

EFFECT OF PICKING DATE AND STORAGE PERIOD ON SOME FRUIT QUALITY PARAMETERS OF PERSIMMON "*Diospyrus kaki*" DURING COLD STORAGE

El-Morsy, A.A.*; M.M. El-Ansary*; S.A. Dawood**; M.H. Abdel-Aziz**

* Hort. Dept., Fac. Agric., Kafr El-Sheikh, Tanta Univ., Egypt

** Hort. Res. Instit., Agric. Res. Center, Sakha, Egypt

ABSTRACT

This work was carried out during 1998/1999 and 1999/2000 seasons to study the effect of picking date of "Triumph" and "Costata" persimmon on some quality attributes during cold storage for 8 weeks at 1°C & 85-90% R.H. Fruits were harvested after 146, 153, 160, 167 days, and 158, 165, 172, 179 days from full bloom for "Costata" and "Triumph" cvs., respectively. Periodical sampling during storage indicated that weight loss % increased as time progressed in storage, and this was significantly higher in "Triumph" than "Costata" cv. It was also found that total acidity, firmness, vitamin C content, tannin content and total chlorophyll content decreased as maturity progressed and with time in storage. However, fruit SSC % and carotene content increased in the later harvesting dates as well as during storage. It could be concluded that the best picking date for "Costata" and "Triumph" cvs. under the conditions of this experiment is 167 and 179 days from full bloom, respectively. This will achieve best postharvest fruit quality.

INTRODUCTION

Persimmon (*Diospyrus kaki*) has been cultivated in the Mediterranean basin for more than a century (Morton, 1987). In Egypt, the total fruitful area of this fruit is 1029 feddans with total production of 4271 tons as shown in the Agricultural Economics Annual Report (1998).

The future of persimmon depends on the selection of high quality cultivars and specific marketing techniques to ensure a firm non-astringent fruit reaching the consumer (George and Nissen, 1990). One of the most critical handling points of any commercial fruit operation is harvest. Mistakes made at harvest will be reflected and magnified down the line. This emphasizes the importance of harvesting at maturity stage where quality can be best maintained (Gast, 1994).

Persimmon is a climacteric fruit (Turk, 1993). Softening of the fruit coincide with the climacteric rise in CO₂ evolution. This takes place between 20-30 days after harvest at 20°C. During fruit ripening, soluble solid content (SSC) and carotenoids increased (Forbus *et al.*, 1991 and Senter *et al.*, 1991). Moreover, tannin content decreased as maturity stage advanced (El-Azab *et al.*, 1994). Also, fruit firmness decreased with progress of ripening (Senter *et al.*, 1991; Forbus *et al.*, 1991 and Turk, 1993).

The objective of this work was to study the effect of picking date on some quality attributes of "Triumph" and "Costata" cvs. and their subsequent behaviour during cold storage.

MATERIALS AND METHODS

This work was carried out during 1998/1999 and 1999/2000. Seven years old, healthy and as uniform as possible in both vegetative growth and fruit load "Costata" and "Triumph" persimmon trees grafted on *Diospyros lotus* rootstock were selected. Cultural practices, as recommended by the Ministry of Agriculture for persimmon were followed. Date of full bloom was determined.

Fruits for this work were harvested from the selected trees at 4 different picking dates, i.e., 146, 153, 160, 167 days for "Costata" and 158, 165, 172, 179 days from full bloom for "Triumph" cultures during the two seasons.

About 300 mature, sound persimmon fruits of each cultivar were selected at each picking date. Fruits were harvested and transferred into laboratory, washed using 10% chlorax solution, air dried then packed in carton boxes where each one contained 60 fruits (3 replicates, 20 fruits each) and then stored at 1°C and 85-90% R.H. for 8 weeks. Sampling schedule was as follows: at picking date (zero storage time), and after 2, 4, 6, 8 weeks in cold storage. Each of these dates were represented by two cartons for analysis, one of each cultivar. The following parameters were determined.

