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Effect of some Pre- and Postharvest Treatments on the Ability of "Balady" Orange Fruits to Storage

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Abstract:

The experiment was conducted during two successive seasons (2015 and 2016) on Balady orange trees (*Citrus sinensis*) which divided in two groups. The first group was sprayed with potassium sulphate (48%) in the orchard at three times sequential (March, June and August) and the second group was sprayed with water (control). Orange fruits of both treatments were collected in maturity stage and dipped in salicylic acid (SA) at 4mM/l in laboratory. The purpose of this investigation is studying the effect of SA and K on orange fruits quality during storage at room temperature (13+2 C°). Some physical and chemical properties of fruits were estimated every 10 days till 50 days (the end of storage) such as weight loss %, juice content%, acidity%, total soluble solids% (TSS), TSS/ acid ratio and ascorbic acid during both seasons. The results illustrated that, SA had a positive effect on fruit quality of the fruits treated with SA single or combined with potassium sulphate.

Keywords: *Balady orange(Citrus sinensis) -salicylic acid - potassium sulphate.*

Introduction:

Citrus are considered an important fruits in many parts of the world because it has a high nutritional values of vitamins, essential oils, minerals, sugarsand salts. In general, citrus fruits especially sweet orange (*Citrus sinensis* L.) are an important fruit crop of Egypt. It is grown on an area of 23057 feddans and produced about146469 tones (FAO, 2014). Orange is considered as a main source of antioxidants like vitamin C, phenolic compounds and carotenoids, so it has an important functions in resistance against many human illnesses (Del Caro *et al.*, 2004); (Dhuique-Mayer *et al*., 2005) and (Wu *et al*., 2007).

Edible coatings are used on vegetables and fruits to improve appearance, modifying atmosphere around fruit's surface to reduce fruit respiration rate of fruit and improve the environmental conditions like humidity and temperature (*Baldwin et al., 1995*). These conditions providing a semi permeable barrier for enhancing carbon dioxide rates and reducing oxygen rates and therefor reducing respiration retard the ripening, reducing decay and water loss, decrement the oxidation reaction rates and metabolic activities, especially transpiration and respiration. So, coating fruits becomes more resistance to pathogens and promoting their marketing and storage (Petracek *et al*., 1998), (Park, 1999) and (Chitarra and Chitarra, 2005).

The low temperature is one of the most efficient methods to improve the storage life and prolong the shelf life of fresh food product (Shein *et al*., 2008). It is the main way to extend the storage life, however, there

are other means to improve the storage life.

Salicylic acid (SA) or Ortho-hydroxy benzoic acid was found at different concentrations in horticultural crops. It is a simple phenolic compound with a phytohormone–like function as plant growth and development because of its effects on plant physiological processes and it enhances plant vigour under biotic and abiotic stresses (Scotter *et al*., 2007), (Hayat *et al*., 2010). There are many important functions of SA such as delaying ripen and senescence of fruits by stimulating the accumulation of biologically active compounds and antioxidant enzymes such as catalase (CAT), peroxidase (POD) and superoxide dismutase (SOD) leading to a reduce in free radical levels and lipid peroxidation (Huang *et al*., 2008), reducing fruit softening rate, inhibiting ethylene biosynthesis and action by preventing the conversion of ACC into ethylene and suppressing ACC oxides' activity thereby, it causes the delay of fruit ripening (Zhang *et al*., 2003). It also increases the resistance of chilling injury, accumulation of phenolic compounds and prolonging storage life of fruits (Srivastava and Dwivedi, 2000), (Zhang *et al*., 2003), (Chen *et al*., 2006).

Potassium is also important in formation and functioning of proteins, fats, carbohydrates and chlorophyll and in maintaining the balance of salts and water in plant cells, (Achilea, 1998). Heavy citrus orchards should receive considerable amount of K, nearly at the same level as nitrogen, in order to preserve high yields of fruits with the required qualities. The relatively high acid level caused by application of K can be qualified, in most cases, by briefly delaying the harvest. The physiological functions of potassium and its conspicuous role in plant water relations has long been known and serve to emphasize that there should be adequate K contents in all plant parts (Hsiao and Lauchli, 1986).

