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EFFECT OF PREHARVEST FOLIAR SPRAY WITH GIBBERELLIC ACID AND CALCIUM ON YIELD AND QUALITY OF ON -TREE STORED FRUITS OF NAVEL ORANGE.

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ABSTRACT

This experiment was carried out during two successive seasons (2002-2003 and 2003-2004) on Washington navel orange trees 30 year old grafted on sour orange grown in a private orchard in Elkaliobia Governorate to explore the possible effects of foliar application of gibberellic acid at 10, 15, 20ppm and calcium chloride at 1% and2% on the quality of on-tree-stored fruits of Washington navel orange. Treatments were applied at fruit color break as whole tree sprays .Fruits were harvested at four dates January, February, March, and April. Yield and fruit quality parameters were recorded.

Gibberellic acid at 20ppm significantly decreased the reduction in fruit weight, fruit drop and increased juice weight percentage, juice acidity, ascorbic acid. Nevertheless GA_3 at all the tested concentrations minimized the peel thickness in the last harvesting date and decreased juice T.S.S

Calcium chloride at 2%caused significant increases in fruit weight, juice weight percentage, juice acidity, ascorbic acid and insignificant increase in peel thickness while it significantly decreased number of fruit dropped and juice T.S.S

INTRODUCTION

Navel orange is considered as the most popular citrus variety for both local consumption and export thus there is an economical importance for prolonging the period of marketing which may be achieved by storing fruit on tree or tree storage (Mehana *et al.*, 1987) .On the other hand keeping Navel fruits on tree after maturation reduce its marketability due to the development of certain rind disorders. Moreover, long harvest season may result in reduction in the total yield by increasing fruit drop percentage (El-Otmani, 1991).

Gibberellic acid is commonly applied to citrus intended for the fresh –fruit market because such applications improve peel quality, delay rind coloration and delay the onset of senescence related to peel disorders thus extending the harvest season when applied as a preharvest spray `(El-Otmani, 1991 and Fidelibus, *et al.*, 2002).

Gibberellic acid is used by citrus growers not only to increase rind firmness externally, but also internally moreover it retains the fruit round shape and reduces fruit drop in Navel orange(Harty *et al.*, 2004) .

Calcium plays an important role in maintaining cell wall structure and delay cell wall breakdown and fruit softening (Poovaiah, 1988 and Ferguson, 1988) .On the other hand, this application depressed respiration in some fruits and salts prevent ethephon- induced-abscission in mandarins (Hsiung and Iwahori , 1984). Moreover, calcium reduced number of dropped fruits this may be attributed to the effect of calcium in inhibiting ethylene biosynthesis (Poovaiah and Leopoid 1973).

The objective of this investigation was to find out the best concentration of calcium chloride, gibberellic acid for prolonging the period of the on- tree storage of Navel orange and Investigating it's effect on the physical and chemical properties of the on- tree storage fruit .

MATERIALS AND METHODS

The present investigation was carried out during the two successive seasons (2002-2003) and (2003-2004)on Washington Navel orange fruits (Citrus sinensis (L)osbeck) .The trees were 30 years old grafted on sour orange grown in a private orchard in Kafr Shokr at El Kaliobia governorate .

Thirty six trees uniform in growth were selected in a complete randomized design of about similar vigor and yield. The trees were divided into 6 groups. Each group contained 6 random trees. The date at which fruit color break occurred was determined for each season. Each group received one of the following treatments: (no treatment) control, GA_3 at concentrations of 10, 15,20ppm and calcium chloride at concentrations of 1% , 2%.

Fruits were stored on tree till April .Fruit samples were harvested from each 6 replications by collecting 30 fruits from all sides of each tree to study the following parameters

Physical characters:

Fruit weight, yield /tree, axial and equatorial dimensions as well as percentage of juice contents

Chemical characters:

1- Total soluble solids percentage (TSS%) using hand refractometer(AOAC, 1985)
2- Titatratable acidity: as citric acid grams per 100ml juice
3- Ascorbic acid (vitamin C): By using 2,6-dichlorophenol indophenol dye and 3%oxalic acid substrate as milligrams per 100milliliter.

