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EFFECT OF SOME POST- HARVEST TREATMENTS AND TYPE OF BAGGING ON SOME QUALITY PARAMETERS OF AWAIS MANGO FRUITS DURING AND AFTER COLD STORAGE

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ABSTRACT : In 1996 and 1997 seasons, mature (M) and start ripe (R) Awais mango fruits were adapted to one of the following treatments : 1. M fruits soaked in $CaCl_2$ (Ca) at 8% for 15 min., then in (GA_3) at 550 ppm for 15 min., and finally in Savlon (S) at 500 ppm for 5 min. This treatment was referred to as (M+ Ca+ GA_3 + S); 2. also (M + Ca + GA_3 + S) and packed in sealed low density polyethelene (SPE) bags; 3. M fruits soaked in hot water at 52°C for 5 min. (H), then in Ca and GA_3 . This treatment was referred to as (M + H + Ca + GA_3); 4. (M + H + Ca + GA_3 + SPE) ; 5. (R + H + Ca + GA_3) ; 6. (R + H + Ca + GA_3 + SPE) ; 7. R fruits soaked in Ca then in thiobendazol (TBZ) at 1000 ppm for 5 min., then packed in perforated polyethelene bags (PPE), this treatment was referred to as (R + Ca + TBZ + PPE); and 8. (R + Ca + TBZ + SPE). Treatments with M fruits were stored in cold rooms under 13±1°C while those with R fruits were stored under 8 ±1°C . After each week of cold storage the fruits were kept on shelf under 20°C and 60-70% RH for 5 days to evaluate the effect of shelf life.

Bagging fruits in (SPE) gave the lowest values of fresh weight losses (FWL), fruit decay index (FDI) and peel color index (PCI) ascendingly followed by bagging in (PPE) . The highest values resulted from nacked fruits during cold storage and during shelf life. Nacked R fruits gave higher panel test index (PTI) after 5 and 6 weeks cold storage while bagging in (SPE) gave the lowest values after 7 weeks cold storage . Bagging in (PPE) gave the best (PTI) after 6 weeks cold storage and during shelf life . Bagging, generally, increased pulp firmness and decreased activated acidity during cold storage and after shelf life.

INTRODUCTION

Mango (*Mangiferae indica* L.) is an important fruit in Egypt. Awais cv. is an important cultivar for its high fruit quality and its high crop, especially in newly reclaimed areas. The harvest season of this cultivar begins in late September and lasts for a short period. Mango fruits have potentially a short storage life. Cold storage would be the most promising solution to prolong storage life.

Most of cold rooms in Egypt are not humidity controlled, therefore the suitable relative humidity percentage has to be attained throw packing treatments. In addition, bagging prevents the recontamination of fruits in cold storage rooms . In this respect, weight losses and spoilage were reduced when Alfonso mango fruits were stored in perforated polyethelene bags (Shivarama - Reddy *et al.*, 1985).

Packing in several kinds of plastic bags resulted in decreasing fresh weight losses, especially in cold rooms without humidity control. Perforated polyethylene bags have no effect on O_2 and CO_2 concentration, but sealed bags modified the atmosphere by increasing CO_2 concentration (produced from respiration) and decreasing O_2 (consumed in respiration).

Storing Alfonso mango in perforated polyethylene bags reduced weight loss and spoilage (Shivarama- Reddy *et al.* 1985). Mango fruits cv Tommy Atkins wrapped in plastic film when mature, with green peel color, had more serious decay before reaching the soft - ripe stage and had less yellow color development of the pulp at soft - ripeness, than non- wrapped fruits held in storage at 21°C , fruits tended to have a higher incidence of off-flavour and soft - ripeness (Miller *et al.* 1986).

Packing in boxes over-wrapped with stretch PVC film delayed ripening, controlled decay, minimized weight loss and extended shelf life of the wild mango fruits (Joseph and Aworth, 1992). Rot severity was significantly reduced as a result of wrapping semi- ripe mango fruits in plastic bags (Jagdish - Chandra *et al.* 1992). Semi-ripe mangoes were inoculated with 5 fungal rot pathogens , then incubated for 12 hours at 30°C , then wrapped in 0.002 cm plastic film and incubated at 30°C and 75-90% RH. Rot severity was significantly reduced as a result of wrapping fruits in plastic films .

Weight loss of keitt mangoes packaged in sealed polyethelene films was significantly lower than that of the non-wrapped fruits, but unwrapped mangoes had a higher overall eating quality (Yamashita *et al.* , 1994).

The present study aimed mainly to determine the effect of packing mango fruits in perforated and sealed polyethelene films after some heat, Savlon, TBZ, $CaCl_2$ and GA_3 treatments on quality of Awais mangoes after cold storage periods.

MATERIALS AND METHODS

The present investigation has been carried out during the two successive seasons of 1996 and 1997 on fruits harvested from > 60 -year-old Awais mango trees grown in an orchard with fine sandy soil at Anchas, Sharkia Governorate. The trees were budded on seedling rootstock and were irrigated with Nile water using the traditional basin system, and uniformly received other horticultural practices. Harvesting took place in the morning. Experimental fruits were either mature green (M) or starting to ripe (R) with a slight green blush. The fruits were then taken to post - Harvest Lab in Hort. Dept., Fac. of Agric., Zagazig Univ. 600 fruits (4 treatments x 3 reps) of each group (M and R) were used in this investigation.

The harvested fruits were washed with water and soap , then rinsed with water. Four groups of each of (M) and (R) fruits were randomly taken to apply eight post-harvest treatments as follow: 1-M fruits soaked in $CaCl_2$ (Ca) at 8% for 15min., then in GA_3 (as Berlex of ICI) at 550 ppm for 15 min., and finally in Savlon (chlorohexidine 0.3% + citrimide 3%) at 500 ppm for 5 min. This treatment was referred to as (M + Ca + GA_3 +S), 2- M fruits soaked in Ca at 8% for 15 min., then in GA_3 550 ppm for 15 min. and finally in S at 500 ppm for 5 min. the fruits were then packed in sealed low density polyethelene (SPE) bags. This treatment was referred to as (M + Ca+ GA_3 + S + SPE), 3-M fruits soaked in hot water at 52°C (H) for 5 min., then in Ca (8%) for 15 min., and finally in GA_3 (550 ppm) for 15 min. and this treatment was referred to as (M + H + Ca+ GA_3). 4- M fruits soaked in hot water at 52°C (H) for 5 min., then in Ca (8%) for 15 min., then in GA_3 at 550 ppm for 15 min., and packed in SPE bags. This treatment was referred to as (M + H + Ca + GA_3 + SPE). 5- R fruits soaked in (H) for 5 min., then in Ca (8%) for 15 min., then in GA_3 at 550 ppm for 15 min. This treatment was referred to as (R + H + Ca + GA_3) , 6-R fruits soaked in (H) for 5 min. , then in Ca 8% for 15 min., then in GA_3 550 ppm for 15 min., then packed in SPE bags. This treatment was referred to as (R + H + Ca + GA_3 + SPE), 7-R fruits soaked in Ca 8% for 15 min., then in thiobendazol (TBZ) at 1000 ppm