The aim of this research is achieving the following specific objectives;

1. Prolonging the storage period of orange fruits with retention the highest quality of marketing and consumables with the lowest cost.

2. Studying the effect of salicylic acid and potassium on physical and chemical properties and the quality of fruits during storage.

Materials and Methods:

This investigation was conducted on Balady orange (Citrus sinensis) during two successive seasons 2015 and 2016 at the orchard and laboratory of Pomology department, Faculty of Agriculture, Assiut University. Twenty trees were healthy, uniform in vigor as possible were chosen for achieving this study. All trees received the standard agricultural practices that are used in the orchard including soil fertilization, irrigation and pest control. The selected 20 trees were divided into two groups, the first group was sprayed with potassium sulphate (48%) at three times individually and sequentially (March, June and August) and the second group was sprayed with water (control). Orange fruits of both groups were collected at maturity stage (index –MI, calculated as SSC/TA ratio, was 8.3). The fruits were selected for uniformity of shape,

size, color and free of physical damage and infections. The fruits were washed by distilled water and then dipped in a 500 ppm binomial solution after that left in air for about 20 mins until dry and then fruits were immersed in SA (4 mM/l) for 3 mins. The fruits were randomly divided into four treatments with 3 replicates (each replicate had 6 fruits) as follow:-

- Control (untreated) ($\mathbf{T_1}$)
- Potassium Sulphate (48%) ($\mathbf{T_2}$)
- Salicylic acid(SA) 4mM/l ($\mathbf{T_3}$)
- Potassium Sulphate (48%) and SA ($\mathbf{T_4}$)

Ten fruits of each treatment were numbered and used for weight loss determination.

*(SA was prepared, by dissolving SA powder in hot distilled water or ethanol alcohol then completed to liter of distilled water).

The fruits were placed in layersin a carton boxes and stored in room temperature at 13±2 C°. Fruits were evaluated through the following determinations every 10 days until 50 days (the end of storage).

1-Weight loss (%):

$$\frac{\text{Weight of fresh fruit (g)} - \text{Weight after interval (g)}}{\text{Weight of fresh fruits (g)}} \times 100$$

*Interval = 10 days

2-Fruit juice content %:

$$\frac{\text{Weight of extracted juice}}{\text{Fruit weight}} \times 100$$

3-Total soluble solid (T.S.S): A hand refractometer was used to determine the soluble solids content in fruit juice according to (AOAC 1990).

4-Total acidity%: Total acidity was measured by titrating 5 ml juice on 0.1 N NaOH solution and was then determined as the percent age of citric acid (Equation 2).

Citric acid (%) =

$$\frac{\text{Standard solution (N) x base solution (ml) x 0.06404}}{\text{Total juice volume (ml)}} \times 100$$

*The equivalent weight of citric acid =0.06404
*juice volume =5ml

5-TSS/Acid ratio:= $\frac{\text{TSS}}{\text{Total Acid contents}}$

6-Percentage of reducing sugars in the juice according to Lane and Eynon procedure which was outlined in AOAC., (1985).

7-Ascorbic acid content (mg/100ml) Ascorbic acid was determined by using 2.6 dichloro phenol indophenol dye method AOAC, (1990), ten $_g$ of the fresh sample was blended with 3% metaphosphoric acetic acid extracting solution to homogenous slurry, then 5ml of the filtrate extract were then titrated with standard indophenols until reached to pink end point.

Statistical analysis

This experiment was set up as split plot design. The storage treatments were in the whole plots (T), while the storage period were in-sub.plots (p). All data were tabulated and statistically analyzed according to (Snedecor and Cochran, 1989) using L.S.D at 0.05 levels for comparison between various treatment means.

Results

A- Physical properties:

1- **Weight loss %:**

The obtained results in Table 1 proved that the weight loss % significantly increased with the prolonging of storage period in the two successive seasons. Data illustrated that there were significant differences between control with treatments and within treatments too during storage. At the end of storage the highest value of weight loss% was found in control fruit (29.33 and 28.33%) while the lowest value was recorded by SA treatment (22.20 and 23.53%) in the two seasons, respectively. Data

proved that the best treatment which included with SA, gave the best effect to prevent the fruits from loss their weight.