Physical characters:

Weight loss: 10 fruits/carton were marked and their weight determined before and after storage at different periods and weight loss percentage (WLP) was calculated as follows:

$$WLP = \frac{\text{Fruit wt. at zero time} - \text{wt. after storage}}{\text{wt. at zero time}}$$

Fruit firmness was measured on the two opposite sides of fruit using Effige penterometer, 8 mm probe and data were recorded in Lbf.

Chemical characters:

Soluble solid content (SSC%) was determined in the juice after tannin precipitation using polyethylene glycol (PEG) (Sugira *et al.*, 1993). Acidity %, soluble tannin content, and vitamin C were determined as described in the A.O.A.C. methods (1980).

Total chlorophyll and carotene content were determined as mg/100 gm fruit fresh wt. according to the method of Wettstein (1957).

The obtained data in the present work was statistically analyzed by using the analysis of variance method as a randomized complete block design according to Snedecor and Cochran (1967) and means were compared according to Duncan (1955).

RESULTS AND DISCUSSION

Physical characters:

Weight loss percentage:

Data in Table (1) showed that fruit weight loss percentage of both "Costata" and "Triumph" cultivars continuously increased as time advanced in storage at 1°C + 85-90% R.H. Highest weight loss percentage was that after 8 weeks in storage.

Moreover, it could also be seen from the same table that weight loss percentage of "Triumph" cultivar was higher than that of "Costata" during both seasons. These results are in agreement with those of El-Azab *et al.* (1994) on "Coststa" persimmon.

Regarding the effect of picking dates on weight loss percentage data showed that lowest values for "Triumph" was observed in the second picking dates for both seasons. However, for "Costata" cv. the lowest weight loss percentage was observed in the third harvesting date in the first season, while this was in the first harvesting date in the second one. Senter *et al.* (1991) reported that the highest weight loss during cold storage of "Fuyu" persimmon was observed in the third stage of fruit development.

Table (1): Effect of picking date and storage period at 1°C and 85-90 % RH. on fruit weight loss percentage and firmness of "Costata" and "Triumph" persimmon cultivars.

Storage period	Weight loss (%)				Firmness (Lbf)			
	1998/1999		1999/2000		1998/1999		1999/2000	
	Costata	Triumph	Costata	Triumph	Costata	Triumph	Costata	Triumph
1st Picking date								
0 time					22.48 a	22.20 a	17.18 a	17.47 a
2 weeks	1.31 d	1.41 c	1.03 d	1.25 c	19.96 b	21.82 a	16.82 ab	15.14 b
4 weeks	1.89 c	2.02 b	1.49 c	2.63 b	19.56 b	20.83 ab	16.08 b	13.95 c
6 weeks	2.45 b	3.35 a	2.53 b	2.76 b	18.67 b	19.76 b	14.28 c	13.23 cd
8 weeks	3.25 a	3.47 a	3.17 a	4.07 a	14.82 c	16.25 c	13.95 c	12.88 d
Mean	2.23 B	2.56 B	2.06 B	2.68 B	19.10 A	20.17 A	15.66 A	14.53 A
2nd Picking date								
0 time					21.85 a	22.25 a	16.77 a	17.09 a
2 weeks	0.99 d	1.37 d	1.12 d	1.43 d	20.23 b	22.17 a	15.57 b	14.65 b
4 weeks	1.74 c	2.02 c	1.71 c	2.54 c	17.98 c	20.93 a	14.95 b	13.71 b
6 weeks	2.41 b	2.61 b	2.66 b	3.19 b	17.99 c	17.08 b	13.43 c	14.66 b
8 weeks	3.31 a	3.09 a	3.37 a	3.48 a	18.13 c	14.07 c	13.10 c	13.63 b
Mean	2.11 C	2.27 C	2.22 A	2.66 B	19.24 A	19.30 B	14.76 B	14.75 A
3rd Picking date								
0 time					20.68 a	22.82 a	14.09 a	14.25 b
2 weeks	1.04 d	1.51 d	1.10 d	1.66 d	19.98 ab	18.75 b	13.84 ab	16.33 a
4 weeks	1.74 c	2.37 c	1.75 c	2.59 c	20.42 ab	18.66 b	13.18 ab	13.70 b
6 weeks	2.43 b	3.17 b	2.65 b	3.15 b	19.18 bc	17.64 bc	12.85 b	13.25 b
8 weeks	2.93 a	3.73 a	2.92 a	4.01 a	17.97 c	16.52 c	11.78 c	12.14 c
Mean	2.04 D	2.70 A	2.11 B	2.85 A	19.65 A	18.88 B	13.15 C	19.93 B
4th Picking date								
0 time					19.85 a	21.62 a	13.23 a	12.93 a
2 weeks	1.13 d	1.42 d	1.23 d	1.42 d	19.16 ab	16.42 b	10.62 b	10.90 b
4 weeks	2.18 c	2.08 c	2.10 c	2.63 c	18.07 bc	15.14 bc	10.43 b	10.77 b
6 weeks	2.47 b	2.71 b	2.44 b	3.52 b	16.79 cd	14.12 c	9.61 b	10.64 b
8 weeks	3.43 a	3.83 a	3.11 a	3.74 a	16.05 d	14.80 c	4.58 c	10.23 b
Mean	2.30 A	2.51 B	2.22 A	2.83 A	17.98 B	16.42 C	9.69 D	11.09 C

