Effect of Some Cultural Treatments on Growth, Yield, Fruit Quality and Storage Life of Valencia Orange Trees Grown in Sandy Soil under Drip Irrigation

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ABSTRACT

This study was carried out during 2003 and 2004 seasons. Valencia orange trees were sprayed twice with 1-Tap water (as a control) 2-Zinc sulphate (0.5%) 3-GA_3 (20ppm) 4-Amcoton (NAA), (0.6gm/L) 5-Paclobutrazol (PP333), (500 ppm). The data revealed that either NAA or PP333 was the most effective treatment in increasing fruit set %. All treatments insignificantly influenced fruit weight. Spraying PP333 gave the highest significant yield; peel weight and thickness and V.C content. Zn and NAA treatments resulted in the highest significant values of juice volume; total sugars and SSC/acid. The most efficient treatment in reducing acidity was spraying Zn. Fruits were stored for 60 days at room temperature (18-20°C and 85-90% RH). The results indicated that, as the storage period advanced, peel weight and thickness; juice volume; V.C and acidity decreased, while SSC; total sugars%; SSC/acid ratio; weight loss % and decay% increased. At the end of storage period, the highest significant values of juice volume were recorded with Zn; NAA and GA_3 treatments. Concerning SSC and total sugars, NAA treatment was the best treatment in increasing their percentages. The lowest percentages of citric acid were obtained due to Zn and PP333 treatments. Spray of PP333 gave also the highest significant values of V.C, compared with other treatments. The least total loss % (weight loss% and decay %) was obtained due to PP333 treatment (45.60 and 45.10% in the first and second seasons, respectively) compared with other treatments (47.00-55.50 % in the first season and 46.60-54.90% in the second one).

Key words: Valencia orange; Zn; GA_3; NAA, PP333; yield; fruit quality and storage.

INTRODUCTION

Citrus fruits are the most popular fruits produced in Egypt. Valencia orange is greatly desired in local markets in summer time and for export. Valencia orange now is the first variety of orange cultivated in desert under drip irrigation system.

In this study, the important aim is to maximize the yield, maintain fruit quality and storability during marketing or storage of Valencia oranges.

Several treatments have been tried to achieve this objective by spraying Valencia orange trees on sour orange rootstock (*Citrus aurantium*, *B*) with Zn, GA_3, NAA and PP333. Zinc sulphate is needed by trees,

especially in sandy soil, zinc is very effective in regulating plant growth and fruit set by sharing the formation of tryptophan amino acid as a basic to auxin structure. Zinc improved size of yield and fruit quality in different fruit crops (Dube and Sazene, 1971 and Rai *et al.*, 1988).

Naphthalene acetic acid (NAA) as an effective compound had been used to increase fruit set and reduce fruit drop is confirmed in several studies (Pereira *et al.*, 1985).

Gibberellin compared usually in bioassay with auxin and gibberellin in many cases is more active than natural and original auxin and it increases fruit set (Devlin and Witham, 1985). Gibberellin induced parthenocarpy in prunus (Crane *et al.*, 1960).

The most remarkable effect of paclobutrazol (PP333) is noticed on plant growth through interfering with gibberellin biosynthesis (Steffens *et al.*, 1985), therefore it is classified as a plant growth retardant. PP333 not only controls growth, but it may also influence cropping (Williams, 1983 and Williams and Edgerton, 1983).

PP333 application also increased fruit set and yield (EL-Khoreiby and Abbas, 1987). Susan *et al.* (1997) reported that because of the very strong inhibitory effect on shoot growth in fruit trees, PP333 may enhance crop yield by reducing competition from vegetative growth. Fruits characteristics were also influenced such as improvement fruit quality (Curry and Williams, 1983 and Wang and Steffens, 1987). Elfving *et al.* (1990) reported that foliar PP333 reduced post storage ethylene production.

This experiment was carried out to study the effect of some cultural treatments (Zn sulphate; GA_3; NAA and PP333) on growth, yield, fruit quality and storability of Valencia orange trees grown in sandy soil under drip irrigation

MATERIALS AND METHODS

This investigation was carried out in the years of 2003 and 2004 on 10 years old trees of Valencia orange grown in EL-Noubaria (Behera Governorate) in a sandy soil. All trees are spaced at 5 x 5 meters grown on sour orange rootstock (*Citrus aurantium, B*) under drip irrigation system.

