe) 50%	75.32d	75.18c	92.47de	81.90e	12.48c	2.15de	5.84c	48.17d
Cisslein (Ci) 250 mg/L	74.55d	73.46d	91.99e	82.13e	12.77bc	2.19cd	5.83c	48.31d
Wbe + Ci	76.45c	76.87c	93.68d	83.31d	12.82b	2.20bc	5.82c	49.90bc
(SFe) 30%+Wbe	78.82b	77.69c	95.61c	83.73d	12.79b	2.20bc	5.81c	49.77b
(SFe) 40%+Wbe	78.98b	78.50b	95.73bc	85.85c	12.83b	2.21bc	5.80c	49.84bc
(SFe)30%+Ci	77.25c	76.86c	95.21c	85.79c	12.86b	2.18c	5.89bc	49.78b
(SFe)40%+Ci	78.60b	78.72b	95.00c	86.83c	12.91b	2.23ab	5.78c	50.04bc
(SFe) 30%+Wbe + Ci	79.34b	78.98ab	96.36b	87.76b	13.82b	2.30 ab	6.00b	50.44bc
(SFe) 40%+Wbe +Ci	80.65a	79.85a	97.70 a	90.14a	14.97a	2.39 a	6.26a	50.82a

Table 2 : Effect of spraying with seed Fenugreek extracts, Willow bark extracts and Cisslein on percentage disease, total decay, percentage of total soluble sold, acidity, vitamin C and Antioxidant capacity of fruits local sours orange after 3 months from storage at 5^0C and 80-85% R.H. for season 2017.

Treatments	% weigh loss	% physiologi-cal decay SERB	% physiologi-cal decay RS	%fungi decay	%Total decay	% Total soluble solid	Vitamin C mg/100 ml Juice	Antioxidant capacity (mmol TE/g FW)
Control	5.15a	2.19a	2.35a	2.45a	6.99a	**11.42e**	47.51g	1.35i
Seed Fenugreek extracts (SFe) 30%	4.10b	1.97b	2.06b	1.31ab	5.34b	11.98d	48.05ef	1.90gh
Seed Fenugreek extracts (SFe) 40%	3.78c	1.86b	1.96b	1.26b	5.08b	**12.21d**	48.13e	2.13fg
Willow bark extracts (Wbe) 50%	3.89c	1.91b	1.98b	1.30b	5.19b	**12.08d**	48.33e	2.20f
Cisslein (Ci) 250 mg/L	3.90c	1.97b	1.49c	1.22b	4.68c	**12.19d**	48.24e	2.25f
Wbe + Ci	3.23d	1.94b	1.60c	1.29b	4.83bc	**12.30cd**	48.50cd	2.71de
(SFe) 30%+Wbe	2.93de	1.50c	1.72bc	1.19c	4.41d	**12.43c**	48.41d	2.75de
(SFe) 40 %+Wbe	2.72e	1.64c	1.40c	1.17cd	4.21d	**12.41c**	48.75c	2.87cd
(SFe)30%+ Ci	3.16d	1.96b	1.39d	1.20bc	4.55d	**12.55c**	48.78c	2.95cd
(SFe)40%+ Ci	2.85ef	1.77bc	1.50c	1.18c	4.45d	**12.64c**	48.69c	3.11bc
(SFe) 30%+Wbe + Ci	2.46f	1.53c	1.27e	1.12de	3.92e	**13.09b**	48.90b	3.24b
(SFe) 40%+Wbe + Ci	2.09g	1.34d	1.21e	0.77f	3.32f	**14.75a**	49.49a	3.78a

Cisslein 250 mg/L) in comparison to the highest percentage 5.15% in the control treatment. The reason of decreasing the percentage of weight loss of fruits lead to influence these materials in some physiological changes in the fruit peel. This process leads to may be due to decrease respiration and transpiration of water through peel tissue and perishable fruit is a serious concern in its storage (Devlin and Witham, 2001).

Effect of spraying with seed Fenugreek extracts, Willow bark extracts and Cisslein physiological decay Stem End Rind Breakdown (SERB), Rind Stem (RS), fungi decay and total decay of fruits local sours orange after 3 months from storage at 5^0C and 80-85% R.H.

Data presented in table 2 indicated that, spraying trees with seed Fenugreek extracts, Willow bark extracts and Cisslein in single way or combination led to decreased in the percentage physiological decay (SERB and RS), % fungi decay and total decay significantly compared to control treatment. The treatment (seed fenugreek extracts 40% + Willow bark extracts 30% + Cisslein 250 mg/L) gave the lowest values in percentage physiological decay, fungi decay and total decay they were (1.34, 1.21, 0.77 and 3.32%) in comparison to the highest rates (2.19, 2.35, 2.45 and 6.99%) in control treatment in the end of storage. The decrease in different type of physiological decay, fungi decay and total decay in fruits as a result of all treatments led to its role in making new balance in fruits and around between O_2, CO_2 and ethylene. The increase of water content in fruits leads to decrease the percentage of decays (Roy, 2008). Abobatta (2015) mentioned that , the growth regulator protected fruits from some biological dieses are which caused by fungi and Bacteria .

Effect of spraying with seed Fenugreek extracts, Willow bark extracts and Cisslein on percentage of total soluble sold, acidity, vitamin C, Antioxidant capacity of fruits local sours orange after 3 months from storage at 5^0C and 80-85% R.H.

Data in table 2 shows that percentage of total soluble solids, Vitamin C and Antioxidant capacity in fruits were increased significantly when trees sprayed with seed Fenugreek extracts, Willow bark extracts and Cisslein in

single way or combination. The highest significance result were recorded in treatment (seed fenugreek extracts 40% + Willow bark extracts 30% + Cisslein 250 mg/L), that gave the highest percentages of total soluble solids, Vitamin C and Antioxidant capacity, they were (14.75%, 49.49 mg/100 ml Juice and 3.78 (m mol TE/g FW)) comparison with lest rates of percentages (11.42 % , 47.51 mg / 100 ml Juice and 1.35 (m mol TE/g FW)) in the control treatment respectively at the end of storage. The increase in chemical companied of fruit juice because of fruits treated with such materials led to increase in the content of leaves from growth hormones and total chlorophyll , these led to increase the chemical parameters of fruits. These results are in harmony with this found by (El-Helaly, 2002). Possible those treatment led to reduction the respiration rate of storage fruits.

Conclusion

It could be concluded from this experiment that, spraying trees of sours orange with seed fenugreek extracts, Willow bark extracts and Cisslein improve physical and chemical characteristics of fruits pre storage and reducing percentage of weigh loss physiological disorders disease (SERB +RS), % fungi decay, total decay and increasing percentage of total soluble sold , acidity, vitamin C and Antioxidant capacity of fruits after 3 months from storage at 5^0C and 80-85% R.H. compared to control treatment.

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