for five min., then packed in perforated polythelene (PPE) bags. This treatment was referred to as (R+Ca+TBZ+PPE), and 8- R fruits soaked in Ca (8%) for 15min., then in TBZ (1000 ppm) for 5 min., then packed in SPE bags. This treatment was referred to as (R+ Ca + TBZ + SPE).

Fruits of all treatments were then packed in 3 kg-capacity carton boxes.

The hot water treatment was applied by immersing the fruits in stirred hot water bath at 52°C, for 5 min after the pulp next to endocarp reached 52°C then transferred immediatly to cold water.

Fresh weight of each fruit was recorded before treatment and every week during cold storage and the subsequent shelf life (5 days). Cold storage of M fruits was at 13 ± 1°C , while R fruits were cold stored at 8 ± 1°C.

After each week of cold storage, samples of each treatment were taken out to evaluate storage period effects. After 3 weeks of cold storage, samples were taken to evaluate fruit behaviour under shelf life conditions (20°C and 60-70% RH) in an incubator (i.e. the same as supermarket conditions) for 5 days .

Evaluation of cold storage period and shelf life effects on Awais mango fruits was carried out through the following parameters.

1.Fresh weight losses (FWI) %: The fruits were weighted before cold storage , after each week of cold storage and after 5 days of the shelf life ; the fresh weight losses % at each period were calculated .

2.Peel color index (PCI) : It was subjectively scored on scale of O to 10 where O = 100% green (no yellow ground color) , 2= 1-25%, 4= 26 - 40%; 6 = 41-60%; 8 = 61-80% ; 10 = 81 - 100% ground yellow-color. The average values were calculated .

3.Fruit decay index (FDI): It was subjectively scored on a scale of O to 8 , where O = without decay ; 2 - spot; 5 = 25% and 8= 50% of peel surface was decayed. The overage values were calculated .

4.Panel test index (PTI): Each replicate was judged by 5 persons who gave the score as follows : 4 = excellent test; 3=very good test; 2= good test; 1= acceptable test, and O = bad test. The averages of the 5 persons were calculated.

5.Fruit pulp firmness (FPF): It was determined on three fruits per replicate, three measurements were carried out on each fruit after removing peel using push pull dynamometer Mc cormick (Model FT 327) with pluger tip 5/16. The average firmness of the sample was expressed as (Lb).

6.Juice total soluble solids (TSS) % : Three fruits were randomly taken from each sample, the juice was extracted and the TSS (%) was determined using a hand refractometer .

7.Juice active acidity (pH value) : It was determined using pH meter (style Hanna 8514).

8.Respiration rate : To measure respiration rate, three fruits from each replicate were randomly taken and placed in 3.8-L glass jar (respiratory chambers) mounted in groupes of four pieces, three of which were used for the respiration rate determination while the fourth was used as a blank. The air stream from each jar for through precision tube meters (model XPR, Valborg Instrument, NY)was passed through two dispersion tubes connected in series (double trap) containing 0.1*N* barium hydroxide and 0.2% barium chloride solution. CO_2 output was recorded titrimetrically and the respiration rate was calculated as mg CO_2 / kg/hr. Respiration rate of fruits was determined under 20°C.

The complete randomized block design with 3 replicates and with factorial arrangement was followed throughout the whole work (Snedecor and Cochran,1980). The means of main factors and their interactions were compared using the New LSD method at 0.05.

RESULTS AND DISCUSSION

1.Fresh Weight Losses (FWL)

1.1 Effect of cold storage period

Data in Table 1 indicated significant differences between the tested treatments after four weeks of cold storage. The values ranged from 1.2 to 6.7% in the first season and from 1.1 to 6.5% in the second season. It was clear that treatments without PE bags gave the highest FWL ; those were : (M + Ca + GA_3 + S) and (M + H + Ca +GA_3) which always indicated FWL over 6% and without significant differences between them. On the other hand, all treatments implying packing in PE bags (sealed or perforated), generally, resulted in much lower FWLs which ranged from 1.2 to 2.7% in the first season and from 1.1 to 2.8% in the second season.

The treatments that showed relatively lower FWLs up to the seventh week of cold storage were (R + H+ Ca +GA_3 + SPE) and (R + Ca+ TBZ + SPE). These results are in line with those obtained by (Shivarama - Reddy *et al.* (1985) on Alfonso mango and Ben-Yehoshua *et al.* (1996) using perforated polyethylene . As for packing in sealed PE bags, Miller *et al.* (1986), Joseph and Aworth (1992) and Yamashita *et al.* (1997) obtained analogical results.

The above mentioned results might be due to the higher relative

humidity (RH) in the bags, considering that RH in the cold room was always less than 90% thus packing in PE decreased water loss from fruits through lenticels .

The data also cleared that FWL's were at the lowermost level after one week of cold storage, then gradually increased. This was quite expected due to the continuous water removal from fruits during cold storage.

The interaction (period x treatment) was statistically significant in the two seasons. The highest values were always concomitant to (later samples x treatments without PE bags), while the lower FWl's came from (earlier samples x treatments with PE bags).

1.2 Effect of five - day shelf life after cold storage:

The data in Table indicated a reverse trend compared with that observed during cold storage. As such, treatments without PE bags, which indicated high FWL's during cold storage, revealed relatively low FWL's during shelf life. Those were : (M + Ca + GA_3 +S) , (M+ H+ Ca +GA_3) and (R+ H+ Ca+ GA_3). Meanwhile, the treatments: (M +Ca + GA_3 + SPE), (M + Ca + GA_3 + SPE), (R+H + Ca+ GA_3+ SPE) and (R+ Ca + TBZ+ SPE) which depressed FWL's during cold storage recorded higher values during the shelf - life . The same trend was observed in the two experimental seasons. Anyhow, after seven weeks of cold storage, the five days shelf life indicated insignificant differences in FWL's between other represented treatments .