The experimental trees have been subjected to the same fertilization, irrigation, pruning and pest control practices usually done at EL-Noubaria region. The selected trees were almost uniform as possible concerning vigour and were free from diseases.

During two seasons, 60 trees were selected and arranged in randomized complete block design, 3 replicates, in each replicate, 4 trees were chosen at random to receive one of the 5 practices shown in Table (1).

All treatments were sprayed twice, at full bloom and 15 days after fruit setting. Each tree was sprayed with 10 liters from each of the sprayed solutions.

Table (1): Experimental treatments :

No.	Treatments
1	Control (tap water).
2	Zinc sulphate at 0.5 %.
3	GA_3 at 20 ppm.
4	Amcoton (NAA) at 0.6 gm/L.
5	Paclobutrazol (PP333) at 500 ppm.

To determine fruit set, four main branches on each tree were chosen. The number of flowers on each branch for every treatment was counted and recorded. To calculate the percentage of fruit setting per treatment, after petal-fall the number of setting fruits on each branch was counted by using the following equation:

$$\text{Fruit set \%} = \frac{\text{Total number of setted fruits}}{\text{Total number of flowers}} \times 100$$

I- Measurements at harvest:

When the fruits reached the harvesting stage, the yield was determined by weighting the fruits per tree (kg) and a sample of about 12 fruits was taken for every replicate and the following characteristics were determined:

1- Fruit weight (gm).
2- Fruit peel weight (gm) and peel thickness (mm).
3- Juice volume (cm^3).
4- Soluble solids content % (SSC), measured by hand refractometer.
5- Titratable acidity % (TA), expressed as percent of citric acid, was determined according to the A.O.A.C. (1985).
6- SSC/TA ratio.

7- Ascorbic acid (V.C), was determined by titration against 2.6 dichlorophenol indophenol blue dye, according to the A.O.A.C, (1985).
8- Total sugars %, were determined in fruit juice, according to Somgyi, (1952).

II- Measurements at storage :

For all determinations, one replicate (consists of 12 fruits) of each treatment, was placed in open plastic box. Three boxes (every one, contained one replicate of each treatment) were taken at every evaluation date. All boxes were stored at room temperature (18-20 °C) with relative humidity of (85-90 %). Fruits were evaluated at 15 day-interval throughout the storage period (60 days), to be subjected to the following determinations:

1- Total loss % (weight loss % + decay%).
2- Fruit peel weight (gm) and peel thickness (mm).
3- Juice volume (cm^3).
4- Soluble solids content % (SSC).
5- Titratable acidity %(TA).
6- SSC/TA ratio.
7- V.C mg/100ml Juice.
8- Total sugars %.

The obtained data were statistically analyzed, according to Snedecor and Cochran (1971).

RESULTS AND DISCUSSION

I- Fruit set, yield and fruit weight :

Data in Table (2) clearly showed that, in the both experimental seasons, fruit set % and yield significantly increased in response to spraying with all treatments (Zinc; GA_3; NAA or PP333). The significant highest fruit set % was obtained due to spray with either PP333 or NAA and the differences were significant between those treatments (PP333 or NAA) and other ones. The significant increment in yield of trees treated with PP333, compared with other treatments, may explain the importance of spraying orange trees with PP333. These results are confirmed by the results obtained by Crane *et al.* (1960); Dube and Sazene (1971); Maiti (1973); Azzouz *et al.* (1984); Delgado *et al.* (1986) and Ahmed *et al.* (1993).

Table (2): Effect of some cultural treatments on fruit set percentage; fruit weight and yield of Valencia orange trees in 2003 and 2004 seasons.

