

## EVALUATION OF SOME RIPENING METHODS FOR PERSIMMON FRUITS

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### ABSTRACT

Persimmon fruits of six varieties and strains were picked at optimum picking stage from farms in Gharbia Governorate, and treated for ripening by ethyl alcohol (35%), sealed and wrapped in P.V.C., high-density polyethylene, in addition the traditional ripening treatment by calcium carbide as control. Objective of the study is a comparison among ripening methods in order to obtain fruits with good quality for consumers.

The obtained results indicated that packing Kaki fruits in sealed bags kept fruits in fresh conditions due to a minimum weight loss. Traditional ripening method by calcium carbide recorded the highest percentage of fruit decay. Among varieties, Warda fruits were the most resistant to storage conditions and to microbial decay. All ripening methods were effective in removing astringency and resulting in good taste fruits, but Bassateen 1 and 2 were the best in organoleptic notes. Tannins declined noticeably, especially by Ethyl alcohol treatment in the first year and P.V.C. wrapping in the second one. Tozuru kaki had the highest tannins after ripening. Generally, there was no significant change in total soluble solids by the end of storage. Tozuru kaki had the highest T.S.S.% in both seasons. Some minor fluctuations happened in fruit acidity content, which it is low by nature. These changes may be related to natural variability among fruits. There was an effective increase in red colour after storage compared to the start colour, for all treatments, as expressed by "a" colorimeter value and yellow color regressed expressed by "b" as colorimeter value, Tozuru kaki fruits showed the highest increase in redness and highest drop in yellow colour.

### INTRODUCTION

Persimmon or Kaki trees are well known fruit for its high nutritious quality. The fruit of the Japanese or Oriental persimmon (*Diospyros Kaki L.*) or simply Kaki, shows a wide variation in size, shape, and colour, as well as it broadly classified for horticultural purposes into two major groups. The first is Astringent in taste with a high content of tanins at harvest time, and the second is characterized by its sweet non-astringent taste by harvest time (Kitagawa and Glucina, 1987).

Persimmon fruit should be harvested at mature but not ripe stage, having the characterized colour of the variety and then subjected to a ripening treatment (Kader, 1994). The main problem facing kaki growers is that fruit does not ripe on the tree. Moreover, it does not ripe after a long time of storage at room temperature, and sometimes many fruits deteriorate before reaching ripening. Ripening treatments essentially aim to remove astringency taste (tanins destruction), (Watada, 1986); complete colour formation and tissues become soft (Seymour *et al*, 1993 and Romer *et al*, 2000).

Previous studies proved that ripening is accomplished after picking by certain treatments. An alcoholic solution applied on immature fruit to induce ripening (Kitagawa and Glucina, 1987). Gassing with CO<sub>2</sub> or with a certain dosage of ethylene gas can induce fruit ripening (Turk, 1993). In the mean time modified atmosphere packaging can be used to keep fruits in good quality and push them towards ripening, because of the formation of a high level of CO<sub>2</sub> gas inside the package due to fruit respiration and permeability mechanism of the package film itself, (Brackmann et al, 1999 and Lee yong et al, 2000).

Persimmon cultivated in Egypt, belongs to Japanese group, and includes a few varieties like Costata, Hachya, Warda and Tozuru gaki. Its acreage is 7000 feddans only. Fruit quality when was properly ripened is considered very fine (Wali, 1998).

The main objective of this research is to compare some methods on achieving a complete ripening and their effect on quality of some persimmon varieties grown in Egypt.

### MATERIALS AND METHODS

Kaki fruits of six varieties and strains, Tozuru gaki (New Zealand var.), Warda strain, Tamopan (Abu Takeya), Bassateen (1 and 2), and Vanilia strain were brought from Saad Basha and Meet Badr-Halawa districts in Gharbia Governorate, during seasons of 2000 and 2001.

Fruits were treated by three different ripening methods, in addition to the traditional method used locally, and taken as a control. Fruits afterwards were packaged in bags of 4.8-5.1 kg each and bags dimensions of 30X50 cm. Each treatment consists of ten replicates (ten bags). Details of treatments are listed below.

- 1- Fruits in flat cartons were pulverized by 35% ethanol solution and covered tightly for 2-3 hours, and then packed in polyethylene bags provided with many holes and transferred to cold store (0 °C).
- 2- Packaging fruit trays covered hermetically with a film of 30 thickness of polyvinyl chloride (P.V.C.)
- 3- Packaging of fruit sealed in high density polyethylene bags of 30 thickness (H.D.P.E.).
- 4- Traditional ripening method; fruits exposed to gaseous emanations of calcium carbide mixed with water (10gm + 40cm of water in a small closed space of 8m<sup>3</sup>) for 24 hour period, before removed to external conditions, and packing fruits in polyethylene holed bags, and transfer to cold store. This method was taken as a control to compare the effectiveness of the above-mentioned methods.