In a column under each picking date, means followed by a common small letter are not significantly different at the 5% level by DMRT.

In a column means of each picking date followed by a common capital letter are not significantly different at the 5% level by DMRT.

Fruit firmness:

Data in Table (1) showed that, in the first season, there were no significant differences in “Costata” fruit firmness for the 1st, 2nd and 3rd picking dates, while fruits of the 4th picking date showed significantly lower fruit firmness. In the mean time, the differences in the second season were significant within the four picking dates.

It could also be seen that fruit firmness of “Costata” and “Triumph” persimmon gradually decreased as storage period advanced. Moreover, fruit firmness of both cultivars gradually decreased over the picking period. During and at the end of the storage period, fruits of late harvest (3rd and 4th) had the lowest firmness.

Similar results were reported by Senter *et al.* (1991) for several persimmon cultivars. They found that firmness declined significantly as fruit maturity and ripening progressed.

Chemical characteristics:

Soluble solids content (SSC%):

Data of Table (2) indicated that generally SSC% increased with increasing the storage period. The same trend was also observed as maturity of fruits progressed. The differences of SSC% of the juice after tannin precipitation within the four picking dates were significant in both seasons for “Costata” cultivar. As for “Triumph” cultivar, in the first season, it was found that the difference between the 1st picking date and each of the 2nd, 3rd and 4th was significant. The differences were also significant between the 2nd and 4th picking dates. In the second season, it was found that fruits of the 3rd and 4th picking dates had significantly higher SSC% than those of 1st on 2nd dates.

These results are in agreement with those reported by Rouhani *et al.* (1975) and Senter *et al.* (1991) who reported that the SSC% increased as maturity of persimmon advanced.

Total acidity content:

Data in Table (2) showed that during the harvesting period, the titratable acidity of “Costata” and “Triumph” persimmon cultivars mostly decreased as fruits became more mature from the 1st to 4th picking date.

Data also showed that, during cold storage at 1°C, all picking dates showed similar trend with respect to titratable acidity of fruit. There was a general decrease as the storage period advanced.

These results are in agreement with those of Rouhani *et al.* (1975) and El-Azab *et al.* (1994) who found that acidity of persimmon fruits decreased as maturity progressed. However, it was found by Ben-Arie and Guelfat-Reich (1973), Senter *et al.* (1991) and Sourial *et al.* (1993a), that acidity content of persimmon fruits did not significantly change during storage which is in contradiction to the data reported here.

Table(2): Effect of picking dates and storage period at 1°C and 85-90 % RH. on fruit SSC% and acidity% of “Costata” and “Triumph” persimmon cultivars.