Treatments	Fruit set (%)			Yield per tree (kg)			Fruit weight (gm)		
	2003	2004	Mean	2003	2004	Mean	2003	2004	Mean
Control	4.53	4.66	4.595	76.30	76.80	76.55	233.0	235.0	234.0
Zn	4.94	5.10	5.02	79.80	80.70	80.25	235.0	240.0	237.5
GA_3	5.20	5.25	5.225	81.50	82.00	81.75	232.0	235.0	233.5
NAA	5.46	5.49	5.475	83.0	83.80	83.40	240.0	242.0	241.0
PP333	5.53	5.57	5.55	88.10	88.90	88.50	235.0	236.0	235.5
L.S.D at 5 %	0.128	0.129	---	2.013	2.031	---	N.S	N.S	---

Concerning fruit weight, Table (2) revealed that all treatments had no significant influence on fruit weight in both seasons, the results are in agreement with the findings of Raese and Burts (1983) and Swietlik and Fucik (1988).

II- Fruit quality at harvest:

Peel weight and thickness

Data in Table (3) clearly indicated that, in both experimental seasons, peel weight and thickness significantly increased, compared with control, after spraying the trees with all treatments, except GA_3 in the first season. However, peel thickness was not influenced by Zn treatment (in second season only). PP333 treatment gave the highest values of peel weight and thickness, compared with other treatments with significant differences. These results are in agreement with Hikal (1994).

Juice volume

The data illustrated in Table (4) disclosed that all treatments increased juice volume compared with control. However, PP333 treatment gave insignificant increment. The highest volumes of juice were obtained as result of spraying the trees with Zn and NAA, compared with other treatments with significant differences.

Total sugars%

The data presented in Table (4) showed that a significant increment in their percentages was only obtained due to spray with Zn and NAA.

SSC%

Regarding to soluble solids content% (SSC), the data in Table (4) recorded that Zn and NAA treatments in the first experimental season and all treatments (Zn; GA_3; NAA and PP333) in the second one, gave significant increment in SSC% compared with control. These results are in line with those reported by Williams (1984) and Webster and Andrews (1988).

Titratable acidity (TA)

The data presented in Table (5) clearly pointed out that applying Zn; NAA and PP333 significantly decreased the value of acidity compared with control and GA_3. Zn treatment was almost the most efficient treatment in reducing acidity. The results were in line with those obtained by Curry (1988) and Chen *et al.* (1989).

SSC/ acid ratio

The data in Table (5) detected that Zn; NAA and PP333 treatments significantly increased SSC/acid ratio, compared with control and GA_3, in both experimental seasons. The first ones (Zn and NAA) gave the highest ratios. Differences, however, were significant.

Vitamin C (V.C)

The data in Table (5) showed that V.C content significantly increased by spraying with GA_3; NAA and PP333 compared with control and the last one (PP333) gave the highest value of ascorbic acid, in the two years of study. The obtained results agree with Hikal (1994).

III- Fruit quality during storage:

Peel weight and thickness

From Table (3) the data showed that with all treatments, peel weight and thickness gradually decreased with the advance of storage period during the two seasons of this study. Spraying with PP333 and NAA gave the lowest significant reduction in this respect compared with other treatments, at the end of the storage period.

Juice volume

Data in Table (4) showed an obvious decline in juice volume at the end of storage period. The results were confirmed with those found on Balady limes by El-Hefnawi (2002). The treatments of zinc sulphate, NAA and GA_3 had the highest significant juice volume at the end of storage period.

SSC% and total sugars

The tabulated results in Table (4) indicated that SSC and total sugars % increased gradually as the storage period advanced. The highest significant percentages of SSC and total sugars were recorded in treatment with NAA.

Titratable acidity (TA)

The results in Table (5) revealed that juice acidity behaviour during storage period showed a remarkable reduction during storage. This result agree with EL-Gazawy (1973) on lime fruits; Angadi and Krishnaurthy (1992) on Coorg mandarin fruits; El-Zayat *et al.* (1998) on lime fruits and El-

Wahab (2000) on Washington navel oranges. The treatments of Zn and PP333 gave the lowest percentages of citric acid in both years of study.

SSC/acid ratio

Data presented in Table (5) revealed that SSC/acid ratio was almost similar to that found with SSC. The ratio gradually increased with all treatments as the storage period advanced during the two seasons of study.

