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STUDIES TOWARDS FOR EFFECT OF SOME ANTIOXIDANTS ON YIELD AND FRUIT QUALITY OF BALADY MANDARIN TREES *(Citrus reticulata, Blanco).*

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ABSTRACT

This study was carried out during three seasons of 2008, 2009 and 2010 on Balady mandarin trees (*Citrus reticulata, Blanco*). This work was to evaluated the effect of some antioxidants namely ascorbic acid, salicylic acid and chelated zinc on yield and fruit quality of Balady mandarin fruits.

The results reveled that sprayed mandarin trees with the three antioxidants increased the yield/tree than the control. Furthermore, lower concentration (500 ppm) of ascorbic acid, salicylic acid and chelated zinc gave a higher effect in this respect comparing with high concentration. The increment in yield /tree may be due to the increment in number of fruit/tree. Yet, these treatments resulted in somewhat effect on average fruit weight, SSC/acid ratio and vitamin C content in fruit juice. Furthermore, sprayed mandarin trees with ascorbic acid at 500 ppm produced higher content of soluble solid and vitamin C than the other treatments. The data indicated that spray 500 ppm of ascorbic acid, salicylic acid and chelated zinc at after fruit set and the one month later were beneficial to obtain economic yield with quality of Balady mandarin fruits.

INTRODUCTION

Citrus one of the most important of fruit crops allover the world, especially in U.S.A and warm temperate regions and grows and well adapted successfully in Egypt. Citrus occupied the third position among to fruit crops production in the world after grapes and apples. Citrus is a backbone of fruit crop cultivation in Egypt, since, its rank the first order among all other fruits. The total area of citrus reached about 368290 feddans, which produce about 3510858 metric ton according to the Statistics of the Agriculture Ministry, Egypt in 2009.

Mandarin *(Citrus reticulate, Blanco)* is one of the most important of citrus fruit in many countries including Egypt. The major mandarin production in Egypt is confined to the local cultivars Balady which belongs to common Mediterranean mandarin group.

Antioxidants compounds which have an auxinic action, and synergistic effect on flowering and fruiting of fruit trees, their practical use on fruit trees under field conditions is favorably possible further and additional studies are needed to evaluated their action on fruit trees and to find cheap and safe antioxidants that are beneficial for enhancing growth and productivity at the same time Elad (1992). Antioxidant is safe to human and environment and use successfully to control some plant diseases, Prusky (1988). The antioxidants play an important role in protecting the cell from senescence as well as enhancing the formation of organic foods. Also, they prevent free radicals produced during plant metabolism from oxidation of lipids, the

components of plasma membrane which is an accompanied with the loss of membrane permeability and the death of cell, Raskin (1992).

Recently antioxidants have been used instead of auxins and other chemicals for enhancing growth and fruiting of various fruit trees (El-Sayed *et al*., 2000) and Ragab (2002). In this respect, vitamin C functions as antioxidant play an important role in different processes, including photosynthesis, photo protection, cell wall growth and cell expansion resistance to environmental stresses, synthesis of ethylene, gibberellins, anthocyanins and hydroxyproline, (Nicholas and Wheeler, 2000).

Salicylic acid is also involved in minimizing of the stresses during inducing antioxidant system when plants are exposed to it, and now is considered a hormonal substance that plays a key part in regulating plant growth and development, (Senaratna *et al*., 2004).

Zinc is known to stimulating growth and its deficiency leads to short of internodes. This led to the discovery that this addition, it was thought that Zn deficiency causes the destruction of IAA by an increasing in oxidation that causes the promotion of peroxides activity. Moreover, it was clearly shown that a lower auxin level in the plant due to Zn deficiency is an account of reduced synthesis of tryptophan, a precursor of IAA (Nason and McElroy, 1963).

Therefore, the main goals of this study are to evaluate the effect of some antioxidants, (ascorbic acid, and salicylic acid) and chelated zinc on fruiting as well as physical and chemical characteristics of fruits, and yield of Balady mandarin trees.