Storage period	SSC (%)				Acidity (%)			
	1998/1999		1999/2000		1998/1999		1999/2000	
	Costata	Triumph	Costata	Triumph	Costata	Triumph	Costata	Triumph
1st Picking date								
0 time	11.80 b	15.54 c	12.07 c	14.40 c	0.56 a	0.48 a	0.56 a	0.41 a
2 weeks	13.54 a	15.74 c	12.80 bc	15.54 b	0.52 b	0.41 b	0.53 ab	0.36 b
4 weeks	13.66 a	16.06 bc	13.20 b	15.60 b	0.57 a	0.35 d	0.53 ab	0.41 a
6 weeks	14.20 a	16.74 ab	14.20 a	15.86 ab	0.43 c	0.37 c	0.51 b	0.25 c
8 weeks	14.34 a	17.14 a	14.94 a	16.74 a	0.42 c	0.41 b	0.33 c	0.25 c
Mean	13.51 A	16.24 A	13.44 A	15.63 A	0.50 A	0.40 A	0.49A	0.34A
2nd Picking date								
0 time	13.80 b	16.54 b	13.20 c	15.20 c	0.49 a	0.36 a	0.46 b	0.43 a
2 weeks	14.34 b	17.20 b	14.80 b	15.80 bc	0.46 b	0.33 b	0.52 a	0.37 b
4 weeks	14.46 b	17.20 b	15.00 ab	16.00 abc	0.46 b	0.30 c	0.51 a	0.25 c
6 weeks	14.60 b	19.00 a	15.34 ab	16.54 ab	0.40 c	0.22 d	0.44 b	0.24 c
8 weeks	15.46 a	19.66 a	15.74 a	16.86 a	0.38 d	0.19 e	0.43 b	0.24 c
Mean	14.53 B	17.92 B	14.82 B	16.08 A	0.44 C	0.28 C	0.47 B	0.31 B
3rd Picking date								
0 time	14.06 b	17.26 c	14.60 c	16.34 d	0.44 c	0.34 a	0.49 a	0.37 a
2 weeks	14.20 b	18.06 b	15.60 b	17.60 c	0.43 c	0.35 a	0.37 b	0.37 a
4 weeks	14.40 b	18.46 b	15.86 ab	19.00 b	0.43 c	0.31 b	0.38 b	0.35 a
6 weeks	15.40 a	18.80 ab	16.26 ab	19.20 b	0.51 b	0.31 b	0.35 b	0.23 b
8 weeks	15.86 a	19.46 a	16.74 a	20.22 a	0.56 a	0.23 c	0.34 b	0.21 b
Mean	14.78 B	18.41 BC	15.81 C	18.47 B	0.47 B	0.31 B	0.39 C	0.31 B
4th Picking date								
0 time	16.74 c	17.74 d	16.06 b	18.40 c	0.45 a	0.33 a	0.46 a	0.29 a
2 weeks	17.66 b	18.20 cd	16.14 b	19.66 b	0.45 a	0.30 b	0.40 b	0.27 a
4 weeks	18.14 ab	18.86 bc	17.26 a	20.40 ab	0.46 a	0.24 c	0.48 a	0.27 a
6 weeks	18.60 a	19.14 ab	17.54 a	20.86 a	0.42 b	0.22 d	0.27 c	0.26 ab
8 weeks	18.34 ab	19.86 a	17.86 a	21.26 a	0.37 c	0.21 d	0.29 c	0.23 b
Mean	17.90 C	18.76 C	16.79 D	20.12 C	0.43 D	0.26 D	0.38 C	0.26 C

In a column under each picking date, means followed by a common small letter are not significantly different at the 5% level by DMRT.

In a column means of each picking date followed by a common capital letter are not significantly different at the 5% level by DMRT.

Tannin content:

From Table (3), it became evident that fruit tannin content of the 1st picking date was the highest and significantly decreased as maturity advanced. This trend was true for both cultivars during both seasons.

It was also observed, for both cultivars during both seasons, that tannin content of the fruits decreased as the storage period advanced. The rate of decrease was faster during the early period of storage (till the 4th week), then it was much slower. The differences between these periods were generally significant.

Similar reports were those of Fouad and Abd El-Latif *et al.* (1976), Taira and Itamura (1989) and Ben-Aire and Guelfat-Reich (1973) who reported that tannin content of persimmon fruits decreased as maturity progressed.