2. Fruit Decay Index (FDI)

2.1 Effect of cold storage period

Data in Table 2 revealed significant differences between the tested treatments after four weeks of cold storage . In both seasons the values ranged from 0.0 to 1.3 . In addition, it was clear that treatments without PE packing indicated higher FDI in the two seasons. On the contrary, most of treatments with PE packing revealed low FDI values. However, the FDI increased after the for week of cold storage , but with significant differences among treatments. In the fifth and sixth weeks, the treatments that managed to depress FDI were (M + H + Ca + GA_3 + SPE) and (R + Ca + TBZ + SPE) ; FDI values of those treatments were 0.3 in both seasons with the former treatment and 0.6 and 1.7 with the later one . In the 7th week the FDI values of the other three treatments ranged from four to seven ; Worthwhile fruits of treatments without PE packing were unsuitable to extend cold storage to the 7th week.

The data also cleared that FDI values were relatively low (1.8 and 1.7) after one week of

cold storage, then gradually increased to reach 4.8 and 4.9 after four weeks in the two seasons, respectively.Moreover, the average FDI continued to increase in the 5th, 6th weeks of cold storage.

The interaction was significant in the two seasons. The highest values achieved from treatments without PE packing in the 4th week of cold storage. On the other hand, the lowest values were , generally , recorded for all treatments in the 1st and 2nd weeks of cold storage as well as in the 3rd and 4th weeks with the treatments (M + H + Ca + GA_3 + SPE) and (R + Ca + TBZ + SPE).

2.2 Effect of five - day shelf life after cold storage :

The data, generally, indicate higher FDI values during shelf life than during cold storage (Table 2). In addition, treatments without PE packing revealed higher FDI values during the shelf life compared with treatments implying PE packing ; this was true up to the 4th week. However, from the 5th to 7th week fruits of treatments without PE packing were, in most cases, unsuitable for shelf keeping , while fruits of other treatments showed relatively high FDI values.

The data also revealed that FDI during shelf life were, generally, increased as the preceding cold storage period was longer.

The reduction in FDI by bagging in SPE may be greatly related to the reduction in O_2 and the increment in CO_2 concentration in the modified atmosphere. Packing in PE, generally, prevent recontamination after the denaturation of the fungicides. The obtained herein results are in line with those reported by Shivarama -Reddy *et al.* (1985) ; Jadish - Chandra *et al.* (1992); Joseph and Aworth (1992) and Ben- Yehoshua *et al.* (1996).

3. Peel Color Index (PCI)

3.1 Effect of cold storage period

Data in Table 3 show significant differences between the tested treatments after four weeks of cold storage. The values ranged from O to 3.7 in the first season and from O to 3.9 in the second season. The higher values , i.e., 2.9 - 3.7 in the first season and 3-3.9 in the second season resulted from treatments without PE packing as well as with perforated PE packing. On the other hand, treatments with sealed PE packing recorded only O-1.6 and 0-1.4 in the first and second seasons, respectively. In the following weeks (5th to 7th), however, fruits of the treatments (M + Ca+ GA_3 +S) and (M + H + Ca + GA_3) were unsuitable to continue cold storage. Also, fruits of the treatments (R + H + Ca + GA_3) and (R+ Ca + TBZ + PPE) reached high PCI in the 6th week (4.3 and 4.6) with the former and (9 and

8.8) with the later, in the first and second seasons, respectively, and were unsuitable for longer cold storage .

Storage period also significantly affected PCI in the two seasons. Thus, the PCI values were only (1.3 and 1.2) after one week in the two seasons, then gradually increased to reach (2.3 and 2.4) in the 4th week.

The interaction was significant in the two seasons. The uppermost values came from treatments without PE packing and with perforated PE packing during the 2nd , 3rd and 4th weeks. The lowermost values were obtained by treatments with sealed PE packing during the weeks from one to four cold storage.

3.2 Effect of five - day shelf life after cold storage

The data, generally, showed higher PCI values during the shelf life than during cold storage. In addition , treatments without PE packing as well as with perforated PE packing recorded much higher PCI values compared with those with sealed PE packing. The former group of treatments recorded 6.5 -8.2 in the first season and 6.6-8.4 in the second season; the latter group recorded 2.9-3.8 in the first season and 2.9-3.9 in the second season. However, the shelf life PCI values of any treatment indicated continuous promotion with successive storage weeks .

The obtained results are in line with those reported by Chaplin (1989) and Joseph and Aworth (1992) who reported that modified atmosphere conditions delayed ripening and cause poor color; these responses are considered to be examples of CO_2 injury. On the other hand, perforating the film cancelled the inhibition of the ripening process that prevailed in mangoes cv Tommy Atkins in non perforated packages (Ben-Yehoshua *et al.* 1996).

4. Panel Test Index (PTI)

4.1 Effect of cold storage period

As shown in Table 4, the PTI evaluation began in the 4th week and contimued up to the 7th week . In the 4th week the values ranged from 2 to 3.1 in the first season without significnat differences between treatments . In the second season, however, the PTI values ranged from 1.8 to 3. The higher values (3, 2.8 and 2.3) were recorded by the three treatments : (R+ GA_3+ TBZ + SPE), (M+ Ca+ GA_3+S) and (R +H+ Ca+GA_3 + SPE), respectively. The other tested treatments revealed lower and close values.

In the 5th and 6th weeks, treatments with ripe fruits indicated higher PTI values compared with mature ones. In the 7th week fruits of all tested treatments were unsuitable for consumption.

4.2 Effect of five-day shelf life after cold storage

The results indicated a trend nearly similar to that discussed for the effect of cold storage.

These results are nearly similar to those obtained by Miller *et al.* (1986) who reported that fruits stored in modified atmosphere often show undesirable response such as poor color, low eating quality and the presence of off-flavours. Such responses are considered to be examples of CO_3 injury (Chaplin, 1989). Generally, unwrapped mangoes had a higher overall eating quality (Ben -Yehoshua *et al.*, 1996 and Yamashita *et al.* , 1997).