MATERIALS AND METHODS

This study was carried out during three seasons 2008, 2009 and 2010 on Balady mandarin trees (*Citrus reticulata, Blanco*) cultivated in the Agriculture Research Station of Faculty of Agriculture, Mansoura University, Dakahlia Governorate, Egypt. Trees were about 25 years old, spaced at 3x4 meters a part budded on sour orange rootstocks. Sixty-three trees almost uniform in vigor and apparently healthy were chosen for the present study. The experiment was arranged in a randomized complete block design. The study was content of seven treatments with three replicates and each replicate was presented by 3 trees as shown in Table (1)

Table (1) :The applied treatments

No	Applied treatment
1	Control treated with tap water only
2	Ascorbic acid at 500 ppm
3	Ascorbic acid at 1000 ppm
4	Salicylic acid at 500 ppm
5	Salicylic acid at 1000 ppm
6	Chelated zinc at 500 ppm
7	Chelated zinc at 1000 ppm

All treatments were applied twice, one after fruit set and one month later. Since, these treatments were carried out as twice in 24-24, 27-27 and 29-29 April and May in 2008,2009 and 2010 during the three seasons respectively of the study.

At harvest time, when the color of the fruits became yellow orange the number of fruits was counted and average of fruits was estimated to presented yield/tree.

Sixty-three fruits from replicates under study were randomly collected in mid December taken and determined both physical and chemical properties of fruits as the follows:

1 **Fruit weight (g):** it was estimated of 10 fruits from each replicate and average fruit weight was calculated.

2 **Fruit dimensions (cm)**: they were measured by using vernier caliper.

Samples of fruits juice filtered through muslin cloth to determine fruit chemical characteristics.

Soluble solids content: (SSC %)

It was expressed by using carlzesis hand refractometer.

Total acidity percent:(mg/100ml juice)

It was determined by titrating 10 ml juice from each sample using NaOH (0.1N) phenolphthalein (ph.th) as an indicator. The acidity was expressed as mg of citric acid /100 ml juice according to A.O.A.C (1980)

Soluble solids content/acid ratio:

This ratio was calculated by diving of SSC% on total acidity to be used as a criterion for maturity determination

Ascorbic acid (vitamin C):(mg/100 ml. juice)

It was determined by using 2, 6 dichlorophenol indophenol dye 2 % oxalic as a substract. Vitamin C content was calculated as mg /100 ml juice (A.O.A.C (1980).

Statistical analysis

All data of the study were statistically analyzed according to the technique of analysis of variance (ANOVA**)** for experiment in randomized complete block design according to Gomez and Gomez, (1984). L.S.D at 5% was used to compare the variances between the data

RESULTS AND DISCUSSION

Effect of ascorbic and salicylic acids as well as chelated zinc on yield of Balady mandarin trees:

Data from Table (3) show clearly that mandarin trees which sprayed with both ascorbic and salicylic acids at 500 or 1000 ppm and chelated zinc increased yield per tree (kg) than the untreated trees during the seasons under the study, where applications significantly increased the total number of fruits per tree at harvest time. While, there were no significant effect obtained between the application with ascorbic, salicylic acids and chelated zinc on average number of fruits/tree. In this respect, the best results of yield were registered from trees that sprayed with ascorbic acid at 500 ppm. Since, this treatment gave the highest yield and number of fruits/tree. These results

were in a harmony with those obtained by Abd El- Rahman (2003); Gobara (2004); Omaima *et al*., (2007); Tariq *et al*., (2007); Dhinesh Babu *et al*., (2007) and Abd ELaal *et al*., (2009).

Table (2): Effect of ascorbic & salicylic acids and chelated zinc on number of fruits of Balady mandarin trees.

Treatment	Number of fruits/tree				
	2008	2009	2010	mean	% loss than control
Control	455.33	311.33	320.33	362.33	------
Ascorbic acid at 500 ppm	656.00	363.67	441.67	487.11	34.44
Ascorbic acid at 1000 ppm	632.67	351.33	402.67	462.22	27.57
Salicylic acid at 500 ppm	632.67	401.00	408.67	480.78	32.69
Salicylic acid at 1000 ppm	640.00	318.33	428.33	462.22	27.57
Chelated zinc at 500 ppm	658.00	348.33	441.00	482.44	33.15
Chelated zinc at 1000 ppm	670.00	351.67	375.00	465.56	28.49
L.S.D at 0.05 %	96.79	82.97	109.26	96.34	------

Table (3): Effect of ascorbic& salicylic acids and chelated zinc on yield of Balady mandarin trees.