Table (3): Effect of picking date and storage period at 1°C and 85-90 % RH. on fruit Tannin and vitamin C content of “Costata” and “Triumph” persimmon cultivars.

Storage period	Tannin (%)				Vitamin C (mg/100 ml juice)			
	1998/1999		1999/2000		1998/1999		1999/2000	
	Costata	Triumph	Costata	Triumph	Costata	Triumph	Costata	Triumph
1st Picking date								
0 time	2.73 a	1.54 a	2.66 a	2.21 a	50.76 a	52.07 a	60.29 a	66.94 a
2 weeks	0.76 b	1.28 b	0.83 b	1.43 b	48.20 a	40.86 b	48.71 c	43.98 c
4 weeks	0.67 c	1.15 c	0.75 b	1.38 b	49.30 a	43.14 b	61.00 a	53.33 b
6 weeks	0.37 d	1.14 c	0.70 b	0.94 c	47.13 a	41.85 b	54.18 b	46.38 c
8 weeks	0.38 d	0.65 d	0.37 c	0.76 d	41.97 b	31.10 c	48.91 c	40.12 d
Mean	0.98 A	1.15 A	1.06 A	1.34 A	47.47 B	41.80 B	54.62 A	50.15 A
2nd Picking date								
0 time	0.97 a	1.28 a	0.96 a	1.12 a	56.99 a	51.13 a	53.92 a	61.74 a
2 weeks	0.76 b	1.12 b	0.74 b	0.88 b	51.73 b	46.45 b	46.92 bc	61.04 a
4 weeks	0.32 c	1.05 b	0.66 bc	0.67 c	53.40 b	48.34 ab	50.23 b	45.44 b
6 weeks	0.30 c	0.68 c	0.53 cd	0.59 c	51.47 b	39.02 c	43.94 c	47.38 b
8 weeks	0.32 c	0.57 d	0.44 d	0.29 d	45.29 c	37.97 c	40.18 d	30.63 c
Mean	0.53 B	0.94 B	0.67 B	0.71 B	51.78 A	44.58 A	47.04 A	49.25 A
3rd Picking date								
0 time	0.47 a	1.16 a	0.81 a	0.65 a	54.99 a	44.39 ab	47.40 a	45.59 a
2 weeks	0.38 b	1.06 b	0.68 ab	0.61 a	39.03 d	43.97 ab	43.16 bc	36.28 c
4 weeks	0.31 bc	1.01 b	0.54 bc	0.34 b	50.11 b	45.23 a	45.92 ab	41.71 b
6 weeks	0.29 cd	0.64 c	0.47 c	0.37 b	50.04 b	41.14 bc	40.40 c	35.93 c
8 weeks	0.23 d	0.42 d	0.44 c	0.07 c	42.67 c	40.15 c	36.00 d	34.41 c
Mean	0.34 C	0.86 C	0.59 C	0.41 C	47.37 B	42.98 AB	42.58 C	38.78 B
4th Picking date								
0 time	0.56 a	0.92 a	0.30 a	0.48 a	48.54 a	41.07 a	40.01 a	42.12 a
2 weeks	0.30 b	0.63 b	0.28 a	0.46 a	47.29 a	38.19 ab	41.13 a	40.79 a
4 weeks	0.28 b	0.52 c	0.27 a	0.42 ab	47.89 a	35.42 b	37.92 ab	33.92 b
6 weeks	0.20 c	0.48 c	0.27 a	0.34 ab	35.97 b	34.71 b	35.60 b	29.38 c
8 weeks	0.17 c	0.33 d	0.26 a	0.28 b	30.72 c	28.35 c	34.72 b	23.85 d
Mean	0.30 D	0.58 D	0.28 D	0.40 C	42.08 C	35.55 C	37.88 D	34.01 C

In a column under each picking date, means followed by a common small letter are not significantly different at the 5% level by DMRT.

In a column means of each picking date followed by a common capital letter are not significantly different at the 5% level by DMRT.