5. Pulp Firmness

5.1 Effect of cold storage period

Evaluation of pulp firmness took place from the 4th to the 7th week . In the 4th week, the values ranged from 2.1 to 4.1 LB in the first season and from 2.4 to 4 LB in the second season. The treatments that revealed lower pulp firmness in the two seasons were : (R + H + Ca + GA_3) and (R + H + Ca + GA_3 + SPE). The other tested treatments recorded significantly higher pulp firmness values ranged from 3.5 to 4.1 LB in the first season and from 3.5 to 4 Lb in the second season without significant differences among them. However, the following weeks of cold storage (5th to 7th) showed gradual deterioration in pulp firmness of all tested treatments (Table 4).

5.2 Effect of five -day shelf - life after cold storage

The data recorded after 4 weeks of cold storage reveal that pulp firmness of the shelf life indicated a trend nearly similar to that discussed in the 4th week of cold storage. However, shelf life during the following weeks indicated gradual deterioration in pulp firmness with all tested treatments (Table 1). In addition, the differences between treatments were insignificant beginning with the 5th week in the second season.

6. Juice TSS %

6.1 Effect of cold storage period

The tested treatments obviously affected TSS (%) in the two seasons (Table 5). During the weeks from the 4th to the 7th the highest values (over 20%) always resulted from the treatment (R + Ca+ TBZ + SPE) . In the second rank came other treatments with ripe fruits, i.e. (R + H + Ca+ GA_3) , (R + H + Ca + GA_3 + SPE) and (R + Ca+ TBZ + PPE) with values around 14 - 16% in the first season and around 14-17% in the second season. On the other hand, treatments with mature fruits revealed much lower TSS values along the 4th to 7th week period of cold storage, the values were around 10 - 11%.

6.2 Effect of five-day shelf life after cold storage

The data indicated a trend nearly similar to that discussed above for cold storage period, but with higher TSS values, particularly for the treatments with M fruits. Those treatments (with M fruits) recorded TSS values around 14-16% during shelf life compared with around 10 - 11 during cold storage .

7. Juice pH Value

7.1 Effect of cold storage period

The juice pH values were recorded during the period from the 4th to 7th week of cold storage. The results cleared that treatments with R fruits, generally, gave higher pH values compared with treatments with M fruits. This was clear in the two seasons, juice from R fruit recorded pH values around 4 - 5 in the two seasons against values around 3-4 for juice from M fruits. In addition, the results cleared that pH values increased with the advance in cold storage period (Table 5).

7.2 Effect of five-day shelf life after cold storage

Juice samples were taken after four weeks of cold storage. The five days of shelf life revealed insignificant differences between all tested treatments. The following weeks (i.e. from the 5th to 7th) indicated a trend nearly similar to that discussed above for cold storage period.

8.Respiration Rate

Determination of fruit respiration rate took place for all treatments in the 2nd and 4th weeks of cold storage. The treatments clarified insignificant differences in the first season. However, in the second season, respiration rates from 2.4 to 3.1 mg CO_2/ kg / h were recorded by five treatments, i.e (M + Ca + Ca_2+ S), (M+H + Ca+ GA_3), (M + H+ Ca+ GA_3 + SPE), (R+ H + Ca + GA_3) and (R + Ca + TBZ+ PPE) without significnt differences among them. The other three treatments, i.e. (M+ Ca+ GA_3 + S + SPE), (R + H + Ca + GA_3 + SPE) and (R+ Ca + TBZ+SPE) gave lower respiration rates (from 2.2 to 2.3 mg CO_2 / kg / h).

The data also indicate the reduction of respiration rate with the advance in cold storage period. This was clear in both seasons.

The interaction was insignificant in the two experimental seasons.

Samples taken from the 5th to the 7th week indicated insignificant differences between the still represented treatments.

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Table 1 :Effect of some post - harvest treatments and cold storage period on fresh weight losses (FWL %) of Awais mango fruits during cold storage period and the follows shelf life (1996 and 1997 season).

	Treatments	Fresh weight losses FWL (%)								(FWL) %					
		Cold storage period (weeks)								Shelf - life for 5days after 3-7 weeks of cold storage					
		1	2	3	4	Treat av.	5	6	7	3	4	Treat av.	5	6	7
	First season (1996)														
M fruit	**(Ca + GA_3+S)**	**3.9**	**5.8**	**6.4**	**9.0**	**6.3**	**-**	**-**	**-**	**2.1**	**2.2**	**2.1**	**-**	**-**	**-**
M fruit	**(Ca+GA_3+ S+ SPE)**	**1.0**	**2.1**	**2.8**	**3.7**	**2.4**	**4.4**	**4.9**	**5.1**	**3.1**	**3.0**	**3.0**	**2.9**	**2.7**	**2.5**
M fruit	**(H+Ca+GA_3)**	**4.8**	**5.1**	**7.2**	**8.8**	**6.7**	**-**	**-**	**-**	**2.5**	**2.2**	**2.3**	**-**	**-**	**-**
M fruit	**(H+Ca+GA_3 +SPE)**	**1.0**	**1.8**	**2.5**	**3.2**	**2.1**	**3.4**	**4.1**	**4.7**	**3.3**	**3.1**	**3.2**	**3.1**	**3.0**	**2.1**
R fruit	**(H+Ca+GA_3)**	**0.7**	**3.9**	**4.4**	**6.4**	**3.8**	**8.6**	**10.0**	**-**	**1.9**	**1.7**	**1.8**	**1.6**	**1.5**	**-**
R fruit	**(H+Ca+GA_3+SPE)**	**0.9**	**1.4**	**1.8**	**1.9**	**1.5**	**2.5**	**3.1**	**3.6**	**3.3**	**3.1**	**3.2**	**2.8**	**2.9**	**2.9**
R fruit	**(Ca+TBZ+PPE)**	**1.2**	**2.3**	**3.2**	**4.1**	**2.7**	**4.8**	**5.2**	**-**	**2.7**	**2.5**	**2.6**	**2.2**	**2.0**	**-**
R fruit	**(Ca+TBZ+SPE)**	**0.7**	**1.2**	**1.4**	**1.5**	**1.2**	**1.6**	**2.4**	**2.8**	**3.4**	**3.2**	**3.3**	**3.0**	**3.0**	**2.9**
	Period at (P)	**1.8**	**3.1**	**3.7**	**4.8**	**-**	**-**	**-**	**-**	**2.8**	**2.6**	**-**	**-**	**-**	**-**
	NLSD > 0.05	**P= 0.62**		**T= 2.25**		**P x T =4.21**	**3.01**	**2.72**	**1.33**	**P=NS+T=0.76**		**P xT=NS**	**0.47**	**0.67**	**NS**
	Second season (1997)											**2.2**			
M fruit	**(Ca + GA_3+S)**	**3.7**	**5.9**	**6.9**	**9.1**	**6.4**	**-**	**-**	**-**	**2.2**	**2.3**	**2.9**	**-**	**-**	**-**
M fruit	**(Ca+GA_3+ S+ SPE)**	**1.2**	**2.0**	**2.7**	**3.5**	**2.3**	**4.2**	**4.7**	**5.2**	**3.0**	**2.9**	**2.1**	**2.8**	**2.7**	**2.6**
M fruit	**(H+Ca+GA_3)**	**4.5**	**6.1**	**7.0**	**8.6**	**6.5**	**-**	**-**	**-**	**1.3**	**2.0**	**3.1**	**-**	**-**	**-**
M fruit	**(H+Ca+GA_3 +SPE)**	**1.0**	**1.6**	**2.2**	**3.6**	**2.1**	**3.8**	**4.2**	**4.9**	**3.2**	**3.0**	**1.9**	**2.9**	**2.8**	**2.3**
R fruit	**(H+Ca+GA_3)**	**0.7**	**4.0**	**4.8**	**6.8**	**4.1**	**8.4**	**9.8**	**-**	**2.0**	**1.8**	**3.0**	**1.7**	**1.6**	**-**
R fruit	**(H+Ca+GA_3+SPE)**	**0.8**	**1.3**	**1.7**	**1.8**	**1.4**	**2.6**	**3.3**	**3.7**	**3.1**	**3.0**	**2.6**	**2.7**	**2.7**	**2.6**
R fruit	**(Ca+TBZ+PPE)**	**1.2**	**2.4**	**3.3**	**4.3**	**2.8**	**4.7**	**5.1**	**-**	**2.8**	**2.5**	**3.1**	**2.3**	**2.1**	**-**
R fruit	**(Ca+TBZ+SPE)**	**0.7**	**1.1**	**1.3**	**1.5**	**1.1**	**1.6**	**2.2**	**2.6**	**3.2**	**3.1**	**-**	**2.9**	**2.9**	**2.7**
	Period at (P)	**1.7**	**3.1**	**3.7**	**4.9**	**-**	**-**	**-**	**-**	**2.7**	**2.6**		**-**	**-**	**-**
	NLSD > 0.05	**P= 0.83**		**T= 1.64**		**P x T =3.95**	**2.95**	**2.68**	**1.26**	**P=NS+T=0.59**		**P xT=NS**	**0.52**	**0.39**	**NS**