After one month of cold storage at 0 °C, all fruit packages were removed and kept in ambient conditions for 2 days, after which, the following parameters were evaluated.

- 1- Organoleptic note evaluation of the taste was carried out by a panel test at the start and the end of experiment to estimate the suitable note of taste depending upon absence of astringency, sugars and flesh

consistency. The results divided into 4 grade scale, Excellent (10-8); Good (7.9-6); hardly (5.9-4) the range value for acceptable (with a slight astringency and/or some flesh softness) and Unacceptable (clearly perceptible astringency and /or very soft flesh) values less than 4.

2-Tannins content was evaluated according to the method of Yeshajahu, and Clifton (1977).

3-Percentage of total soluble solids (T.S.S.%) of the flesh, were estimated by a digital refractometer "Abbe".

4-Acidity percentage of the flesh, was estimated by titration with a solution of (0.1)N NaOH.

5-Weight loss percentage calculated for each bag was recorded in both seasons as follows:

$$\text{Weight loss \%} = \frac{\text{Weight at time of sampling} - \text{The initial weight of fruit}}{\text{The initial weight of fruit}} \times 100$$

6-Percentage of spoiled fruit was estimated as completely soft or decayed fruits were removed and weighed.

7-Peel color was estimated by a hunter colorimeter to evaluate color evaluation by using "b", "a" values. "A" value measures a range of colours from green to red (minus "a" values indicate greenness and plus "a" values indicate redness). "B" value measures a range of colours from blue to yellow (minus "b" values indicate blueness and plus "b" values indicate yellowness).

## RESULT AND DISCUSSION

### 1- Organoleptic note

All ripening treatments yielded good results and there were no significant differences between them in both seasons. As organoleptic notes in Table (1) it was cleared that, fruits in high-density polyethylene (HDPE) had the highest score (8.63 in the first year and 8.48 in 2nd one), while P.V.C. packaged fruits had relatively the lowest score (8.34 for both seasons). However, among varieties, Bassateen1 and Bassateen2 enjoyed the best notes as they recorded an average of 9.06 in both years, while Vanilia recorded the lowest organoleptic note (7.92 and 7.70 in 1st and 2nd year). Bassateen1 and 2 had the lowest tannins percentage as indicated later and that may explain their excellent organoleptic quality.

### 2- Tannins percentage

As it's shown in Table (2), beginning from high tannin contents with an average of 2.62% 1st year and 2.75% 2nd year, Ethyl alcohol treated fruits enjoyed a noticeable decline in tannins with average of 0.82% in first year, while high-density polyethylene (HDPE) wrapped fruits had a slower decrease rate, recording a value of 1.5%. In the second year P.V.C. wrapping and HPDE bags recorded lower tannins values, (0.5% and 0.65%, respectively), compared to calcium carbide and ethyl alcohol

treatments (0.93% and 1.12%, respectively). Among varieties, Tozuru gaki, had the highest tannins content after ripening (1.30% 1st year and 1.34 2nd year). Vanilia had the lowest tannins content at the first year (0.94%) and Tamopan (Abu Takeya) at the second year with 0.41%.

### **3- Total soluble solids percentage (T.S.S.%)**

Total soluble solids in fruits slightly declined from an average at start value of 21.14% before storage, to loose 0.99% - 1.20% after storage. This can be explained by the percentage of soluble tannins that vanished during storage (Kitagawa and Glucina, 1987), but no significant differences were observed between treatments. Total soluble solids average values varied between 19.58% and 20.6%, by the end of storage. Fruits treated by ethyl alcohol and those packaged in P.V.C. had the highest T.S.S. by the end of storage (between 20.25% and 20.31%), followed by HDPE packaged fruit (19.96% and 19.67% 1st and 2nd year). Traditionally ripened fruits (by calcium carbide) had the least T.S.S. values (an average of 19.61% in both seasons) which may indicate a lower effectiveness on ripening compared to the other tested methods due perhaps to its basic reaction of generating acetylene which is less powerful in enhancing ripening than ethylene gas (Table 3). Tozuru gaki var. had the highest T.S.S. in both seasons (21.88% and 22.08%, respectively in 2000 and 2001). Other strains showed T.S.S. percentage turned between 19.16% and 20.01%.