Moreover, El-Azab *et al.* (1994) and Barbary (1991) reported that tannin content of persimmon fruits decreased as storage was advanced, which is in agreement with the findings reported here.

Vitamin C content:

Vitamin C content was generally found to be reduced as maturity progressed (Table 3). The highest values in both cultivars during both seasons were found in the early picking dates. The lowest values were those of the 4th picking date. Moreover, it could be observed for both cultivars during both seasons, that there was a reduction in vitamin C content as storage period progressed. The lowest values were obtained when fruits were stored for 8 weeks, while the highest were those of the zero time. These results are in line with those of Turk (1993) and El-Azab *et al.* (1994).

Total chlorophyll:

Total chlorophyll (Table 4) was significantly decreased as maturity progressed. Thus, the highest chlorophyll content was those of fruits from the 1st picking date, while those of the last picking date had significantly the lowest values, in both cultivars during both seasons.

Table (4): Effect of picking date and storage period at 1°C and 85-90 % RH. on fruit total chlorophyll and carotene content of "Costata" and "Triumph" persimmon cultivars.

Storage period	Total chlorophyll (mg/100 g fruit fresh weight)				Carotene content (mg/100 g fruit fresh weight)			
	1998/1999		1999/2000		1998/1999		1999/2000	
	Costata	Triumph	Costata	Triumph	Costata	Triumph	Costata	Triumph
1st Picking date								
0 time	16.48 a	13.12 a	16.31 a	13.75 a	0.95 b	0.99 b	0.98 bc	1.02 b
2 weeks	15.78 b	13.04 a	15.89 b	13.36 a	0.97 b	0.98 b	0.94 c	1.03 b
4 weeks	15.64 b	11.45 b	15.62 b	11.93 b	1.00 b	1.01 b	0.99 bc	1.07 b
6 weeks	15.43 b	10.15 c	15.45 b	11.00 c	1.00 b	1.17 a	1.10 ab	1.22 a
8 weeks	14.40 c	8.88 d	15.56 b	9.78 d	1.16 a	1.26 a	1.14 a	1.21 a
Mean	15.55 A	11.33 A	15.77 A	11.96 A	1.02 D	1.08 D	1.03 D	1.11 D
2nd Picking date								
0 time	9.30 a	8.08 a	9.35 a	8.76 a	1.57 d	1.19 e	1.29 b	1.23 d
2 weeks	8.87 a	7.15 b	8.97 a	8.36 a	1.84 c	1.35 d	1.30 b	1.36 c
4 weeks	8.79 a	6.64 c	8.50 b	4.92 b	1.95 c	1.55 c	1.35 ab	1.61 b
6 weeks	7.35 b	5.76 d	6.89 c	4.55 b	2.28 b	2.03 b	1.38 ab	1.62 b
8 weeks	6.64 c	4.04 e	5.46 d	3.73 c	2.49 a	2.22 a	1.44 a	1.75 a
Mean	8.19 B	6.33 B	7.83 B	6.06 B	2.03 C	1.67 C	1.35 C	1.51 C
3rd Picking date								
0 time	6.46 a	3.97 a	5.70 a	4.98 a	2.11 c	1.89 c	1.64 c	1.77 d
2 weeks	5.98 a	3.20 b	5.21 b	4.72 a	2.36 b	2.37 b	1.66 c	1.91 c
4 weeks	4.83 b	2.98 b	4.87 b	3.70 b	2.46 b	2.42 b	1.95 a	2.19 a
6 weeks	3.98 c	2.01 c	3.59 c	2.85 c	2.80 a	2.68 a	1.82 b	2.08 b
8 weeks	3.26 d	1.64 c	2.58 d	2.17 d	2.81 a	2.61 a	1.90 ab	2.21 a
Mean	4.90 C	2.76 C	4.39 C	3.68 C	2.51 B	2.39 B	1.79 B	2.03 B
4th Picking date								
0 time	2.03 a	2.57 a	2.27 a	3.31 a	2.38 c	2.56 b	2.03 d	1.79 e
2 weeks	1.98 ab	2.50 a	2.21 a	2.33 b	2.43 c	2.62 ab	2.21 c	2.11 d
4 weeks	1.66 ab	1.80 bc	1.73 b	2.13 b	2.63 b	2.67 ab	2.17 c	2.27 c
6 weeks	1.46 b	1.92 b	1.62 b	1.55 c	2.61 b	2.67 ab	2.45 b	2.88 b
8 weeks	0.75 c	1.39 c	1.02 c	0.98 d	2.93 a	2.72 a	2.61 a	3.03 a
Mean	1.58 D	2.04 D	1.77 D	2.06 D	2.60 A	2.65 A	2.29 A	2.42 A