M : mature fruits, R. : Ripe , Ca : $CaCl_2$ 8% , GA_3 : GA_3 550 ppm , S: Savlon 500 ppm, SPE : Sealed polyethelene PPE : Perforated polyethelene.

Table 2 : Effect of some post - harvest treatments and cold stroage period on fruits decay index (FDI) , of Awais mango fruits during colds storage period and following shelf - life (1996 and 1997 seasons)

	Treatments	Fruit decay index (FGI) %								(FDI) %					
		Cold storage period (weeks)								Shelf - life for days after 3-7 weeks of cold storage					
		1	2	3	4	Treat av.	5	6	7	3	4	Treat av.	5	6	7
	First season (1996)														
M fruit	(Ca + GA_3+S)	0.0	0.0	2.0	3.3	1.3	-	-	-	2.6	4.1	3.3	-	-	-
	(Ca+GA_3+ S+ SPE)	0.0	0.6	1.6	1.6	0.9	2.3	2.3	6.0	2.1	2.3	2.2	2.9	3.0	7.0
	(H+Ca+GA_3)	0.0	0.3	1.0	3.0	1.1	-	-	-	1.7	4.0	2.8	-	-	-
	(H+Ca+GA_3+SPE)	0.0	0.3	0.3	0.3	0.2	0.3	0.3	4.0	0.9	1.1	1.0	1.2	1.2	2.1
	(H+Ca+GA_3)	0.0	0.0	1.0	2.3	0.8	3.3	6.0	-	1.9	2.7	2.3	4.0	7.0	-
	(H+Ca+GA_3+SPE)	0.0	0.3	0.3	1.3	0.5	2.0	3.0	7.0	0.8	2.3	1.5	2.7	4.1	7.0
R fruit	(Ca+TBZ+PPE)	0.0	0.1	0.3	1.7	0.5	2.5	5.7	-	0.9	2.5	1.7	3.2	6.1	-
	(Ca+TBZ+SPE)	0.0	0.0	0.0	0.0	0.0	0.6	1.6	2.6	0.2	0.4	0.3	1.0	1.1	3.5
	Period at (P)	0.0	0.2	0.8	1.7	-	-	-	-	1.4	2.4	-	-	-	-
	NLSD > 0.05	P=0.72		T= 0.36		PxT= 0.96	0.83	1.12	2.11	P=0.82		T= 0.61 PxT= 1.91	1.17	1.08	2.19
	Second season (1997)														
M fruit	(Ca + GA_3+S)	0.0	0.0	1.9	3.5	1.3	-	-	-	2.5	4.2	3.3	-	-	-
	(Ca+GA_3+ S+ SPE)	0.0	0.5	1.7	1.9	1.0	2.5	2.5	6.0	2.0	2.4	2.2	2.8	3.1	6.9
	(H+Ca+GA_3)	0.0	0.4	1.1	2.9	1.1	-	-	-	1.6	4.1	2.8	-	-	-
	(H+Ca+GA_3+SPE)	0.0	0.2	0.3	0.3	0.2	0.3	0.4	4.0	0.8	1.2	1.0	1.2	1.3	2.2
	(H+Ca+GA_3)	0.0	0.1	1.2	2.3	0.9	4.4	7.0	-	1.8	2.6	2.2	3.9	6.8	-
	(H+Ca+GA_3+SPE)	0.0	0.4	0.4	1.9	0.6	2.2	3.5	7.0	0.9	2.4	1.6	2.7	4.0	6.8
R fruit	(Ca+TBZ+PPE)	0.0	0.1	0.3	2.2	0.6	2.7	6.0	-	0.8	2.6	1.7	3.3	6.0	-
	(Ca+TBZ+SPE)	0.0	0.0	0.0	0.0	0.0	0.6	1.7	3.0	0.2	0.4	0.3	0.9	1.0	3.3
	Period at (P)	0.0	0.4	1.0	2.0	0.0	-	-	-	1.3	2.5	-	-	-	-
	NLSD > 0.05	P=0.87		T= 0.32		PxT= 0.88	0.91	1.09	1.97	P=1.16		T= 0.48 PxT= NS	1.20	1.25	1.98

M : mature fruits, R. : Ripe , Ca : $CaCl_2$ 8% , GA_3 : GA_3 550 ppm , S: Savlon 500 ppm, SPE : Sealed polyethelene PPE : Perforated polyethelene.