Statistical analysis:

The complete randomized block design was adopted for the experiment .The statistical analysis of the present data was carried out according to Snedecor and Chocran (1972).Averages were compared using the new L.S.D. values at 5% level. Percentages were transformed by the equation prior to the statistical analysis and thereafter percentages were presented with statistical letters.

RESULTS AND DISCUSSION

Physical properties

1- Fruit weight

Data presented in Table (1) pointed that fruit weight increased gradually up to February. then decreased significantly at the late harvesting dates. The lowest values recorded were those for fruit harvested at April 15th in both seasons of the study .

El-Otmani *et al.*, (1991) and Fidelibus *et al.*, (2002) obtained similar results and referred weight gain to natural increase in dimension and weight reduction to water loss.

Table (1): Effect of preharvest foliar spray with gibbberellic acid and calcium on fruit weight (gm) of on- tree storage navel orange

Dates.Treat.	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	259.8	261.4	264.4	252.3	259.5	267.0	270.8	269.2	261.4	267.1
A2 (Ca1)	263.1	265.0	267.0	259.6	263.7	266.3	267.3	270.3	268.7	268.2
A3 (Ca2)	262.3	262.8	264.9	266.6	264.2	267.7	271.4	270.5	276.2	271.4
A4 (GA1)	261.6	262.8	265.7	253.6	261.0	268.3	272.2	271.5	262.7	268.7
A5 (GA2)	261.9	259.8	265.6	255.4	260.7	269.1	273.4	272.6	266.6	270.4
A6 (GA3)	264.7	266.4	267.1	259.6	264.5	271.9	275.8	274.2	269.8	272.9
MEANS (T)	262.2	263.1	265.8	257.9		268.4	271.8	271.4	267.6	

New LSD (A) = 2.0 New LSD (B) = 1.6 New LSD(AXB) = 4.01
New LSD (A) = 1.6 New LSD (B) = 1.3 New LSD (AXB) =3.18

Concerning the specific effect of GA_3 application, data obtained for both seasons (Table 1) show in general that there is no significant effect due GA_3 application at 10 or 15ppm on fruit weight, as the recorded values followed the same trend as control during the first three harvesting dates. These results are in agreement with those of El-Otmani *et al.* 1991. Yet, GA_3 treatment at 20ppm concentration significantly decreased the sharp reduction in fruit weight during the late harvesting date in April 15th compared with control. This may be attributed to the fact that GA_3 applications reduce water loss (Fucik, 1982).

Regarding the specific effect of calcium sprays the obtained data in (Table 1) show that calcium concentration at 2% caused significant increases in fruit weight, as it reduced the decline in the fruit weight during the on-tree storage period when compared with control (Salem,1991). This may be due to the role of calcium in maintaining the cell wall structure in the fruits by interacting with the pectic acid in cell walls as mentioned by Poovaiah (1988).

2-Fruit dimensions

It is evident from (Tables 2 and 3) that the equatorial and axial dimensions of fruit increased gradually till March, then it decreased during April (Mehana *et al.* 1987)

Table (2): Effect of preharvest foliar spray with gibbberellic acid and calcium on fruit diameter(mm) of on- tree storage of navel orange

	First season					Second season				
Date Treat.	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	76.1	77.7	77.3	76.3	76.9	77.7	75.7	77.3	75.0	76.4
A2 (Ca1)	77.7	75.3	77.1	77.5	76.9	78.0	76.0	77.6	75.3	76.7
A3 (Ca2)	77.2	76.2	75.7	76.4	76.4	78.4	76.3	78.1	75.7	77.1
A4 (GA1)	76.6	76.9	75.0	76.0	76.1	79.0	77.1	78.6	76.3	77.7
A5 (GA2)	75.3	74.3	75.7	72.9	74.6	77.7	77.8	79.3	77.1	78.0
A6 (GA3)	77.0	77.3	78.3	74.9	76.9	77.9	76.3	77.6	75.2	76.7
MEANS (T)	76.7	76.3	76.5	75.7		78.1	76.5	78.1	75.8	

New LSD (A) = 0.7 New LSD (B) = 0.6 New LSD (AXB) = 3.8
New LSD (A) = 0.42 New LSD (B) = 0.3 New LSD (AXB) = 0.83

Table (3): Effect of preharvest foliar spray with gibbberellic acid and calcium on fruit heigth(mm) of on- tree storage navel orange