### **4-Acidity percentage**

In most cases, acidity values compared to starting notes showed a slight change. Although statistical analysis showed significant differences as shown in Table (4), most of these differences is due to natural variability between fruits and to the changing climate and cultural practices from one year to the other. This was cleared from the different data tabulated for acidity % in fruit of tested varieties at start time. Bassateen1 fruit had the highest starting value (0.50% and 0.40% in 1st and 2nd years), and after ripening, its acidity percentage dropped markedly in all treatments and both seasons to score an average of 0.17% in 1st year and 0.15% in 2nd year). Fruits wrapped in P.V.C. bags gave the highest acidity in 1st year 0.30%, but second year it was for fruits wrapped in HDPE, with acidity of 0.28%. Fruits ripened traditionally by calcium carbide had the lowest acidity value in both years (0.19% and 0.16% in 1st and 2nd years, respectively).

### **5-Fruits weight loss**

In both seasons of study, the concerned results as shown in Table (5) clearly indicated that hermetically sealed Kaki fruits, lost weight lesser than those packed in holed bags (averaging a value of 9.37% and 9.34%, respectively for Calcium carbide ripening, 4.38% and 4.23, for Ethyl alcohol treatment).

**Table ( 1 ): Effect of ripening methods on organoleptic notes of persimmon varieties during 2000 and 2001 seasons.**

Treatments (A)	Variety (B)	Season 2000		Season 2001	
		Start	By end	Start	By end
Calcium Carbide (Control)	Warda	Astringency	8.07	Astringency	7.50
	Tamopan (Abu Takeya)	Astringency	7.50	Astringency	7.50
	Bassateen 1	Astringency	9.20	Astringency	9.20
	Bassateen 2	Astringency	9.20	Astringency	9.20
	Vanilia	Astringency	7.50	Astringency	7.50
	Tozuru gaki	Astringency	9.20	Astringency	9.20
Average		0.00	8.45	0.00	8.35
Ethyl Alcohol	Warda	Astringency	8.07	Astringency	8.06
	Tamopan (Abu Takeya)	Astringency	8.07	Astringency	8.06
	Bassateen 1	Astringency	9.20	Astringency	9.20
	Bassateen 2	Astringency	8.60	Astringency	9.20
	Vanilia	Astringency	7.50	Astringency	7.50
	Tozuru gaki	Astringency	8.60	Astringency	8.63
Average		0.00	8.34	0.00	8.44
P.V.C. Wrapping	Warda	Astringency	7.50	Astringency	7.50
	Tamopan (Abu Takeya)	Astringency	8.06	Astringency	8.06
	Bassateen 1	Astringency	9.20	Astringency	9.20
	Bassateen 2	Astringency	8.60	Astringency	9.20
	Vanilia	Astringency	8.06	Astringency	7.50
	Tozuru gaki	Astringency	8.63	Astringency	8.60
Average		0.00	8.34	0.00	8.34
H.D.P.E. Wrapping	Warda	Astringency	8.63	Astringency	8.63
	Tamopan (Abu Takeya)	Astringency	8.63	Astringency	8.06
	Bassateen 1	Astringency	8.63	Astringency	8.63
	Bassateen 2	Astringency	8.63	Astringency	8.63
	Vanilia	Astringency	8.63	Astringency	8.30
	Tozuru gaki	Astringency	8.63	Astringency	8.60
Average		0.00	8.63	0.00	8.48
Average year		0.00	8.44	0.00	8.40

L.S.D. at 5%                      A                      N.S.                      N.S.  
     A X B                      1.92                      1.57

Variety (B)	Average	
	Season 2000	Season 2001
Warda	8.07	7.92
Tamopan (Abu Takeya)	8.07	7.92
Bassateen 1	9.06	9.06
Bassateen 2	8.78	9.06
Vanilia	7.92	7.70
Tozuru gaki	8.77	8.78

L.S.D. at 5%                      N.S.                      N.S.

Table ( 2 ): Effect of ripening methods on tannins % content of some persimmon varieties during 2000 and 2001 seasons.