Table 3 : Effect of some post - harvest treatments and cold storage period on peel color index (PCI) of Awais mango fruits during cold storage period and the follows shelf life (1996 and 1997 season).

	Treatments	Peel color index (PCI) Cold storage period (weeks)								(PCI) Shelf - liFe for days after 3-7 weeks of cold storage					
		1	2	3	4	Treat av.	5	6	7	3	4	Treat av.	5	6	7
	First season (1996)														
M fruit	(Ca + GA_3+S)	2.5	2.6	3.3	4.6	3.2	-	-	-	7.9	8.5	8.2	-	-	-
M fruit	(Ca+GA_3+ S+ SPE)	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	3.1	3.2	3.1	4.5	5.0	5.0
M fruit	(H+Ca+GA_3)	2.0	3.0	3.6	4.3	3.2	-	-	-	5.9	7.1	6.5	-	-	-
M fruit	(H+Ca+GA_3 +SPE)	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.3	2.8	3.0	2.9	4.1	4.3	4.5
R fruit	(H+Ca+GA_3)	2.0	4.3	4.3	4.3	3.7	4.3	4.3	-	6.2	7.0	6.6	7.5	7.7	-
R fruit	(H+Ca+GA_3+SPE)	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	3.5	4.2	3.8	4.5	4.7	4.8
R fruit	(Ca+TBZ+PPE)	2.3	2.7	3.2	3.6	2.9	6.1	9.0	-	7.0	8.0	7.5	8.9	10.0	-
R fruit	(Ca+TBZ+SPE)	0.0	0.0	0.0	0.0	0.0	1.6	2.0	2.6	3.2	3.5	3.3	4.5	5.5	5.7
	Period at (P)	1.3	1.7	2.0	2.3	-	-	-	-	4.9	5.6	-	-	-	-
	NLSD > 0.05	P= 0.54		T= 0.89		P x T =1.95	1.61	2.18	0.59	P=0.50		T= 1.36 PxT=NS	2.12	2.31	1.01
	Second season (1997)														
M fruit	(Ca + GA_3+S)	2.6	2.8	3.5	4.8	3.4	-	-	-	8.1	8.7	8.4	-	-	-
M fruit	(Ca+GA_3+ S+ SPE)	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	3.0	3.3	3.1	4.4	4.8	4.9
M fruit	(H+Ca+GA_3)	2.0	2.9	3.7	4.5	3.3	-	-	-	6.0	7.3	6.6	-	-	-
M fruit	(H+Ca+GA_3 +SPE)	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.2	2.7	3.1	2.9	4.0	4.3	4.4
R fruit	(H+Ca+GA_3)	2.0	4.5	4.6	4.6	3.9	4.6	4.6	-	6.3	7.1	6.9	7.5	7.9	-
R fruit	(H+Ca+GA_3+SPE)	1.4	1.4	1.5	1.5	1.4	1.5	1.6	1.6	3.6	4.3	3.9	4.6	4.6	4.9
R fruit	(Ca+TBZ+PPE)	2.0	2.8	3.5	3.7	3.0	5.9	8.8	-	7.1	8.2	7.6	8.8	10.0	-
R fruit	(Ca+TBZ+SPE)	0.0	0.0	0.0	0.0	0.0	1.6	2.0	2.0	3.1	3.3	3.2	4.4	5.3	5.6
	Period at (P)	1.2	1.8	2.1	2.4	-	-	-	-	5.0	5.7	-	-	-	-
	NLSD > 0.05	P= 0.51		T= 0.75		P x T =2.17	2.31	2.82	0.69	P=0.62		T= 1.26 PxT=NS	2.32	2.52	1.13

M : mature fruits, R. : Ripe , Ca : $CaCl_2$ 8% , GA_3 : GA_3 550 ppm , S: Savlon 500 ppm, SPE : Sealed polyethelene PPE : Perforated polyethelene.

Table 4 : Effect of some post - harvest treatments and cold stroage period on panel test index (PTI) and pulp firminess of Awais mango fruits during colds storage period and following shelf - life (1996 and 1997 seasons)

	Treatments	Panel test index (PTI)								Pulp firminess (Lb)							
		Cold storage period (weeks)				5 days shelf life				Cold storage period (weeks)				5 days shelf life			
		4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7
		First season (1996)															
M fruit	(Ca + GA_3+S)	3.1	-	-	-	3.5	-	-	-	4.0	-	-	-	3.1	-	-	-
M fruit	(Ca+GA_3+ S+ SPE)	2.0	1.0	0.0	0.0	2.4	2.0	0.0	0.0	4.1	2.5	2.0	1.0	3.2	1.7	1.3	0.0
M fruit	(H+Ca+GA_3)	2.0	-	-	-	2.5	-	-	-	3.5	-	-	-	2.6	-	-	-
M fruit	(H+Ca+GA_3 +SPE)	2.0	1.1	0.0	0.0	2.5	1.3	0.0	0.0	3.9	3.0	2.5	2.0	3.0	2.2	2.0	1.0
M fruit	(H+Ca+GA_3)	2.0	2.3	2.0	-	3.5	3.0	2.5	-	2.1	1.9	1.4	-	1.2	1.0	1.0	-
M fruit	(H+Ca+GA_3+SPE)	2.2	2.1	1.0	0.0	2.5	2.2	1.0	0.0	2.3	2.1	1.7	1.0	2.2	2.0	1.4	1.0
R fruit	(Ca+TBZ+PPE)	2.2	3.0	3.0	-	3.5	3.8	3.8	-	4.1	3.0	1.0	-	3.0	2.1	0.7	-
R fruit	(Ca+TBZ+SPE)	3.0	2.9	1.3	0.4	3.1	3.0	1.2	0.0	3.6	2.5	2.4	1.0	3.1	2.0	2.0	0.4
R fruit	Period at (P)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R fruit	NLSD > 0.05	NS	0.53	1.45	NS	NS	0.59	1.24	NS	1.01	0.97	0.62	NS	0.74	NS	NS	NS
		Second season (1997)															
M fruit	(Ca + GA_3+S)	2.8	-	-	-	3.4	-	-	-	3.9	-	-	-	3.0	-	-	-
M fruit	(Ca+GA_3+ S+ SPE)	1.8	0.9	0.0	0.0	2.3	1.9	0.0	0.0	4.0	2.3	2.0	1.0	3.1	1.5	1.2	0.0
M fruit	(H+Ca+GA_3)	2.2	-	-	-	2.6	-	-	-	3.9	-	-	-	2.7	-	-	-
M fruit	(H+Ca+GA_3 +SPE)	2.0	1.0	0.0	0.0	2.6	1.2	0.0	0.0	4.0	3.0	2.1	2.0	3.1	2.4	2.0	1.0
M fruit	(H+Ca+GA_3)	2.1	2.2	2.0	-	3.5	3.1	2.6	-	2.6	1.7	1.0	-	1.3	1.1	1.0	-
M fruit	(H+Ca+GA_3+SPE)	2.3	2.0	0.9	0.0	2.5	2.3	1.1	0.0	2.4	2.2	1.6	1.0	2.3	2.0	1.3	1.0
R fruit	(Ca+TBZ+PPE)	2.2	3.0	3.1	-	3.5	3.9	3.9	-	4.0	3.1	1.2	-	3.1	2.2	0.8	-
R fruit	(Ca+TBZ+SPE)	3.0	2.8	1.0	0.5	3.0	3.0	1.1	0.0	3.5	2.9	2.5	1.0	3.0	2.1	1.9	0.5
R fruit	Period at (P)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R fruit	NLSD > 0.05	0.71	1.01	1.43	NS	1.01	0.66	1.02	NS	1.17	0.62	0.82	NS	0.65	0.81	NS	NS