Date Treat.	First season					Second season				
	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	78.9	81.0	82.1	79.0	80.3	80.1	82.8	83.8	78.8	81.4
A2 (Ca1)	78.5	80.6	81.7	78.6	79.9	78.7	83.1	82.4	77.4	80.4
A3 (Ca2)	79.6	81.6	82.9	79.7	81.0	80.8	83.4	84.6	79.5	82.1
A4 (GA1)	80.2	82.4	80.7	80.3	80.9	81.4	84.2	83.3	78.0	81.7
A5 (GA2)	81.0	83.1	84.1	81.1	82.3	82.2	84.9	85.8	80.9	83.5
A6 (GA3)	78.8	80.9	82.0	79.9	80.4	79.3	82.9	83.0	78.0	80.8
MEANS (T)	79.5	81.6	82.3	79.8		80.4	83.5	83.8	78.8	

New LSD (A) = 0.3 New LSD (B) = 0.2 New LSD (AXB) = 0.55
New LSD (A) = 0.54 New LSD (B) = 0.44 New LSD (AXB) = 1.08

Concerning the effect of GA_3 or $CaCl_2$ both treatments at all implemented concentrations had no significant effect on the change of fruit dimensions during both seasons.

3-Rind thickness

Data illustrated in (Table 4) As a general trend ,significant reduction in peel thickness was recorded during the last two harvesting dates of March 15th and April 15th(Table 4) . This reduction may be attributed to entering of the fruit in the over ripening stage at that late harvesting date and thus peel senescence occured in which solublization of pectin took place (El-Otmani *et al.*, 1991) .

Concerning the specific effect of treatments, the obtained data disclosed that GA_3 relatively reduced decline of the peel thickness insignificantly when compared with control for the last harvesting date in April 15th for both seasons. Such results are in general agreement with El-Otmani *et al.*, (1991) and El Zeftawi, (1983) who pointed out that GA_3 delays rind senescence.

As for calcium spray effect , the data showed $Cacl_2$ treatment at 2% caused slight increases in the peel thickness when compared with control treatment .

Table (4): Effect of preharvest foliar spray with gibbbrillic acid and calcium on peel thikcness (mm)of on - tree storage of navel orange

Dates. Treat.	First season					Second season				
	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	45.4	47.8	45.7	43.1	45.5	46.7	48.8	42.7	43.9	45.5
A2 (Ca1)	46.0	47.1	46.0	46.0	46.3	47.0	48.7	48.0	44.0	46.9
A3 (Ca2)	46.5	48.8	46.9	44.7	46.7	47.4	49.4	47.0	46.0	47.5
A4 (GA1)	48.7	49.8	48.3	46.6	48.3	47.0	50.2	44.0	45.2	46.6
A5 (GA2)	47.0	46.0	44.7	46.0	45.9	48.8	50.9	44.7	46.0	47.6
A6 (GA3)	48.9	51.9	40.8	47.0	47.1	49.0	52.0	40.7	49.0	47.7
MEANS (T)	47.1	48.6	45.4	45.6		47.7	50.0	44.5	45.7	

New LSD (A) = 0.6 New LSD (B) =0.7 New LSD (AXB) = 1.15
New LSD (A) = 0.52 New LSD (B) = 0.4 New LSD (AXB) =1.04

4-Juice percentage

The obtained data in Table (5) showed that juice percentage decreased significantly at April, for both seasons. Such result was also recorded by Almeida *et al.*, (2004).

Concerning the specific effect of GA_3 treatment , statistical analysis disclosed that fruit of trees treated with GA3 at 20 ppm significantly contained higher juice weight content than those of the untreated ones . However these differences were not significant with treatments of GA3 at 10and15 ppm. Dealing with, calcium treatment showed in(Table 5) illustrated that $CaCl_2$ significantly increased the juice weight percentage at all harvesting dates when compared with control. The highest value was recorded with $CaCl_2$ at 2% when fruits were harvested at March 15th. While , the lowest values were recorded for control when it was harvested at April for both seasons .Similar trend was mentioned by El-Shafey,(2001) on Navel orange and Kotsias, (2004) on sweet orange.