Treatments (A)	Variety (B)	Season 2000		Season 2001	
		Start	By end	Start	By end
Calcium Carbide (Control)	Warda	2.50	0.37	2.60	0.53
	Tamopan (Abu Takeya)	3.40	1.37	3.40	0.63
	Bassateen 1	4.40	0.77	4.20	0.63
	Bassateen 2	1.70	0.70	2.40	0.90
	Vanilia	2.20	1.47	2.30	1.50
	Tozuru gaki	1.50	1.70	1.60	1.40
Average		2.62	1.06	2.75	0.93
Ethyl Alcohol	Warda	2.50	0.23	2.60	1.27
	Tamopan (Abu Takeya)	3.40	0.77	3.40	0.53
	Bassateen 1	4.40	1.47	4.20	1.33
	Bassateen 2	1.70	0.63	2.40	0.77
	Vanilia	2.20	0.50	2.30	1.33
	Tozuru gaki	1.50	1.33	1.60	1.50
Average		2.62	0.82	2.75	1.12
P.V.C. Wrapping	Warda	2.50	1.57	2.60	0.33
	Tamopan (Abu Takeya)	3.40	1.43	3.40	0.23
	Bassateen 1	4.40	0.93	4.20	0.26
	Bassateen 2	1.70	1.50	2.40	0.73
	Vanilia	2.20	0.90	2.30	0.23
	Tozuru gaki	1.50	0.90	1.60	1.20
Average		2.62	1.21	2.75	0.50
H.D.P.E. Wrapping	Warda	2.50	1.50	2.60	0.37
	Tamopan (Abu Takeya)	3.40	1.67	3.40	0.23
	Bassateen 1	4.40	1.83	4.20	1.16
	Bassateen 2	1.70	1.80	2.40	0.70
	Vanilia	2.20	0.90	2.30	0.20
	Tozuru gaki	1.50	1.27	1.60	1.26
Average		2.62	1.50	2.75	0.65
Average year		2.62	1.15	2.75	0.80

L.S.D. at 5%      A      0.11      0.09  
                           A X B      0.32      N.S.

Variety (B)	Average	
	Season 2000	Season 2001
Warda	0.92	0.83
Tamopan (Abu Takeya)	1.31	0.41
Bassateen 1	1.25	0.85
Bassateen 2	1.16	0.78
Vanilia	0.94	0.82
Tozuru gaki	1.30	1.34

L.S.D. at 5%      N.S.      0.11

Table ( 3 ): Effect of ripening methods on T.S.S.% content of some persimmon varieties during 2000 and 2001 seasons.

Treatments (A)	Variety (B)	Season 2000		Season 2001	
		Start	By end	Start	By end
Calcium Carbide (Control)	Warda	20.00	20.50	22.60	18.63
	Tamopan (Abu Takeya)	21.90	18.90	21.90	18.86
	Bassateen 1	21.20	20.17	21.20	20.43
	Bassateen 2	22.00	19.00	22.30	19.90
	Vanilia	19.50	18.33	19.30	18.33
	Tozuru gaki	22.20	21.00	19.60	21.33
Average		21.13	19.65	21.15	19.58
Ethyl Alcohol	Warda	20.00	21.00	22.60	19.33
	Tamopan (Abu Takeya)	21.90	20.33	21.90	20.33
	Bassateen 1	21.20	17.33	21.20	17.33
	Bassateen 2	22.00	20.50	22.30	20.50
	Vanilia	19.50	21.67	19.30	21.67
	Tozuru gaki	22.00	22.83	19.60	22.33
Average		21.10	20.61	21.15	20.25
P.V.C. Wrapping	Warda	20.00	21.36	22.60	20.17
	Tamopan (Abu Takeya)	21.90	20.60	21.90	20.50
	Bassateen 1	21.20	20.00	21.20	20.33
	Bassateen 2	22.00	19.33	22.30	19.67
	Vanilia	19.50	19.00	19.30	18.83
	Tozuru gaki	22.20	21.67	19.60	22.33
Average		21.13	20.33	21.15	20.31
H.D.P.E. Wrapping	Warda	20.00	19.83	22.60	18.50
	Tamopan (Abu Takeya)	21.90	20.33	21.90	20.33
	Bassateen 1	21.20	20.00	21.20	19.67
	Bassateen 2	22.00	19.60	22.30	19.17
	Vanilia	19.50	18.00	19.30	18.00
	Tozuru gaki	22.20	22.00	19.60	22.33
Average		21.13	19.96	21.15	19.67
Average year		21.13	20.14	21.15	19.95

L.S.D. at 5%                      A                      N.S.                      N.S.  
     A X B                      N.S.                      N.S.

Variety (B)	Average	
	Season 2000	Season 2001
Warda	20.87	19.18
Tamopan (Abu Takeya)	20.04	20.01
Bassateen 1	19.38	19.44
Bassateen 2	19.81	19.81
Vanilia	19.25	19.21
Tozuru gaki	21.88	22.08
L.S.D. at 5%		1.66                      1.51

Table ( 4 ): Effect of ripening methods on acidity % content of some persimmon varieties during 2000 and 2001 seasons.