Treatment	Yield/tree (kg)				
	2008	2009	2010	mean	% loss than control
Control	48.49	37.88	42.07	42.81	------
Ascorbic acid at 500 ppm	71.18	47.52	57.86	58.85	37.47
Ascorbic acid at 1000 ppm	68.96	43.80	55.97	56.24	31.38
Salicylic acid at 500 ppm	67.70	49.05	52.99	56.58	32.17
Salicylic acid at 1000 ppm	69.76	39.47	53.11	54.12	26.41
Chelated zinc at 500 ppm	71.72	45.17	57.18	58.02	35.54
Chelated zinc at 1000 ppm	71.69	47.83	51.00	56.84	32.77
L.S.D at 0.05 %	10.08	9.83	14.58	11.50	------

Effect on fruit weight and diameter:-

Data from Table (4) showed that spraying mandarin trees with ascorbic acid and chelated zinc each at 500 or 1000 ppm gave height weight and diameter of fruits as compare with salicylic acid at 500 or 1000 ppm or the untreated trees. The data reveled that trees sprayed with ascorbic acid and chelated zinc at 500 or 1000 ppm gave a higher fruit diameter than the other used treatments. This result agreed with those found by Abd El Rahman (2003), Tariq *et al*., (2007), Abd ELaal *et al*., (2009) and Dhinesh Babu *et al*., (2007).

Table (4): Effect of ascorbic& salicylic acids and chelated zinc on fruit weight (g) and diameter (mm) of Balady mandarin trees.

Treatment	Fruit weight (g)				Fruit diameter (cm)			
	2008	2009	2010	Mean	2008	2009	2010	Mean
Control	106.50	121.67	131.33	119.83	5.47	6.11	6.47	6.02
Ascorbic acid at 500 ppm	108.50	130.67	131.00	123.39	6.20	6.62	6.45	6.42
Ascorbic acid at 1000 ppm	109.00	124.67	139.00	124.22	6.00	6.35	6.56	6.30
Salicylic acid at 500 ppm	107.00	122.33	129.67	119.67	5.90	6.43	6.50	6.28
Salicylic acid at 1000 ppm	109.00	124.00	124.00	119.00	5.96	6.52	6.33	6.27
Chelated zinc at 500 ppm	109.00	129.67	129.67	122.78	5.90	6.57	6.59	6.35
Chelated zinc at 1000 ppm	107.00	136.00	136.00	126.33	6.70	6.22	6.22	6.38
L.S.D at 0.05 %	5.48	13.04	10.98	9.83	1.01	0.30	0.32	0.54

Effect on juice chemicals constitute of Balady mandarin fruits:

Data from Tables (5) & (6) showed that trees sprayed with ascorbic acid at 500 ppm gave the highest SSC% of fruit juice comparing other treatments. The data also showed that spraying mandarin trees with ascorbic and salicylic acids each at 1000 ppm gave low acidity than the other treatments. It is clear from the data in Table (6) that sprays mandarin trees with chelated zinc reduced SSC/acid ratio than the other treatments .Since, this treatment gave a higher values of total acidity.

With regard to the effect on vitamin C content, the data showed that spraying trees with ascorbic acid at 500 ppm increased value of vitamin C content than the other treatments. These results agreed with those found by Abd ELaal *et al*., (2009), Ahmed *et al*., (2002), ELKhawaga and Samra (2006), Hamdy *et al*., (2007) and Fayad (2010)

Table (5): Effect of ascorbic & salicylic acids and chelated zinc on SSC (%) and total acidity (%) in fruit juice of Balady mandarin.

Treatment	SSC %				Total acidity mg/100ml juice			
	2008	2009	2010	Mean	2008	2009	2010	Mean
Control	12.11	10.30	11.75	11.39	1.07	1.50	1.20	1.26
Ascorbic acid at 500 ppm	12.73	11.83	11.93	12.16	1.17	1.33	1.29	1.26
Ascorbic acid at 1000 ppm	11.37	9.83	10.73	10.64	1.17	1.08	0.89	1.05
Salicylic acid at 500 ppm	12.50	11.17	10.93	11.53	1.17	1.30	1.24	1.24
Salicylic acid at 1000 ppm	11.03	10.33	10.53	10.63	1.15	1.27	1.00	1.14
Chelated zinc at 500 ppm	11.76	9.97	10.56	10.76	1.50	1.50	1.02	1.34
Chelated zinc at 1000 ppm	12.93	10.30	11.20	11.48	1.29	1.50	1.17	1.32
L.S.D at 0.05 %	0.89	1.15	1.15	1.06	0.35	0.27	0.26	0.29

Table (6): Effect of ascorbic& salicylic acids and chelated zinc on SSC/acid ratio and vitamin C (mg/100 ml juice) of Balady mandarin fruits.