Vitamin C (V.C)

Concerning changes in vitamin C during storage, Table (5) indicated that vitamin C in juice decreased during storage at room temperature. Similary El-Shiekh (2002) and El-Hefnawi (2002). However, Artes *et al.* (1993) found that concentration of ascorbic acid was increased during storage period. The highest significant value of V.C was recorded with PP333 treatment.

Weight loss %

Data in Table (6) indicated that the weight loss % gradually increased as the storage period advanced. At the end of storage, Zn in the first season; NAA and PP333 treatments in both seasons significantly reduced the weight loss % compared with either control or GA treatment. The least significant weight loss % was obtained due to PP333 treatment in the both experimental seasons and due to Zn treatment in the first one.

Decay %

The data illustrated in Table (6) clearly pointed out that the decay % increased as the storage period progressed. At the end of storage period Zn; NAA and PP333 treatments resulted in significant decrease in the decay% compared with both control and GA_3 treatments. PP333 treatment was the best one in reducing decay % in both experimental seasons besides NAA treatment in the first one.

Total loss % (weight loss % + decay %)

The data in Table (6) recorded that total loss % increased as the storage period advanced. It was also noticed that, at the end of storage period, Zn; NAA and PP333 treatments significantly decreased total loss % compared with both of control and GA ones. The least significant total loss % was obtained as a result of PP333 treatment compared with other treatments, in both experimental seasons. Paclobutrazol (PP333) reduced senescence and functional breakdown in fruits which may be due to the increase in calcium content in fruits (Greene, 1986).

From this study, it may be concluded that spraying Valencia orange trees on sour orange rootstock (*Citrus aurantium, B*) planted in desert with NAA and PP333 increased fruit set, yield and quality, while reduced total loss and extended storability.

Table (3): Effect of some cultural treatments on peel weight and thickness of Valencia orange fruits during storage at room temperature (18-20°c) in 2003 and 2004 seasons.

Treatments	0-time		Days in storage							
			15		30		45		60	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
					Peel weight (gm)					
Control	50.48	44.80	46.80	40.70	36.20	30.52	29.10	28.40	23.10	22.40
Zn	51.90	47.70	46.70	43.50	35.70	33.30	30.20	27.60	24.00	22.30
GA_3	50.40	49.20	48.20	45.80	38.20	36.70	33.80	30.60	23.90	23.30
NAA	59.80	57.37	55.70	53.27	42.90	40.15	36.80	32.20	32.80	29.30
PP333	62.70	60.57	59.10	57.20	50.10	50.40	44.40	41.70	33.30	30.90
L.S.D at 5 %	1.403	1.340	1.312	1.250	3.596	1.020	0.919	0.843	0.734	0.675
					Peel thickness (mm)					
Control	3.20	3.10	3.00	2.90	2.80	2.70	2.60	2.55	2.40	2.30
Zn	3.30	3.10	3.00	2.80	2.90	2.60	2.60	2.40	2.450	2.30
GA_3	3.00	3.20	2.90	3.00	2.60	2.80	2.30	2.60	2.20	2.40
NAA	3.60	3.40	3.20	3.00	3.00	2.80	2.80	2.60	2.60	2.60
PP333	3.90	3.80	3.60	3.30	3.20	3.00	2.95	2.80	2.70	2.65
L.S.D at 5 %	0.086	0.084	0.079	0.72	0.072	0.068	0.067	0.064	0.062	0.061

Table (4): Effect of some cultural treatments on juice volume, SSC % and total sugars % of Valencia orange fruits during storage at room temperature (18-20°c) in 2003 and 2004 seasons.