M : mature fruits, R. : Ripe , Ca : $CaCl_2$ 8% , GA_3 : GA_3 550 ppm , S: Savlon 500 ppm, SPE : Sealed polyethelene PPE : Perforated polyethelene.

Table 5 :Effect of some post- harvest treatments and cold storage period on total soluble solids (TSS) and activated activity (pH) of Awais mango fruits during cold storage period and the following shelf life (1996 and1997) seasons

	Treatments	TSS %								pH value							
		Cold storage period (weeks)				5 days shelf life				Cold storage period (weeks)				5 days shelf life			
		4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7
		First season (1996)															
M fruit	(Ca + GA_3+S)	10.3	-	-	-	16.2	-	-	-	4.62	-	-	-	4.71	-	-	-
M fruit	(Ca+GA_3+ S+ SPE)	10.3	10.5	10.5	11.0	14.1	14.3	15.1	15.2	3.58	3.70	3.73	4.01	3.81	3.95	4.01	4.17
M fruit	(H+Ca+GA_3)	11.6	-	-	-	14.9	-	-	-	4.40	-	-	-	4.95	-	-	-
M fruit	(H+Ca+GA_3 +SPE)	10.2	10.6	10.8	11.6	13.9	14.1	14.2	14.0	3.42	3.58	3.64	3.80	3.85	3.91	3.98	4.01
R fruit	(H+Ca+GA_3)	15.3	16.0	18.0	-	15.8	16.2	16.5	-	4.25	4.35	0.13	-	4.35	4.49	5.28	-
R fruit	(H+Ca+GA_3+SPE)	14.0	14.0	14.0	14.7	14.8	14.2	14.9	15.0	4.38	4.39	4.51	4.74	4.81	4.92	4.95	4.96
R fruit	(Ca+TBZ+PPE)	15.5	15.1	15.2	-	16.1	16.3	16.9	-	4.30	4.39	2.91	-	4.62	4.71	5.01	-
R fruit	(Ca+TBZ+SPE)	20.0	20.6	20.8	20.8	21.1	21.2	21.9	21.8	4.50	4.94	5.15	5.18	4.71	5.89	5.21	5.21
	Period at (P)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NLSD > 0.05	4.12	4.92	3.29	2.91	2.01	2.19	1.92	4.12	0.91	0.72	0.61	0.69	NS	0.97	1.17	1.02
		Second season (1997)															
M fruit	(Ca + GA_3+S)	10.6	-	-	-	16.4	-	-	-	4.59	-	-	-	4.67	-	-	-
M fruit	(Ca+GA_3+ S+ SPE)	10.4	10.4	10.5	11.1	14.5	14.7	15.2	15.3	3.60	3.72	3.80	4.10	3.84	3.90	4.11	4.19
M fruit	(H+Ca+GA_3)	11.1	-	-	-	13.1	-	-	-	4.38	-	-	-	4.89	-	-	-
M fruit	(H+Ca+GA_3 +SPE)	10.1	10.5	10.9	11.4	14.1	14.2	14.4	14.5	3.38	3.60	3.65	3.81	3.91	3.95	3.99	4.07
R fruit	(H+Ca+GA_3)	14.9	17.9	18.0	-	15.7	14.5	16.5	-	4.20	4.65	5.20	-	4.31	4.41	5.15	-
R fruit	(H+Ca+GA_3+SPE)	14.0	14.1	14.1	14.6	15.1	15.3	15.4	15.4	4.28	4.40	4.55	4.80	4.79	4.87	4.90	4.95
R fruit	(Ca+TBZ+PPE)	14.0	14.8	14.9	-	15.9	16.0	16.1	-	4.20	4.41	0.96	-	4.52	4.75	5.09	-
R fruit	(Ca+TBZ+SPE)	20.1	20.4	20.8	20.9	20.9	20.9	21.2	21.4	4.40	4.84	5.15	5.17	4.61	5.13	5.25	4.75
	Period at (P)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NLSD > 0.05	3.81	2.71	3.89	3.01	1.91	1.46	1.29	5.01	0.87	0.53	0.69	0.78	NS	0.79	1.01	0.98

M : mature fruits, R. : Ripe , Ca : $CaCl_2$ 8% , GA_3 : GA_3 550 ppm , S: Savlon 500 ppm, SPE : Sealed polyethelene PPE : Perforated polyethelene.