Treatment	SSC/acid ratio (%)				Vitamin C (mg/100 ml juice)			
	2008	2009	2010	Mean	2008	2009	2010	Mean
Control	11.35	6.87	9.79	9.34	59.10	69.33	60.00	62.81
Ascorbic acid at 500 ppm	10.88	8.89	9.25	9.67	63.57	73.56	65.83	67.65
Ascorbic acid at 1000 ppm	9.72	9.10	12.06	10.29	61.17	66.90	63.33	63.80
Salicylic acid at 500 ppm	10.68	8.59	8.81	9.36	61.33	63.13	66.17	63.54
Salicylic acid at 1000 ppm	9.59	8.13	10.50	9.41	62.67	62.90	66.90	64.16
Chelated zinc at 500 ppm	7.84	6.65	10.35	8.28	60.50	61.00	61.47	60.99
Chelated zinc at 1000 ppm	10.02	6.87	9.57	8.82	64.90	69.80	65.33	66.68
L.S.D at 0.05 %	3.33	1.92	3.17	2.81	5.46	3.65	4.97	4.69

For this study it is clear that sprayed mandarin trees with ascorbic, salicylic acids and chelated zinc at 500 ppm is very beneficial for improving yield and fruit quality of Balady mandarin trees.

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دراسات على إستخدام بعض مضادات الأكسده على الإنتاجيه وجودة الثمار فى أشجار اليوسفى البلدى

نبيل رشاد السيد سمره ، محمود إبراهيم القاضى ، السيد البدوى طه الباز و منى سامي حامد غانم

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تهدف هذه الدراسه إلى دراسه تأثير بعض مضادات الأكسده مثل حمض الأسكوربيك وحمض الساليسيلك والزنك المخلبى بتركيزى ٥٠٠، ١٠٠٠ جزء فى المليون على عدد الثمار والمحصول وكذا جودة ثمار أشجار اليوسفى البلدي وتم رش الأشجار بكلا من مضادات الأكسده مرتان وذلك بعد العقد والثانيه بعد العقد بشهر.

ولقد أوضحت نتائج الدراسه إلى أن رش أشجار اليوسفي البلدي بمضادات الأكسده (الأسكوربيك و الساليسيلك والزنك المخلبى) أدت إلي زياده المحصول للأشجار بالمقارنه بالكنترول.وكان لإستخدام التركيز الأقل (٥٠٠) جزء فى المليون أثر أكبر فى هذا المجال بالمقارنه بالتركيز الأعلى وأن الزيادة فى الإنتاجيه للأشجار تعزى إلي زيادة عدد الثمار على الأشجار بالرغم من أن هذه المعامله لم تعطى تأثير واضح على متوسط وزن الثمرة

هذا وأوضحت الدراسه أن رش أشجار اليوسفى البلدى بحمض الأسكوربيك بتركيز ٥٠٠ جزء فى المليون أعطى زياده فى نسبة المواد الصلبه الذائبه عن باقى المعاملات فى حين إستخدام التركيز الأعلى قيمه ١٠٠٠ جزء فى المليون أدى لإنخفاض الحموضه الكليه فى عصير الثمار فى حين أدى الرش بالزنك المخلبى لزيادة نسبة المواد الصلبه الذائبه للحموضه مقارنه بباقى المعاملات.

كذلك أوضحت الدراسه أن رش حامض الأسكوربيك أو الساليسيللك أو الزنك المخلبى مرتين بتركيز ٥٠٠ جزء فى المليون يكون مفيدا فى الحصول على كميه محصول إقتصاديه وكذلك تحسين جودة ثمار اليوسفى البلدى.

قام بتحكيم البحث

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