Our results are in agreement with (Goepfert *et al.,* 1987), (Gill *et al.,* 2005), (Hafez and Haggag, 2007), (Ali *et al,* 2010), (Sakhale and Kapse, 2012).

2- Juice content %:

Data presented in Table 2 reveded that there was a gradual and significant reduction of juice content % in Balady orange fruit with progress the storage period during both investigated seasons. At the end of storage period the lowest value of juice content % were found in the untreated fruits (33.17 and 40.10%) during 2015 and 2016 seasons, respectively.

In addition the highest juice percentage at the end of storge time were recorded in orange fruits treated with SA+K (43.43 and 45.20 %) followed by SA alone (43.30 and 42.63 %) during both tested seasons, respectively.

These results are in agreement with those obtained by (Hafez and Haggag, 2007) (Ali *et al,* 2010) and (Sakhale and Kapse, 2012). The effect of potassium on increasing juice volume of citrus fruits was reported by (Lavon *et al.,* 1995) in Star- Ruby grapefruit; and (Maksoud *et al.,* 2003) in Balady mandarin trees; (Miller *et al.,* 1998) reported that spraying of potassium fertilizers gave no significant effect on Midknight Valencia and Robyn Navel fruit quality including juice content.

Table 1. Effect of potassium sulphate (48%) and salicylic acid (4 mM/l) on weight loss % during storage periodat room temperature(13±2 C°) on "Balady" orange fruits during 2015 and 2016 seasons

Season 2015						Season 2016					
Period	Treatments				Mean	Period	Treatments				Mean
	Control	K	SA	SA+K			Control	K	SA	SA+K	
0 date	0.00	0.00	0.00	0.00	0.00	0 date	0.00	0.00	0.00	0.00	0.00
10 days	11.53	13.10	8.90	9.47	10.75	10 days	9.33	9.68	7.80	8.00	8.70
20 days	15.93	17.17	13.33	13.43	14.97	20 days	16.00	16.63	14.23	14.43	15.33
30 days	20.83	20.93	17.60	17.30	19.17	30 days	20.20	20.40	17.80	18.03	19.11
40 days	23.70	23.57	19.67	20.33	21.82	40 days	23.07	22.93	20.73	21.20	21.98
50 days	29.33	28.50	22.20	22.93	25.74	50 days	28.33	27.83	23.53	24.10	25.95
Mean	16.89	17.21	13.62	13.91		Mean	16.16	16.25	14.02	14.29	
L.S.D 0.05 A(Treatments)=				0.49		L.S.D 0.05 A(Treatments)=				0.39	
L.S.D 0.05 B(Period)=				0.59		L.S.D 0.05 B(Period)=				0.48	
L.S.D 0.05 AB=				1.19		L.S.D 0.05 AB=				0.96	

Table 2. Effect of potassium sulphate (48%) and salicylic acid (4 mM/l) on juice content % during storage period at room temperature (13±2 C°) on "Balady" orange fruits during 2015 and 2016 seasons

Season 2015						Season 2016					
Period	Treatments				Mean	Period	Treatments				Mean
	Control	K	SA	SA+K			Control	K	SA	SA+K	
0 date	51.80	54.43	51.80	54.43	53.12	0 date	54.50	55.47	54.50	55.47	54.98
10 days	47.80	50.37	50.27	51.27	49.93	10 days	50.80	52.17	52.90	53.60	52.37
20 days	43.50	46.27	48.00	49.03	46.70	20 days	47.43	47.67	49.53	51.33	48.99
30 days	39.77	42.13	46.30	46.50	43.68	30 days	43.77	43.47	47.20	49.27	45.93
40 days	35.87	38.27	45.03	45.30	41.12	40 days	42.07	42.03	44.97	47.00	44.02
50 days	33.17	35.00	43.30	43.43	38.73	50 days	40.10	40.53	42.63	45.20	42.12
Mean	41.98	44.41	47.45	48.33		Mean	46.44	46.89	48.62	50.31	
L.S.D 0.05 A(Treatments)=				0.51		L.S.D 0.05 A(Treatments)=				0.45	
L.S.D 0.05 B(Period)=				0.63		L.S.D 0.05 B(Period)=				0.56	
L.S.D 0.05 AB=				1.25		L.S.D 0.05 AB=				1.11	