Table (5): Effect of preharvest foliar spray with gibbberellic acid and calcium on Juice weight % of on tree storage of navel orange

Dates.Treat.	First season					Second season				
	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	43.5	40.4	44.6	37.8	41.6	43.4	45.3	46.4	40.3	43.8
A2 (Ca1)	42.7	43.3	44.7	46.3	44.2	47.0	49.0	48.0	45.0	47.3
A3 (Ca2)	42.7	44.1	45.6	46.0	44.6	48.0	50.0	50.0	47.0	48.8
A4 (GA1)	41.1	42.0	45.6	39.1	42.0	44.7	46.7	47.7	41.6	45.2
A5 (GA2)	42.5	43.3	43.3	39.9	42.3	45.5	47.4	48.4	42.4	45.9
A6 (GA3)	43.0	43.0	44.0	43.7	43.9	48.3	48.0	47.5	47.6	47.8
MEANS (T)	42.1	43.5	44.6	42.1		46.1	47.7	48.0	44.0	

New LSD (A) = 1.3 New LSD (B) = 1.1 New LSD (AXB) = 2.60
New LSD (A) = 1.69 New LSD (B) = 1.4 New LSD (AXB) = 3.39

5- Yield/tree

Concerning the effect of harvesting date, it can be mentioned that yield expressed as number of fruits per tree decreased gradually with time (Table 6). This is attributed to the fruit drop during the storage period .Moreover, the last harvesting date showed the greatest number of dropped fruit for both seasons of the study.

Table (6): Effect of preharvest foliar spray with gibbberellic acid and calcium on fruit Number/Tree of on- tree storage of navel orange

Dates. Treat.	Frist season					Second season				
	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	365.2	351.0	337.7	322.8	344.2	355.5	358.1	341.0	327.6	345.6
A2 (Ca1)	370.5	356.6	352.4	335.6	353.8	359.4	356.2	342.3	333.0	347.7
A3 (Ca2)	367.0	357.3	358.8	346.1	357.3	360.2	358.7	344.7	339.5	350.8
A4 (GA1)	366.5	355.6	347.1	232.0	325.3	356.8	359.5	342.3	328.9	346.9
A5 (GA2)	367.3	353.0	349.7	339.3	352.3	358.8	360,2	343.0	335.3	349.3
A6 (GA3)	370.8	358.0	352.3	335.6	354.2	360.4	363.1	343.4	337.6	351.1
MEANS (T)	367.9	355.3	349.7	318.6		358.5	359.3	342.8	333.7	

New LSD (A) = 1.5 New LSD (B) =1.6 New LSD (AXB) = 2.80
New LSD (A) = 1.21 New LSD (B) = 1.0 New LSD (AXB) = 2.42

Concerning the effect of GA_3 it could be noticed that its applications at 15or20 ppm significantly reduced the number of fruit drop when compared with control. A parallel trend was also achieved by calcium at 2% by reducing significantly the number of fruit dropped was markedly lower than that recorded for control treatment .

Chemical properties

1-Total acidity

Concerning specific effect of harvesting date on juice acidity, data in Table (7) show gradual insignificant reduction in fruit juice acidity up to the end of the storage period where such reduction was highly significant at the two last harvesting dates. This could be due to the increase in respiration rate of the fruit and /or as a result consumption of fruit organic acid (Abd-El-Haffz, 1999).

With regard to the specific effect of GA_3, data in Tables (7) show that treatment by GA_3 increased juice acidity. The increment was more pronounced with GA3 at 20 ppm. This result is in harmony with those mentioned by Abd-Elhaffez, (1999). He pointed out that GA_3 generally increases the juice acidity. On the other hand, El-Otmani *et al.* (1991) pointed out that GA_3 has no effect on internal fruit quality.

Regarding to the specific effect of calcium chloride, it is clear that calcium at 2%increased significantly juice acidity for all harvesting dates. This may be due to the role of calcium in depressing the respiration rate of fruit. This result is in accord with Poovaiah, (1988). He reported that calcium treatment depressed respiration rate. Also our results parallel those obtained by Tripathi and Bhorgrave 1993 on apple. It could be noticed that both GA_3 and $CaCl_2$, reduced significantly the decrease in fruit acidity for the untreated fruit during storage period.