Treatments (A)	Variety (B)	Season 2000		Season 2001	
		Start	By end	Start	By end
Calcium Carbide (Control)	Warda	0.20	0.37	0.20	0.13
	Tamopan (Abu Takeya)	0.15	0.15	0.18	0.13
	Bassateen 1	0.50	0.11	0.40	0.13
	Bassateen 2	0.17	0.24	0.20	0.28
	Vanilia	0.30	0.13	0.18	0.13
	Tozuru gaki	0.12	0.13	0.17	0.13
Average		0.24	0.19	0.22	0.16
Ethyl Alcohol	Warda	0.20	0.35	0.20	0.13
	Tamopan (Abu Takeya)	0.15	0.15	0.18	0.13
	Bassateen 1	0.50	0.13	0.40	0.13
	Bassateen 2	0.17	0.24	0.20	0.29
	Vanilia	0.13	0.15	0.18	0.13
	Tozuru gaki	0.20	0.41	0.17	0.13
Average		0.23	0.24	0.22	0.16
P.V.C. Wrapping	Warda	0.20	0.37	0.20	0.13
	Tamopan (Abu Takeya)	0.15	0.37	0.18	0.13
	Bassateen 1	0.50	0.32	0.40	0.13
	Bassateen 2	0.17	0.34	0.20	0.29
	Vanilia	0.13	0.14	0.18	0.13
	Tozuru gaki	0.20	0.27	0.17	0.13
Average		0.23	0.30	0.22	0.16
H.D.P.E. Wrapping	Warda	0.20	0.38	0.20	0.33
	Tamopan (Abu Takeya)	0.15	0.07	0.18	0.11
	Bassateen 1	0.50	0.11	0.40	0.21
	Bassateen 2	0.17	0.38	0.20	0.37
	Vanilia	0.13	0.30	0.18	0.26
	Tozuru gaki	0.20	0.42	0.17	0.42
Average		0.23	0.28	0.22	0.28
Average year		0.23	0.25	0.22	0.19

L.S.D. at 5%                      A                      0.11                      0.03  
     A X B                      1.92                      0.07

Variety (B)	Average	
	Season 2000	Season 2001
Warda	0.37	0.18
Tamopan (Abu Takeya)	0.19	0.13
Bassateen 1	0.17	0.15
Bassateen 2	0.30	0.31
Vanilia	0.18	0.16
Tozuru gaki	0.31	0.20

L.S.D. at 5%                      N.S.                      N.S.



Table (5): Effect of ripening methods on weight loss percentage of some persimmon varieties during 2000 and 2001 seasons.

Treatments (A)	Variety (B)	Season 2000		Season 2001	
		Start	By end	Start	By end
Calcium Carbide (Control)	Warda	0.00	9.90	0.00	9.93
	Tamopan (Abu Takeya)	0.00	9.68	0.00	10.00
	Bassateen 1	0.00	10.05	0.00	10.00
	Bassateen 2	0.00	9.08	0.00	9.00
	Vanilia	0.00	9.42	0.00	9.33
	Tozuru gaki	0.00	8.10	0.00	7.80
Average		0.00	9.37	0.00	9.34
Ethyl Alcohol	Warda	0.00	9.45	0.00	9.50
	Tamopan (Abu Takeya)	0.00	3.56	0.00	3.20
	Bassateen 1	0.00	3.11	0.00	2.67
	Bassateen 2	0.00	2.89	0.00	2.67
	Vanilia	0.00	3.05	0.00	3.00
	Tozuru gaki	0.00	4.22	0.00	4.33
Average		0.00	4.38	0.00	4.23
P.V.C. Wrapping	Warda	0.00	1.22	0.00	1.30
	Tamopan (Abu Takeya)	0.00	1.11	0.00	1.00
	Bassateen 1	0.00	0.25	0.00	0.10
	Bassateen 2	0.00	0.21	0.00	0.23
	Vanilia	0.00	1.01	0.00	1.07
	Tozuru gaki	0.00	0.42	0.00	0.40
Average		0.00	0.70	0.00	0.68
H.D.P.E. Wrapping	Warda	0.00	0.38	0.00	0.40
	Tamopan (Abu Takeya)	0.00	1.42	0.00	1.50
	Bassateen 1	0.00	0.89	0.00	1.00
	Bassateen 2	0.00	0.80	0.00	0.70
	Vanilia	0.00	0.40	0.00	0.37
	Tozuru gaki	0.00	1.76	0.00	1.80
Average		0.00	0.94	0.00	0.96
Average year		0.00	3.85	0.00	3.80