Treatments	0-time		Days in storage							
			15		30		45		60	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
					Juice volume (cm^3)					
Control	120.0	117.0	110.0	106.0	105.0	96.0	94.0	90.0	90.0	88.0
Zn	128.0	127.0	117.0	115.0	110.0	102.0	98.0	94.0	94.0	92.0
GA_3	123.0	121.0	112.0	109.0	108.0	105.0	97.0	96.0	95.0	92.0
NAA	128.0	129.0	118.0	118.0	112.0	108.0	100.0	100.0	95.0	94.0
PP333	122.0	118.0	110.0	105.0	106.0	100.0	93.0	92.0	90.0	89.0
L.S.D at 5 %	2.995	2.958	2.743	2.674	2.611	2.481	2.314	2.291	2.227	2.149
					SSC (%)					
Control	9.5	9.0	9.8	9.9	10.2	10.3	10.5	10.6	10.7	10.9
Zn	10.0	10.0	10.3	10.7	10.8	10.9	10.9	11.0	12.0	12.2
GA_3	9.0	9.5	9.9	9.8	10.2	10.5	10.5	10.8	10.9	11.0
NAA	10.4	10.8	10.9	11.3	11.5	11.8	11.9	12.0	12.5	13.0
PP333	9.6	9.3	9.9	9.7	10.3	10.1	10.6	10.4	10.9	10.9
L.S.D at 5 %	0.237	0.239	0.247	0.251	0.259	0.263	0.262	0.267	0.279	0.277
					Total sugars %					
Control	6.30	6.20	6.60	6.52	6.71	6.70	6.92	6.83	7.33	7.26
Zn	7.70	7.81	7.82	8.03	7.95	8.10	8.11	8.42	8.28	8.50
GA_3	6.06	6.10	6.22	6.31	6.54	6.62	6.83	6.71	7.27	7.10
NAA	7.65	7.9	7.86	8.20	8.33	8.61	8.70	8.87	8.93	8.98
PP333	6.32	6.25	6.62	6.50	6.83	6.71	6.97	6.80	7.38	7.30
L.S.D at 5 %	0.167	0.169	0.173	0.176	0.180	0.182	0.187	0.186	0.193	0.193

Table (5): Effect of some cultural treatments on acidity, SSC/acid ratio and Vitamin C of Valencia orange fruits during storage at room temperature (18-20°c) in 2003 and 2004 seasons.

Treatments	0-time		Days in storage							
			15		30		45		60	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
					Acidity %					
Control	0.980	0.981	0.970	0.972	0.960	0.966	0.920	0.910	0.890	0.885
Zn	0.885	0.850	0.874	0.830	0.863	0.823	0.851	0.812	0.820	0.800
GA_3	0.985	0.950	0.970	0.970	0.962	0.960	0.930	0.925	0.910	0.915
NAA	0.905	0.907	0.900	0.901	0.895	0.890	0.883	0.880	0.850	0.848
PP333	0.900	0.920	0.890	0.900	0.872	0.850	0.863	0.843	0.844	0.820
L.S.D at 5 %	0.022	0.022	0.022	0.022	0.022	0.022	0.021	0.021	0.021	0.020
					SSC/acid ratio					
Control	9.6	10.0	10.10	10.19	10.63	10.66	11.41	11.65	12.02	12.32
Zn	11.30	11.76	11.78	12.89	12.51	13.24	12.81	13.55	14.63	15.25
GA_3	9.14	10.0	10.21	10.10	10.60	10.94	11.29	11.68	11.98	12.02
NAA	11.49	11.91	12.11	12.54	12.85	13.18	13.48	13.64	14.71	15.33
PP333	10.66	10.11	11.12	10.77	11.81	11.88	12.30	12.33	12.91	13.29
L.S.D at 5 %	0.260	0.263	0.273	0.278	0.290	0.296	0.303	0.308	0.327	0.338
					Vitamin C (mg/100ml juice)					
Control	45.90	44.70	42.70	41.60	40.10	39.15	37.60	36.20	33.55	32.20
Zn	46.80	45.55	43.30	42.25	40.50	39.60	38.20	37.10	34.90	34.20
GA_3	49.30	48.70	45.60	44.30	42.30	41.60	39.80	38.80	35.90	34.70
NAA	50.52	51.20	48.10	48.90	44.20	45.00	40.30	41.10	36.60	37.10
PP333	55.80	55.90	50.90	49.80	47.30	46.30	43.80	41.90	40.10	39.20
L.S.D at 5 %	1.240	1.240	1.152	1.141	1.068	1.060	0.987	0.969	0.898	0.887

Table (6): Effect of some cultural treatments on weight loss, decay and total loss % of Valencia orange fruits during storage at room temperature (18-20°c) in 2003 and 2004 seasons.