B- Chemical properties:

1-Total soluble solids content (T.S.S%):

Total soluble solids content in the stored Balady orange fruits as affected by K and SA treatments are shown in in Table 3. Generally, the obtained results took approximalaty the same tendency during both experimental seasons. T.S.S content significantly increased with extending the storage period and reaches its maximum values at the end of storage. Moreover the highest T.S.S percentage (15.10 and 15.00 %) were recorded in the untreated fruits (control), while the lowest values were measured in the treated fruits with SA (13.67 and 13.83%) during both 2015 and 2016 seasons ,respectively. This could be due to the higher water loss percentage of control fruits as compared with other treatments.

In addition significant differences were found between control and SA or SA+K during 2015 season, while all treatments gave a significant high content of T.S.S as compared with control fruits during 2016 season

These results are in line with (Baldwin *et al.,* 1995), (Sabir *et al.,* 2004), (Montanaro *et al.,* 2006), (El-Anany *et al.,*2009) and (Ali *et al.,* 2010).

Increasing T.S.S of citrus fruits according to potassium foliar spraying was proved by *(*Gill *et al.,* 2005) in India working on Kinnow mandarin. Studies, illustrated that potassium foliar spraying did not effecton T.S.S. of citrus fruits (Miller *et al.,* 1998).

Table 3. Effect of potassium sulphate (48%) and salicylic acid (4 mM/l) on TSS % during storage periodat room temperature(13±2 C°) on "Balady" orange fruits during 2015 and 2016 seasons

Season 2015						Season 2016					
Period	Treatments				Mean	Period	Treatments				Mean
	Control	K	SA	SA+K			Control	K	SA	SA+K	
0 date	11.00	12.00	11.00	12.00	11.50	0 date	11.67	13.00	11.67	13.00	12.33
10 days	12.50	12.50	11.33	12.17	12.13	10 days	13.33	13.67	12.00	13.17	13.04
20 days	12.83	12.83	12.17	12.83	12.67	20 days	13.83	14.00	12.33	13.50	13.42
30 days	13.67	13.83	12.33	13.17	13.25	30 days	14.33	14.67	13.00	13.83	13.96
40 days	14.33	14.67	12.83	13.33	13.79	40 days	14.60	15.00	13.50	14.33	14.36
50 days	15.10	15.00	13.67	14.17	14.48	50 days	15.00	15.37	13.83	14.50	14.68
Mean	13.24	13.47	12.22	12.94		Mean	13.79	14.28	12.72	13.72	
L.S.D 0.05 A(Treatments)=				0.15		L.S.D 0.05 A(Treatments)=				0.19	
L.S.D 0.05 B(Period)=				0.19		L.S.D 0.05 B(Period)=				0.23	
L.S.D 0.05 AB=				0.38		L.S.D 0.05 AB=				0.46	

2- Acidity %:

It is known that the acidity percentage is gradually decreased with prolonging of storage period. Data in Table 4 showed the effect of potassium (K) and salicylic acid (SA) on acidity % in the fruit of Balady orange. The obtained results indicated that same trend during both seasons was found, which the content of acidity gradually decreased with storage period progress and reached its minimum values at the end of storage.

Moreover, all treatments significantly increased the acidity content comparing with control, so the untreated fruits had the lowest values of acidity (0.967 and 0.950 %) at the end of storage period during both 2015 and 2016 seasons, respectively.

On the other hand, the treated fruit with (SA+K) contained the highest acidity percentage (1.080 %) in the first season while the fruits treated with SA had the highest acidity content in the second one (1.203%).

These results are in the same line with those obtained by (Willis *et al*., 1998) and (Yaman and Bayoindirli, 2002). Increasing acidity of citrus fruits, by foliar spraying with potassium, was reported by (Gill *et al.,* 2005) and *(Rattanpal et al., 2008*) onKinnow mandarin, While, (Cicala and Catara, 1994) in Italy working on Tarocco orange and (Miller *et al.,*1998) in South Africa using Midknight Valeucia and Robyn navel orange, demonstrated that potassium foliar application did not affect on fruit acidity.