In a column under each picking date, means followed by a common small letter are not significantly different at the 5% level by DMRT.

In a column means of each picking date followed by a common capital letter are not significantly different at the 5% level by DMRT.

Moreover, there was a general trend in both cultivars, during both seasons to have lower total chlorophyll content as storage time progressed. Thus, significantly lower values were those of fruits stored for 8 weeks.

These results are in agreement with those of Ebert and Gross (1984) who found that chlorophyll content of kaki fruits decreased during maturation. Also, El-Azab *et al.* (1994) reported a significant decrease in chlorophyll content of persimmons during cold storage which is in line with the above mentioned results.

Carotene content:

Carotene content (Table 4) was found to increase as fruit maturity advanced. Thus, fruits of the fourth picking date, in both cultivars, during both seasons had significantly higher carotene content, while those of the first picking date had significantly lowest value.

Moreover, carotene content of both cultivars, during both seasons, was found to increase as time progressed in storage. Thus, the highest significant carotene content was that of fruits stored for 8 weeks, while the zero time fruits, had significantly lower values.

These results are consistent with those of previous studies. Sorial *et al.* (1993 a,b), Turk (1993) and El-Azab *et al.* (1994) reported that carotene content of persimmon fruits increased as storage time progressed. Moreover, Hegazi *et al.* (1988) found that carotene content was increased as the fruit maturity advanced, which is in line with the above mentioned results.

It could be concluded that the best picking date for "Costata" and "Triumph" cvs. is 167 and 179 days from full bloom, respectively under the conditions of this experiment. This will achieve best post-harvest fruit quality.

REFERENCES

- Agricultural Economics Annual Report (1998). Ministry of Agriculture and Food Security, Cairo, Egypt.
- A.O.A.C. (1980). Association of Official Agriculture Chemists. Official Methods of Analysis, 13th Ed. Washington, D.C, USA.
- Barbary, O.M. (1991). Effect of storage on sensory and chemical composition of persimmon fruits. *Alex. J. Agric. Res.*, 36(2): 69-85.
- Ben-Arie, R. and S. Guelfat-Reich (1973). On the keeping quality of "Fuyu" persimmons. I.I.F.-I.I.R. Commission C₂ Jerusalem-3.
- Duncan, D.B. (1955). Multiple range and multiple F test. *Biometrics*, 11: 1-42.
- Ebert, G. and J. Gross (1984). Carotenoid changes in the peel of ripening persimmon (*Diospyros kaki*) cv. "Triumph". *Phytochemistry*, 24(1): 29-32.
- El-Azab, E.M.; M.A. Aly; N. Ramadan and N. Abo El-Maged (1994). Effect of NPK fertilizations and two storage methods on the physiochemical changes of persimmon fruits. *Menofiya J. Agric. Res.*, 19(2): 1191-1215.
- Forbus Jr. W.R.; J.A. Payne and S.D. Senter (1991). Nondestructive evaluation of Japanese persimmon maturity by delayed light emission. *J. Food Sci.*, 56(4): 985-988.
- Fouad, M.M. and F. Abd El-latif (1976). Maturity studies on some kaki varieties. *Bull. Fac. Agric., Cairo Univ.*, 27: 527-536.
- Gast, K.L.B. (1994). Harvest maturity indicators for fruits and vegetables. Cooperative extension service, Kansas University Manhattann, Kansas, Publication, MF-1175.
- George, A.P. and R.J. Nissen (1990). Persimmon. p. 469-487. In: T.K. Kose and S.K. Mitra (Eds.), *Fruits: Tropical and Subtropical*. Naya Prokash, Calcutta.