The highest value for fruit juice acidity was recorded for GA_3 at 20ppm and calcium at 2% at the 3rd harvesting date while the lowest recorded value was for untreated fruit harvested at April15th.

Table (7): Effect of preharvest foliar spray with gibbberellic acid and calcium on acidity of on- tree storage of navel orange

	First season					Second season				
Treat. Dates.	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	0.79	0.81	0.82	0.76	0.80	0.81	0.80	0.73	0.75	0.78
A2 (Ca1)	0.80	0.82	0.83	0.77	0.81	0.79	0.81	0.82	0.76	0.79
A3 (Ca2)	0.85	0.87	0.88	0.84	0.86	0.83	0.85	0.86	0.83	0.84
A4 (GA1)	0.81	0.83	0.84	0.78	0.81	0.79	0.79	0.80	0.78	0.80
A5 (GA2)	0.81	0.83	0.84	0.79	0.82	0.80	0.82	0.83	0.79	0.81
A6 (GA3)	0.84	0.86	0.87	0.84	0.85	0.83	0.80	0.83	0.82	0.84
MEANS (T)	0.82	0.84	0.85	0.80		0.80	0.82	0.83	0.78	
New LSD (A) = 0.04			New LSD (B) = 0.04				New LSD (AXB) = 0.09			
New LSD (A) = 0.04			New LSD (B) = 0.03				New LSD (AXB) =			

2-T.S.S

Concerning the effect of harvesting date, the data shown in Table (8) indicate that, fruit juice T.S.S. increased with advancing harvest date and being highly significant for the last harvesting date as the highest T.S.S value was recorded at April 15th in both seasons of the study.

The above mentioned results are in harmony with those obtained by Echerverria and Valich, (1989), El-Otmani *et al.*,(1989) and Mehana, (1987). They pointed out that the increase in T.S.S of on-tree storage fruit is attributed to the conversion of organic acid to glycoltic intermediates and sugar or attributed to water loss from fruit.

Concerning the effect of GA_3 the data illustrated in Table (8) revealed that in general ,that fruits sprayed by GA_3 concentrations showed significant decrease in juice T.S.S when compared with control .

Moreover, the obtained data appeared that GA_3 at 15 or 20ppm shows significant reduction in juice T.S.S when compared with GA_3 at 10ppm, for both seasons. This result is in line with those reported by Harty, (2004) and Abd- El-Hafeez, (1991). On other the hand, Fidelibus, *et al.*, (2002) reported that applying GA_3 decrease T.S.S of Hamlin and Valencia oranges.

Concerning the specific effect of $CaCl_2$ data in Table (8) showed that calcium treatments decreased significantly juice T.S.S of on tree storage fruit, for both seasons. However, such difference did not attain the level of significant when $CaCl_2$ was used at 1%

Table (8): Effect of preharvest follar spray with gibbberellic acid and calcium on TSS of on -tree storage of navel orange

	Firstseason					Second season				
Dates. Treat.	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	11.8	11.8	12.5	12.8	12.2	11.7	11.8	12.6	12.8	12.2
A2 (Ca1)	11.3	11.2	12.3	12.6	11.9	11.2	11.7	11.9	12.5	11.8
A3 (Ca2)	10.4	10.4	10.8	11.2	10.7	10.8	10.9	11.1	11.2	11.0
A4 (GA1)	11.0	11.1	11.5	12.3	11.5	10.9	11.1	11.8	12.3	11.5
A5 (GA2)	10.7	10.7	11.4	12.1	11.2	10.6	10.7	11.5	11.9	11.2
A6 (GA3)	10.5	10.4	11.0	11.5	10.8	10.2	10.4	11.1	11.3	10.7
MEANS (T)	10.9	10.9	11.6	12.1		10.9	11.1	11.7	12.0	
New LSD (A) = 0.2			New LSD (B) = 0.1					New LSD (AXB) = 0.33		
New LSD (A) = 0.21			New LSD (B) = 0.2					New LSD (AXB) = 3.14		

3-Ascorbic acid

As regard to the effect of harvesting date, it could be noticed that ascorbic acid values decrease gradually as the harvest season advance after Feb. and the lowest recorded values were obtained when fruits were harvested at April 15th.