3- TSS/Acid Ratio:

It is known that the TSS/acid ratio is indicator for reaching the fruits to ripening stage. In general, with the prolonging of storage period the percentage of TSS% is increased and the acidity % is decreased therefore the TSS/ acid ratio is increased. Data in Table 5 illustrated that, at the end of storage in the both seasons the highest reduction of TSS/acid ratio was noted inT_3 (12.66 and 11.43), respectively and the highest value was obtained by control (15.60 and 15.79), in the both seasons respectively and there were significant differences between all treatments and control in the two successive seasons.

Table 4. Effect of potassium sulphate (48%) and salicylic acid (4 mM) on Acidity % during storage period at room temperature (13±2 C°)on "Balady" orange fruits during 2015 and 2016 seasons

Season 2015						Season 2016					
Period	Treatments				Mean	Period	Treatments				Mean
	Control	K	SA	SA+K			Control	K	SA	SA+K	
0 date	1.313	1.310	1.350	1.353	1.332	0 date	1.363	1.443	1.467	1.497	1.443
10 days	1.207	1.210	1.303	1.310	1.258	10 days	1.267	1.387	1.417	1.433	1.376
20 days	1.127	1.130	1.237	1.240	1.183	20 days	1.213	1.310	1.370	1.357	1.313
30 days	1.097	1.110	1.187	1.207	1.150	30 days	1.117	1.220	1.327	1.287	1.238
40 days	1.003	1.050	1.127	1.183	1.091	40 days	1.010	1.173	1.260	1.227	1.168
50 days	0.967	0.990	1.077	1.080	1.028	50 days	0.950	1.087	1.203	1.153	1.098
Mean	1.119	1.133	1.213	1.229		Mean	1.153	1.270	1.341	1.326	
L.S.D 0.05 A(Treatments)=				0.012		L.S.D 0.05 A(Treatments)=				0.019	
L.S.D 0.05 B(Period)=				0.015		L.S.D 0.05 B(Period)=				0.023	
L.S.D 0.05 AB=				0.030		L.S.D 0.05 AB=				0.047	

Table 5. Effect of potassium sulphate (48%) and salicylic acid (4 mM) on TSS/Acidity % during storage period at room temperature (13±2 C°) on "Balady" orange fruits during 2015 and 2016 seasons

Season 2015						Season 2016					
Period	Treatments				Mean	Period	Treatments				Mean
	Control	K	SA	SA+K			Control	K	SA	SA+K	
0 date	8.33	9.13	8.11	8.80	8.59	0 date	8.50	8.93	7.93	8.67	8.51
10 days	10.33	10.30	8.63	9.23	9.63	10 days	10.47	9.83	8.43	9.17	9.48
20 days	11.40	11.33	9.80	10.33	10.72	20 days	11.33	10.63	8.93	9.93	10.21
30 days	12.40	12.45	10.36	10.87	11.52	30 days	12.82	12.00	9.73	10.73	11.32
40 days	14.27	13.93	11.37	11.25	12.71	40 days	14.46	12.78	10.70	11.93	12.47
50 days	15.60	15.15	12.66	13.13	14.13	50 days	15.79	14.15	11.43	12.58	13.49
Mean	12.06	12.05	10.15	10.60		Mean	12.23	11.39	9.53	10.50	
L.S.D 0.05 A(Treatments)=				0.17		L.S.D 0.05 A(Treatments)=				0.22	
L.S.D 0.05 B(Period)=				0.21		L.S.D 0.05 B(Period)=				0.27	
L.S.D 0.05 AB=				0.41		L.S.D 0.05 AB=				0.55	

4- Ascorbic acid:

The obtained results indicated thatduring storage periodthe ascorbic acid content of fruits gradually decreased with prolonging the storage period.

Data in Table 6 revealed thatthere were significant differences between the treatments and control in both successive seasons (2015 and 2016). At the end of storage period, the lowest value of ascorbic acid % was found in control fruits (27.60 and 26.50) during both seasons, respectively.