L.S.D. at 5%

A  
A X B

0.63  
1.55

0.62  
1.51

Variety (B)	Average	
	Season 2000	Season 2001
Warda	3.94	3.93
Tamopan (Abu Takeya)	3.58	3.44
Bassateen 1	3.25	3.15
Bassateen 2	3.47	3.44
Vanilia	3.63	3.58
Tozuru gaki	3.85	3.80

L.S.D. at 5%

0.79

0.76

While completely Kaki sealed P.V.C. packages and high-density polyethylene sealed bags were recorded 0.70% and 0.94 % weight losses in the 1st season and 0.68% and 0.96% weight losses in the 2nd season, respectively. Warda kaki fruits in holed bags recorded the highest loss weight (9.90% and 9.93%) for Calcium carbide treated fruits, and (9.45% and 9.50%) for ethyl alcohol treated fruit, in 1st and 2nd years, respectively. These results prove the importance of using sealed bags to alleviate water loss from fruits and keep them in a fresh appearance.

#### **6-Percentage of decayed fruits**

Calcium carbide treatments resulted in more decayed fruits by end of storage in both seasons (10.66 % and 11.01 %, respectively), while fruits P.V.C. packed had the least decay percentage (1.80 % and 3.06 % 1st and 2nd season). Ethyl alcohol treatment resulted in 2.76% and 2.89% of decayed fruits in both seasons, while polyethylene packaged fruits had about 4.03% and 3.95% of decayed fruits. Warda fruits had the lowest spoiled fruits (about 1.88% and 1.99% in 1st and 2nd seasons, respectively). In the same time, Abu Takeya variety was more vulnerable to decay and severe softening, having an average of 8.17% and 8.66% of decay fruits in 1st and 2nd seasons, respectively (Table 6).

#### **7-fruits colour changes**

As it's shown in table (7), in all cases "a" values had been increased compared to the start value. The highest increase was associated with calcium carbide treatment (15.3 at start, and an average of 31.2 by end, irrespective of varieties). The increase in positive "a" values indicate an increase in redness. Fruits in High-density polyethylene wrapping had the lowest increase in average "a" value (22.8). Among varieties (and strains), Tozuru gaki had the highest "a" average value (37.6).

In opposition to "a" values, the "b" values decreased constantly in all cases. That means destruction of yellow carotenoid pigments and synthesis of red anthocyanins. Starting at an average "b" value of (51.8), all fruits by the end of storage, had lower values in the average ranging from 35.6 to 36.8.

Vanilia and Tozuru gaki especially, showed the biggest drop in "b" value (64.2) at start for Vanilia, reaching an average of 37.6, while Tozuru gaki had a "59.7" value of "b" at start, to reach 28.9 by end of storage, which means that their yellow color at start had changed to a more reddish one.

### **CONCLUSION**

The four ripening methods under investigation were effective in removing astringency from persimmon fruits and bestowing them a good organoleptic note. Ethyl alcohol at 35% and P.V.C wrapping gave the best results. Keeping fruits in completely sealed bags reduce significantly weight loss, while conventional ripening method using calcium carbide increased decayed fruit percentage. Fruit colour changed to more reddish and less yellowish tint after ripening and cold storage especially with Tozuru gaki variety.

Table ( 6 ): Effect of ripening methods on decayed fruits % of some persimmon varieties during 2000 and 2001 seasons.