Treatments	0-time		Days in storage							
			15		30		45		60	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
					Weight loss %					
Control	-	-	7.60	7.70	10.20	10.60	17.20	16.50	24.80	22.60
Zn	-	-	6.50	6.50	8.90	8.80	14.40	15.00	21.90	22.20
GA_3	-	-	7.80	7.90	10.40	10.30	17.80	17.20	24.70	23.00
NAA	-	-	6.20	6.30	8.30	8.80	15.80	14.90	22.70	21.60
PP333	-	-	6.00	6.10	7.80	7.50	13.60	13.80	21.80	20.50
L.S.D at 5 %	-	-	0.156	0.158	0.207	0.210	0.368	0.359	0.546	0.517
					Decay %					
Control	-	-	0.00	0.00	16.50	17.20	22.70	23.20	30.20	30.00
Zn	-	-	0.00	0.00	14.40	15.80	21.80	22.10	26.90	28.20
GA_3	-	-	0.00	0.00	16.80	17.70	23.0	23.30	30.80	31.90
NAA	-	-	0.00	0.00	12.20	13.50	19.50	20.10	24.30	25.00
PP333	-	-	0.00	0.00	13.30	12.10	18.60	19.00	23.80	24.60
L.S.D at 5 %	-	-	0.00	0.00	0.330	0.339	0.483	0.494	0.617	0.193
					Total loss%					
Control	-	-	7.60	7.70	26.70	27.80	39.90	39.70	55.00	52.60
Zn	-	-	6.50	6.50	23.30	24.60	36.20	37.10	48.80	50.40
GA_3	-	-	7.80	7.90	27.20	28.00	40.80	40.50	55.50	54.90
NAA	-	-	6.20	6.30	20.50	22.30	35.30	35.00	47.00	46.60
PP333	-	-	6.00	6.10	21.10	19.60	32.20	32.80	45.60	45.10
L.S.D at 5 %	-	-	0.156	0.158	0.537	0.548	0.850	0.853	1.162	1.151

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الملخص العربى

تأثير بعض المعاملات الحقلية على المحصول والجودة والتخزين فى البرتقال الفالنشيا النامى في الأراضي الرملية تحت ظروف الرى بالتنقيط.

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أجرى هذا البحث خلال موسمى ٢٠٠٣ – ٢٠٠٤ بهدف دراسة تأثير بعض المعاملات الحقلية على أشجار برتقال الفالنشيا المطعوم على أصل نارنج و النامية بأرض رملية تحت نظام الرى بالتنقيط و كانت المعاملات هى:

١- الرش بماء الصنبور (مقارنة).
٢- الرش بسلفات الزنك (٠,٥ %).
٣- الرش بجبرلين GA_3 (٢٠ جزء فى المليون).
٤- الرش بنفثالين اسيتيك أسيد (امكتون)(٠,٦ جم/لتر).
٥- الرش بالباكلوبيوترازول PP333 (٥٠٠ جزء فى المليون).

وقد تم الرش مرتين (عند الإزهار الكامل و بعد ١٥ يوم من عقد الثمار).

و تم قطف الثمار بمجرد وصولها مرحلة القطف و تخزينها على درجة حرارة الغرفة (١٨-٢٠°م) و رطوبة نسبية ٨٥-٩٠% لمدة ٦٠ يوماً.

و قد تم قياس النسبة المئوية لعقد الثمار، ووزن المحصول / شجرة، ومتوسط وزن الثمرة كذلك المواصفات الطبيعية و الكيميائية للثمار عند جمع المحصول و أيضاً التغيرات الطبيعية و الكيميائية و النسبة المئوية للفقد الكلى للمحصول (% فقد الوزن+% الأعفان) و ذلك أثناء مدة التخزين.

وقد أظهرت النتائج ما يأتى:

أولاً: النسبة المئوية للعقد و المحصول ووزن الثمار

١- جميع المعاملات أدت الى زيادة معنوية فى نسبة العقد و المحصول و كانت أعلى نسبة عقد ترجع الى الرش بأى من NAA أو PP333. كما أن أعلى زيادة معنوية فى المحصول كانت نتيجة معاملة PP333.

٢- لم تحدث زيادة معنوية لوزن الثمار نتيجة إستخدام المعاملات المختلفة.