All GA_3 concentrationstended to produce insignificant increase in fruit ascorbic acid content except for GA_3 at 20ppm where ascorbic acid content wassignificantly higher than the control .

The above mentioned results are in accordance with those reported by Zhang, (1987) and Abd El-Hafeez, (1991). They pointed out GA_3 sprays increase fruit vitamin C .

As for the effect of calcium results in hand show that treatment with $CaCl_2$ for both concentrations have cause a significant increase in juice ascorbic acid during storage period. This could be attributed to effect of calcium in depressing the rate of respiration of fruit which affects ascorbic acid degradation (Burdurlu *et al.*, 2006).

Overall, it could be concluded that both GA_3 and Calcium sprays have reflected a positive unique impact on navel orange on-tree storage as expressed by reducing decline in fruit weight, peel thickness and minimizing fruit drop, whereas, they tended to increase fruit juice content, juice acidity and vitamin content, while TSS was reduced.

Table (9): Effect of preharvest foliar spray with gibbberellic acid and calcium on ascorbic acid of on- tree storage of navel orange

	First season					Second season				
Dates. Treat.	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)	B1 (Jan)	B2 (Feb)	B3 (March)	B4 (April)	MEANS (D)
A1 (Control)	44.8	46.9	43.0	42.0	44.2	47.0	47.3	43.0	42.4	45.0
A2 (Ca1)	50.1	51.2	48.2	47.0	49.1	47.0	49.7	48.7	49.3	48.7
A3 (Ca2)	50.0	49.7	49.0	48.0	49.2	47.2	48.1	48.7	47.7	47.9
A4 (GA1)	48.4	47.9	44.3	43.3	46.0	48.3	48.7	44.3	43.7	46.3
A5 (GA2)	45.6	49.0	45.0	44.1	45.9	49.1	49.4	45.0	44.5	47.0
A6 (GA3)	49.7	51.9	47.8	49.3	49.7	51.9	50.6	47.8	46.7	49.3
MEANS (T)	48.1	49.4	46.2	45.6		48.4	49.0	46.3	45.7	

New LSD (A) = 3.2 New LSD (B) = 1.3 New LSD (AXB) = 3.19
New LSD (A) = 1.57 New LSD (B) = 1.3 New LSD(AXB) =

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تأثير الرش ما قبل الحصاد بالجبر يلين والكالسيوم علي المحصول و جودة ثمار البرتقال أبو سره المخزنة على الأشجار

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**** معهد بحوث البساتين ، المركز القومي للبحوث الزراعية الجيزة**

نُفذتْ هذه التجربةِ خلال موسمي (٢٠٠٢-٢٠٠٣) و(٢٠٠٣-٢٠٠٤) على أشجار برتقال أبو سره واشنجطن بعمر ٣٠ سنة مُطعُومة على أصل نارنج في احد الحدائق الخاصّةِ في محافظةِ القليوبية وذلك لدراسة التأثيراتِ المحتملةِ للرش بالجبر يلين بتركيزات١٠،١٥ و٢٠ جزء في المليون وكلوريد الكالسيوم بتركيز ١ % و٢ % على جودة ثمار البرتقال أبو سره المخزنة على الأشجار ،وقد تم إجراء المعاملات عند مرحلة كسر اللون ' وقد تم جمع الثمار في أربع مواعيد مختلفة يناير – فبراير – مارس- ابريل وقد تم تسجيل قياسات الجودة والمحصول للثمار وقد أظهرت النتائج أن االجبرالين بتركيز ٢٠ جزء في المليون أدى إلى تقليل الانخفاض في وزن الثمار وتساقط الثمارو زيادة النسبة المئوية لوزن العصير وحموضة العصير وحامض الاسكوربيك بصورة معنوية كما ساعد الرش الجبرالين مع جميع التركيزات على تقليل الانخفاض في سمك القشرة في أخر ميعاد حصاد وأدى الرش بكلوريد الكالسيوم بتركيز ٢ % إلي حدوث زيادة معنوية في وزن الثمار وزيادة النسبة المئوية لوزن العصير و حامض الاسكوربيك وزيادة غير معنوية في سمك القشرة بينما أدي إلي انخفاض معنوي في عدد الثمار الساقطة والمواد الصلبة الذائبة الكلية.