Treatments (A)	Variety (B)	Season 2000		Season 2001	
		Start	By end	Start	By end
Calcium Carbide (Control)	Warda	0.00	4.73	0.00	4.40
	Tamopan (Abu Takeya)	0.00	23.00	0.00	23.87
	Bassateen 1	0.00	12.00	0.00	12.00
	Bassateen 2	0.00	0.90	0.00	1.10
	Vanilia	0.00	14.00	0.00	15.50
	Tozuru gaki	0.00	9.33	0.00	9.17
Average		0.00	10.66	0.00	11.01
Ethyl Alcohol	Warda	0.00	0.27	0.00	0.30
	Tamopan (Abu Takeya)	0.00	2.67	0.00	3.10
	Bassateen 1	0.00	6.67	0.00	6.67
	Bassateen 2	0.00	3.67	0.00	3.93
	Vanilia	0.00	2.33	0.00	2.33
	Tozuru gaki	0.00	0.93	0.00	1.00
Average		0.00	2.76	0.00	2.89
P.V.C. Wrapping	Warda	0.00	2.00	0.00	2.67
	Tamopan (Abu Takeya)	0.00	3.67	0.00	4.67
	Bassateen 1	0.00	1.00	0.00	1.33
	Bassateen 2	0.00	0.80	0.00	5.67
	Vanilia	0.00	2.33	0.00	3.00
	Tozuru gaki	0.00	1.00	0.00	1.00
Average		0.00	1.80	0.00	3.06
H.D.P.E. Wrapping	Warda	0.00	0.50	0.00	0.57
	Tamopan (Abu Takeya)	0.00	3.33	0.00	3.00
	Bassateen 1	0.00	1.00	0.00	1.00
	Bassateen 2	0.00	3.67	0.00	3.67
	Vanilia	0.00	7.00	0.00	6.67
	Tozuru gaki	0.00	8.57	0.00	8.77
Average		0.00	4.03	0.00	3.95
Average year		0.00	4.81	0.00	5.22
L.S.D. at 5%		A		0.93	
		A X B		3.73	
				0.95	
				3.76	

Variety (B)	Average		
	Season 2000	Season 2001	
Warda	1.88	1.99	
Tamopan (Abu Takeya)	8.17	8.66	
Bassateen 1	5.17	5.25	
Bassateen 2	2.26	3.59	
Vanilia	6.42	6.88	
Tozuru gaki	4.98	4.99	
L.S.D. at 5%		1.65	1.67

Table (7): Effect of ripening methods on color a & b values of hunter tristimulus colorimeter of some persimmon varieties during 2000 and 2001 seasons.

Treatments (A)	Variety (B)	Season 2000				Season 2001			
		a value		b value		a value		b value	
		Start	By end	Start	By end	Start	By end	Start	By end
Calcium Carbide (control)	Warda	18.90	16.00	43.21	42.00	19.00	15.90	43.67	41.67
	Tamopan (Abu Takcya)	7.10	26.50	43.55	46.01	7.00	26.63	43.67	45.30
	Bassateen 1	23.80	37.77	50.89	34.90	24.00	37.67	51.00	35.20
	Bassateen 2	20.01	36.44	49.00	35.73	20.00	36.73	48.00	35.83
	Vanilia	17.20	31.00	64.44	29.00	17.00	31.20	64.67	29.17
	Tozuru gaki	4.70	39.76	59.80	33.42	4.80	39.33	59.77	33.77
Average		15.29	31.25	51.82	36.84	15.30	31.24	51.80	36.82
Ethyl Alcohol	Warda	18.90	19.65	43.21	33.01	19.00	19.47	43.67	32.53
	Tamopan (Abu Takcya)	7.10	22.05	43.55	34.62	7.00	21.60	43.67	34.80
	Bassateen 1	23.80	17.09	50.89	40.52	24.00	17.13	51.00	40.73
	Bassateen 2	20.01	20.60	49.00	44.43	20.00	20.97	48.00	44.90
	Vanilia	17.20	31.61	64.44	36.99	17.00	31.53	64.67	37.73
	Tozuru gaki	4.70	36.42	59.80	25.01	4.80	36.60	59.77	24.43
Average		15.29	24.57	51.82	35.76	15.30	24.55	51.80	35.85
P.V.C. Wrapping	Warda	18.90	20.32	43.21	36.56	19.00	20.87	43.67	37.07
	Tamopan (Abu Takcya)	7.10	24.20	43.55	36.00	7.00	24.23	43.67	35.80
	Bassateen 1	23.80	21.55	50.89	35.46	24.00	21.73	51.00	35.37
	Bassateen 2	20.01	20.00	49.00	30.00	20.00	19.83	48.00	29.10
	Vanilia	17.20	14.44	64.44	44.21	17.00	14.23	64.67	45.00
	Tozuru gaki	4.70	39.01	59.80	32.02	4.80	38.87	59.77	31.10
Average		15.29	23.25	51.82	35.71	15.30	23.29	51.80	35.57
H.D.P.E. Wrapping	Warda	18.90	20.53	43.21	41.88	19.00	20.67	43.67	42.53
	Tamopan (Abu Takcya)	7.10	17.56	43.55	34.01	7.00	17.57	43.67	33.87
	Bassateen 1	23.80	21.86	50.89	36.22	24.00	22.37	51.00	36.37
	Bassateen 2	20.01	25.49	49.00	37.50	20.00	25.57	48.00	37.53
	Vanilia	17.20	16.00	64.44	39.01	17.00	15.30	64.67	38.63
	Tozuru gaki	4.70	35.44	59.80	26.55	4.80	35.43	59.77	26.37
Average		15.29	22.81	51.82	35.86	15.30	22.82	51.80	35.88
Average year		15.29	25.47	51.82	36.04	15.30	25.48	51.80	36.03