ثانياً: المواصفات الطبيعية و الكيميائية للثمار عند مرحلة الجمع

١- أدت جميع المعاملات الى زيادة معنوية فى وزن قشرة الثمار وسمكها بالمقارنة بثمار المقارنة (باستثناء GA_3 فى الموسم الأول) كما لم يتأثر سمك القشرة بمعاملة الزنك فى الموسم الثانى. و قد أظهرت معاملة PP333 أعلى زيادة معنوية فى وزن و سمك القشرة بالمقارنة بباقى المعاملات.

٢- أظهرت معاملات NAA, GA_3, Zn زيادة معنوية فى حجم العصير بالمقارنة بالكنترول و أعلى زيادة نتيجة لمعاملتى NAA, Zn.

٣- حدثت زيادة معنوية فى النسبة المئوية للسكريات الكلية نتيجة الرش ب NAA و Zn.

٤- ظهرت زيادة معنوية فى النسبة المئوية للمواد الصلبة الذائبة بالمقارنة بثمار control عند استخدام معاملتى, NAA, Zn فى الموسم الأول و باستخدام جميع المعاملات فى الموسم الثانى. و أعطت معاملة NAA اعلى زيادة معنوية بالمقارنة بباقى المعاملات.

٥- حدث إنخفاض معنوى فى النسبة المئوية لحموضة الثمارنتيجة الرش بـ NAA، Zn، PP333 بالمقارنة بثمار معاملتى GA_3، control و أعطت ثمار المعاملة بـ Zn أعلى انخفاض معنوى.

٦- زادت نسبة المواد الصلبة الذائبة/ الحامض فى الثمار معنوياً نتيجة معاملات NAA, Zn, PP333 بالمقارنة بثمار control و حدثت أعلى زيادة معنوية فى ثمار معاملتى NAA, Zn.

٧- زاد محتوى الثمار من V.C معنوياً نتيجة لاستخدام معاملات PP333, NAA, GA_3 بالمقارنة بثمار control و أعطت الأخيرة (PP333) أعلى زيادة معنوية.

ثالثاً: التغيرات الطبيعية والكيميائية للثمار أثناء فترة التخزين:

١- بتقدم فترة التخزين، حدث انخفاض فى وزن القشرة وسمكها و حجم العصير و محتوى الثمار من V.C و كذلك النسبة المئوية للحموضة بينما زادت المواد الصلبة الذائبة و النسبة المئوية للسكريات الكلية و نسبة المواد الصلبة الذائبة/ الحموضة و النسبة المئوية للفقد الوزن و النسبة المئوية للأعفان.

٢- عند نهاية فترة التخزين وجد أن أعلى قيمة معنوية لحجم العصير كان نتيجة لمعاملات NAA, Zn, GA_3. و بالنسبة للمواد الصلبة الذائبة و السكريات الكلية فقد كانت أفضل معاملة فى زيادة نسبتهم المئوية هى NAA. و ظهرت أقل نسبة مئوية للحموضة نتيجة معاملتين PP333, Zn. كما وجد أن معاملة PP333 اعطت أعلى قيم معنوية للـ V.C فى العصير و ذلك بالمقارنة بباقى المعاملات.

٣- وجدت أقل نسبة مئوية معنوية للفقد الكلى (%فقد الوزن + % أعفان) فى ثمار الأشجار المعاملة بـ PP333 (٤٥,٦، ٤٥,١٠% فى الموسم الأول و الثانى على الترتيب) بالمقارنة بباقى المعاملات (٤٧-٥٥,٥% فى الموسم الأول و ٤٦,٦- ٥٤,٩ فى الموسم الثانى) و ذلك عند نهاية فترة التخزين.

و بناء على ذلك توصى هذه الدراسة بإستخدام نفثالين أستيك أسيد (NAA) والباكلوبترازول (PP333) على أشجار البرتقال الصيفى المطعوم على أصل نارنج والمنزرع بالأراضى الرملية حيث أدت هذه المعاملات إلى زيادة فى العقد والمحصول والجودة وكذلك تقليل الفاقد والتالف من الثمار وبالتالى تحسين القدرة التسويقية للثمار.