Ascorbic acid reached to a highervalue in all treated fruits compared with control in the two seasons. The highest value of ascorbic acid was found inT_3treatment (44.80 and 40.87%) in two seasons, respectively.

These results are in the same line withthe findings of (Ali *et al*, 2009) and (Ali, Eskandari *et al*, 2013)

(Ali and Gobran, 2002), (Gill *et al.,* 2005), (Rattanpal *et al.,* 2008) notified that foliar application of potassium increased vitamin C content of citrus fruits.

Table 6. Effect of potassium sulphate (48%) and salicylic acid (4 mM/l) on V.C (mg/100mL) during storage period at room temperature (13±2 C°) on "Balady" orange fruits during 2015 and 2016 seasons

Season 2015						Season 2016					
Period	Treatments				Mean	Period	Treatments				Mean
	Control	K	SA	SA+K			Control	K	SA	SA+K	
0 date	52.70	53.40	52.70	53.70	53.13	0 date	52.60	53.93	52.60	53.93	53.27
10 days	44.63	47.67	50.80	51.43	48.63	10 days	44.70	50.07	50.33	51.60	49.18
20 days	42.27	45.50	48.73	49.93	46.61	20 days	41.97	45.83	47.50	49.10	46.10
30 days	39.37	43.37	45.80	48.10	44.16	30 days	38.67	42.67	46.50	45.77	43.40
40 days	37.50	40.03	43.73	46.13	41.85	40 days	34.97	39.00	43.33	42.37	39.92
50 days	27.60	35.90	42.50	44.80	37.70	50 days	26.50	32.20	40.77	40.87	35.08
Mean	40.68	44.31	47.38	49.02		Mean	39.90	43.95	46.84	47.27	
L.S.D 0.05 A(Treatments)=				0.43		L.S.D 0.05 A(Treatments)=				0.38	
L.S.D 0.05 B(Period)=				0.53		L.S.D 0.05 B(Period)=				0.46	
L.S.D 0.05 AB=				1.06		L.S.D 0.05 AB=				0.93	

Discussion:

There is a correlation between weight loss% and juice content%. Increment of weight loss is indicator for decreasing of juice content% in the fruits during storage period. Water loss begins firstly from the peel then from the pulp of fruit. The time which takes for water loss or evaporation from fruit depends on the thickness of the fruit skin, the temperature and the length of storage period. The basic mechanism of weight loss from fresh vegetables and fruit is by respiration addition to that, vapor pressure at different locations also causes a weight reduction (Yaman and Bayoindirli, 2002).

The major problem for the fruits during storage period is the loss of water thus, the fruit could lose its quality (Ben-Yehoshua and Rodeo, 2003). Salicylic acid prolongs the storage period of orange fruits by decreasing both of the rate respiration and transpiration, ethylene biosynthesis, water loss and decay infection (Zheng and Zhang, 2004), (Ehsan *et al.,* 2011). Salicylic acid is considered a plant hormone that prevents ethylene biosynthesis, delays the senescence by inhibiting the conversion of ACC to ethylene and suppressing ACC oxides' activity, thereby, it causes the retard of fruit ripening. In addition, is contributory in local and systemic resistance to pathogens (Leslie and Romani, 1988), (Yan *et al.,* 1998); (Han *et al.,* 2003) and (Ozeker, 2005).

Total soluble solids (represents the main amount of soluble sugars), are the most important parameters that determine the quality of fruits and their ability to storage (Shwartz *et al,* 2009). Increasing of total soluble solids in treated fruits with SA due to reduce of ethylene production and that might be resulted in reducing enzyme activity and sucrose-phosphate syntheses leading to reduce in sucrose synthesis. Furthermore, cell walls contain great values of polysaccharides, mainly pectin and cellulose, and are digested because of the activity of the cell wall degrading enzymes leading to a significant increase in TSS content (Baldwin *et al.,*

1995) (Sabir *et al.,* 2004) (Montanaro *et al.,* 2006), (El-Anany *et al.,* 2009) and (Ali *et al,* 2010).