L.S.D. at 5%      A                      2.24                      2.55                      2.22                      2.51  
                           A X B                      5.48                      6.24                      5.42                      6.20

Variety (B)	Average								
	Season 2000				Season 2001				
	Start		By end		Start		By end		
Warda	a value	b value	a value	b value	a value	b value	a value	b value	
Tamopan (Abu Takeya)	18.90	43.21	19.13	38.36	19.00	43.67	19.23	38.45	
Bassateen 1	7.10	43.55	22.58	37.66	7.00	43.67	22.51	37.44	
Bassateen 2	23.80	50.89	24.57	36.78	24.00	51.00	24.73	36.92	
Vanilia	20.01	49.00	25.63	36.92	20.00	48.00	25.78	36.84	
Tozuru gaki	17.20	64.44	23.26	37.30	17.00	64.67	23.07	37.83	
L.S.D. at 5 %		4.70	59.80	37.66	29.25	4.80	59.77	37.56	28.92
L.S.D. at 5 %		2.78    3.14		2.74    3.12					

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### تقييم بعض طرق إنضاج الكاكي

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تهدف هذه الدراسة الى التعرف على تأثير بعض طرق إنضاج الكاكي على جودة الثمار حتى تصل الى المستهلك بحالة جيدة للاكل.

جمعت ثمار ستة أصناف وسلالات من الكاكي هي وردة و تاموبان (ابو طاقية) وبساتين ١ وبساتين ٢ وفانيليا وتوزورو جاكى قطفت في المرحلة المثلى للتلطف من مزارع سعد باشا وميت بدر حلاوة بمحافظة الغربية، وعوملت الثمار من أجل إنضاجها بكحول الإيثيل (٠.٣٥٪)، والتغليظ بالبولى فينيل كلورايد (سمك ٢٠ ميكرون) او البولى ايثيلين على الكثافة (سمك ٢٠ ميكرون) بالإضافة الى المعاملة بالطريقة التقليدية لإنضاج الكاكي (كربيد الكالسيوم) كمقارنة.

تغليظ الثمار فى عبوات مغلقة من البولى ايثيل كلورايد او البولى ايثيلين على الكثافة كان له اكبر الاثر فى المحافظة على نضارة الثمار وذلك لإنخفاض نسبة الفقد فى وزن الثمار الى الحد الأدنى بينما الطريقة التقليدية لإنضاج الكاكي بكربيد الكالسيوم أدت الى اعلى زيادة فى نسبة الثمار التالفة. مما على مستوى الاصناف والسلالات، اوضح الصنف وردة اعلى مقاومة لظروف التخزين وعوامل التلف الميكروبية.

جميع طرق الإنضاج تحت الدراسة كانت فعالة فى إزالة المادة القابضة من الثمار وانتجت ثمار ذات مذاق جيد لجميع الاصناف والسلالات تحت الدراسة، وكان افضل الاصناف مذاقا بساتين ١ وبساتين ٢ والملاحظ ان المعاملة بكحول الايثيل (الموسم الاول) والتغليظ بالبولى فينيل كلورايد (الموسم الثانى) اكثر فاعلية فى إزالة التانينات، بينما احتوى الصنف توزورو جاكى على اعلى نسبة تانينات بعد الإنضاج.

وعلى وجه العموم لم توجد اى فروق معنوية فى التغيرات التى حدثت لمحتوى الثمار من المواد الصلبة الذائبة الكلية وسجل الصنف توزورو جاكى اعلى نسبة منها فى كل من موسمى الدراسة. ومن ناحية اخرى حدث تذبذب طفيف نسي محتوى الثمار من الحموضة يرجع الى التباين الطبيعي بين ثمار الاصناف فى محتواها من الحموضة.

أدت جميع معاملات الإنضاج الى زيادة واضحة فى اللون الاحمر للثمار فى نهاية الفترة التخزينية مقارنة بلون الثمار قبل التخزين والتي عبرت عنها بـ "٣" او "٤" اعلى جهاز قياس الالوان "هانتر"، وسجل الصنف توزورو جاكى اعلى زيادة فى كثافة اللون الاحمر واقل كثافة فى اللون الاصفر.