Table 6 : Effect of some post- harvest treatments and cold storage period on respertation rate of Awais mango fruits during cold storage period and the following shelf life (1996 and1997) seasons

	Treatments	Respiration rate (mg $CO_2/kg^{-1}/h^{-1}$)					
		2	4	Treat av.	5	6	7
	First season (1996)						
M fruit	**(Ca + GA_3+S)**	**3.2**	**2.6**	**2.9**	-	-	-
M fruit	**(Ca+GA_3+ S+ SPE)**	**2.6**	**2.4**	**2.5**	**17.1**	**18.6**	**19.2**
M fruit	**(H+Ca+GA_3)**	**2.6**	**2.4**	**2.5**	-	-	-
M fruit	**(H+Ca+GA_3 +SPE)**	**2.7**	**2.4**	**2.6**	**16.9**	**19.1**	**19.2**
R fruit	**(H+Ca+GA_3)**	**2.3**	**2.3**	**2.3**	**17.6**	**19.1**	-
R fruit	**(H+Ca+GA_3+SPE)**	**2.3**	**2.4**	**2.3**	**18.2**	**18.6**	**19.1**
R fruit	**(Ca+TBZ+PPE)**	**2.7**	**2.1**	**2.4**	**16.1**	**17.1**	-
R fruit	**(Ca+TBZ+SPE)**	**2.4**	**2.4**	**2.4**	**18.8**	**18.9**	**19.3**
	Period at (P)	**0.6**	**2.4**	-	-	-	-
	NLSD > 0.05	**P=0.19 PxT=NS T= NS**		**NS**	**NS**	**NS**	**NS**
	Second season (1997)						
M fruit	**(Ca + GA_3+S)**	**3.4**	**2.8**	**3.1**	-	-	-
M fruit	**(Ca+GA_3+ S+ SPE)**	**2.6**	**2.1**	**2.3**	**17.1**	**18.9**	**19.3**
M fruit	**(H+Ca+GA_3)**	**2.4**	**2.3**	**2.4**	-	-	-
M fruit	**(H+Ca+GA_3 +SPE)**	**2.6**	**2.4**	**2.5**	**15.9**	**18.9**	**19.3**
R fruit	**(H+Ca+GA_3)**	**2.3**	**2.4**	**2.4**	**17.4**	**19.1**	-
R fruit	**(H+Ca+GA_3+SPE)**	**2.2**	**2.3**	**2.2**	**18.1**	**18.2**	**19.0**
R fruit	**(Ca+TBZ+PPE)**	**2.8**	**2.1**	**2.5**	**15.4**	**16.9**	-
R fruit	**(Ca+TBZ+SPE)**	**2.2**	**2.5**	**2.3**	**18.6**	**18.9**	**19.5**
	Period at (P)	**2.6**	**2.4**	-	-	-	-
	NLSD > 0.05	**P=0.17 PxT=NS T= NS**		**0.72**	**NS**	**NS**	**NS**

M : mature fruits, R. : Ripe , Ca : $CaCl_2$ 8% , GA_3 : GA_3 550 ppm , S: Savlon 500 ppm, SPE : Sealed polyethelene PPE : Perforated polyethelene.

تأثير بعض معاملات بعد الحصاد ونوع اكياس التعبئة على بعض صفات الجودة لثمار المانجو صنف عويس أثناء وبعد التخزين البارد

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فى عامى ١٩٩٦ ، ١٩٩٧ عوملت ثمار مكتملة النمو (م) وأجرى فى بداية النضج (ن) من المانجو صنف عويس لأحد المعاملات الاتية : ١- ثمار مكتملة النمو نقعت فى محلول كلوريد الكالسيوم (كا) بتركيز ٨ ٪ لمدة ١٥ دقيقة ، ثم فى حمض (ج) بتركيز ٥٥٠ جزء فى المليون لمدة ١٥ دقيقة واخيراً فى سافلون (س) بتركيز ٥٠٠ جزء فى المليون لمدة ٥ دقائق وللاختصار يرمز لهذه المعاملة (م + كا + ج + س) ، نفس معاملات النضج مع تعبئة الثمار فى اكياس من البولى اثلين قليل السمك الغير مثقب (ب أ غير مثقب) ، ٣ - (م) منقوعة فى ماء ساخن (٥٢م°) لمدة ٥ دقائق (ح) ثم فى (كا) ثم فى (ج). وللاختصار يرمز لهذه المعاملة (م + ح + كا + ج) ، ٤ - (م + ح + كا + ج + ب أ غير مثقب) ، ٥ - (ن + ح + كا + ج) ، ٦ - (ن + ح + كا + ج + ب أ غير مثقب) ، ٧ - (ن + كا ثم نقع فى ثيوبندازول بتركيز ١٠٠٠ جزء فى المليون لمدة ٥ دقائق (ث) ثم التعبئة فى اكياس بولى اثلين مثقبة (ب أ مثقب) وللاختصار يرمز لهذه المعاملة (ن + كا + ث + ب أ مثقب) ، ٨ - (ن + كا + ث + ب أ غير مثقب) .

وقد تم تخزين الثمار مكتملة النمو (م) فى غرف تبريد على حرارة ١٣ ± ١ م ، بينما خزنت الثمار (ن) على حرارة ٨ ± ١م . وبعد كل اسبوع من فترة التخزين البارد تركت الثمار على الرف فى حرارة ٢٠م° ورطوبة نسبية ٦٠ - ٧٠٪ لمدة ٥ أيام.

وتظهر النتائج أن تعبئة الثمار فى (ب أ غير مثقب) سجلت أقل القيم فى نسبة الفقد فى الوزن الطازج للثمار ، معامل تلف الثمار ، معامل تلوين الثمار ، وتصاعدت القيم تدريجيا مع تعبئة الثمار فى (ب أ مثقب) ، ولكن اكبر القيم سجلت من الثمار المخزنة بدون تعبئة فى اكياس سواء فى فترة التخزين البارد أو فترة بقاءة بعد ذلك على الرف . ومع ذلك فإن الثمار الغير معبأه فى اكياس اعطت افضل النتائج من حيث اختبار التذوق بعد ٥ ، ٦ اسابيع من التخزين البارد . وكانت اسوأ الثمار فى اختبارات التذوق تلك المعبأه فى (ب أ غير مثقب) بعد تخزين بارد لمدة ٧ أسابيع . أما التعبئة فى (ب أ مثقب) فأعطى افضل النتائج فى اختبار التذوق بعد ٦ أسابيع من التخزين البارد وخلال بقاء الثمار على الرف وتظهر النتائج أيضا أن التعبئة فى الأكياس - عموماً - يزيد من صلابة الثمار ويقلل من الحموضة النشطة للعصير خلال فترة التخزين البارد ووجود الثمار بعد ذلك على الرف .