Generally, citrus fruits have abundant amounts of organic acids. The major organic acids in the juice are tartaric, oxalic, lactic, malic, citric and ascorbic. Of these six acids, citric acid considered the major acid of the total acid constituents of the juice followed by malic acid. The decreasing of acid contents during fruits storage was referred to the use of acids in the fruit as a source of respiration and energy therefor, the conversion of organic acids to form of sugar (Karadeniz, 2004).

The increment of TSS and the loss of the TA determine the ripening stage of the fruits as well as to estimate the fruit taste which is demonstrated mainly by the balance between sweetness and acidity. The mainly function of SA is delaying the fruit ripening during storage by decreasing of ethylene production (Kazemi *et al.,* 2011) and also improving the fruit quality (Asghari and Aghdam, 2010). Furthermore, SA gives small effect on TSS for some non-climacteric fruits during cold storage (Sayyari *et al.,* 2009).

The values which resulted are due to the use of citric acid in the process of respiration of fruits. Then with the time passing the degradation of citric acid lead to increase TSS as structural formula of citric acid is similar to glucose therefore decrease in citric acid is correlated with increase in TSS/acid ratio so sugar contents had become higher than acids. (Manzano and Diaz, 2001).

The conserving of ascorbic acid% in fruits which were treated with SA due to the reducing of respiration process and water loss thus decreasing of oxidation of ascorbic acid content compared with the reducing rate of ascorbic acid in control where increase respiration process and there for increasing of oxidation of ascorbic acid. The results of this study were in line with (Ali *et al,* 2009) *and (*Ali, Eskandari *et al,* 2013).

The DPPH scavenging activity, flavonoids, total phenols, ascorbic acid and anthocyanins contents of the fruits were significantly increment by SA treatment may be due to the stimulationenzyme activity of Phenylalanine ammonia-lyase (PAL) and therefor triggering the phenylpropanoid–flavonoids pathways then, these explained that SA as a safe signaling molecule could promote nutritional quality and enhanced health promoting and properties of fruits (Tareen *et al.,* 2012), (Dokhanieh *et al.,* 2013).

(Gill *et al.,* 2005) in India illustrated that foliar potassium applications significantly increased peel thickness of know mandarin fruits. In addition, using Valencia orange demonstrated that potassium increased peel thickness (Goepfert *et al.,* 1987).

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تأثير معاملات ما قبل وبعد الحصاد على قابلية ثمار البرتقال البلدي للتخزين

طلعت كامل المهدى ، احمد مخلص السيسى، مها محمد عبد السلام ، فاطمه عبد الحكيم اسماعيل

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الملخص

اجريت هذه التجربة على أشجار وثمار البرتقال البلدي بمزرعة الفاكهة– كلية الزراعة– جامعة أسيوط خلال موسمي ٢٠١٥–٢٠١٦ بغرض دراسة تأثير رش أشجار البرتقال البلدي بسماد سلفات البوتاسيوم ٤٨% قبل الجمع ثم معاملته بحمض السالسيلك (٤مليمول) بعد الجمع وذلك على بعض الصفات الطبيعية والكيماوية للثمار اثناء التخزين فى جو الغرفة (١٣± ٢) درجة مئوية.

وتم تقسيم المعاملات كالاتى :

١ – كنترول (بدون معامله).

٢ – الرش بسلفات البوتاسيوم (٤٨%) قبل الجمع (ثلاث دفعات في مارس ويونيو وأغسطس).

٣ – الغمس في حمض سالسيلك (٤مليمول/ لتر) فى المعمل بعد الجمع.

٤ – الرش بسلفات البوتاسيوم (٤٨%) + حمض السالسيلك (٤مليمول/ لتر) .

ويمكن تلخيص اهم النتائج كالاتي :

–ادت جميع المعاملات تحسين جودة الثمار اثناء التخزين وذلك بحدوث نقص معنوي فى الفقد فى الرطوبة وزيادة معنوية فى نسبة العصير بالثمار وذلك خلال موسمي الدراسة مقارنة بالكنترول.

–ادت المعاملات بحمض السالسيلك منفردا او بالإضافة الى سلفات البوتاسيوم الى زيادة معنوية فى كلا من نسبة المواد الصلبة الذائبة الكلية وفيتامينC ونقص معنوي فى حموضة الثمار اثناء التخزين خلال موسمي الدراسة.