- Hegazi, E.S.; A.S. Wally and G.R. Stino (1988). Effect of growth regulators on ripening and quality of persimmon fruits (*Diospyros kaki* L.). Bull. Fac. Agric., Cairo Univ., 39(1): 281-294.
- Morton, J.F. (1987). Fruits of warm climates. Julia. F. Morton, Miami, Fl.
- Rouhani, I.; A. Bassiri and B. Shayabany (1975). Effect of post harvest ethephon applications on ripening and physiology of persimmon fruits at various stages of maturity. J. Hort. Sci., 50: 73-79.
- Snedecor, G.W. and W.G. Cochran (1967). Statistical Methods. 6th ed. Iowa State Univ. Press, Ames. USA.
- Senter, S.D.; B.G. Lyon; R.J. Horvat; W.R. Forbus, Jr., and J.A. Payne (1991). Chemical, sensory and aroma volatile profiles of Japanese persimmons grown in the southeastern United States. Annual Report Northern Nut Growers Association, 82: 111-120.
- Sourial, G.F.; A.S. Abdel-Aziz; M.H. El-Kholy; A.A. Tewfik and S.I. Habashy (1993a). Rapid depression of total tannins in "Costata" persimmon fruits by ethephon treatment. I. Short-term soaking and high concentrations. Zagazig J. Agric. Res., 20(2B): 825-836.
- Sourial, G.F.; A.S. Abdel-Aziz; M.H. El-Kholy; A.A. Tewfik and S.I. Habashy (1993b). Rapid depression of tannins in "Costata" persimmon fruits by ethephon treatments. 2. Long-term soaking and low concentrations. Zagazig J. Agric. Res., 20(2B): 837-853.
- Sugiura, A.; I. Kataoka and T. Tomana (1983). Use of refractometer to determinel soluble solids of astringent fruit of Japanese persimmon (*Diospyros kaki* L.). J. Hort. Sci., 58(2): 241-246.
- Taira, S. and H. Itamura (1989). Aspects of fruit development and maturation in Japanese persimmon (*Diospyros kaki* thunb. cv. 'Hiratanenashi') for these five years (1983~1987) in Yamagata prefecture. Bull. Yamagata Univ., Agr. Sci., 10(4): 903-910.
- Turk, R. (1993). The cold storage of persimmons (*Diospyros kaki* cv. Fuyo) harvested at different maturities and the effect of different CO₂ applications of fruit ripening. Acta Horticulturae, 343: 190-194.
- Wettstein, D. Von (1957). Chlorophyll-latale under submikro-skopische formwe chselder plastiden. Experimental Cell. Res., 12: 424.

تأثير ميعاد الجمع والتخزين البارد على بعض صفات الجودة لثمار الكاكي

عبد الوهاب المرسي* ، محمد الأنصاري* ، سامي داود** ، مها عبد العزيز**

* قسم البساتين - كلية الزراعة بكفر الشيخ - جامعة طنطا

** معهد بحوث البساتين - مركز البحوث الزراعية - سخا - مصر

أجرى هذا البحث خلال موسمى ١٩٩٨/١٩٩٩ ، ١٩٩٩/٢٠٠٠ لدراسة تأثير ميعاد الجمع والتخزين البارد على جودة ثمار الكاكي صنفى تريمف و كوستاتا. تم جمع الثمار بعد ١٤٦ ، ١٥٣ ، ١٦٠ ، ١٦٧ يوم من الإزهار الكامل لصنف كوستاتا و١٥٨ ، ١٦٥ ، ١٧٢ ، ١٧٩ يوم لصنف تريمف و خزنت الثمار على درجة حرارة ١ مئوية ورطوبة نسبية ٨٥-٩٠% لمدة ٨ أسابيع.

أوضحت النتائج زيادة النسبة المئوية للفقد فى الوزن للثمار بزيادة فترة التخزين وكان الفقد فى الوزن أعلى فى صنف تريمف عنه فى صنف كوستاتا ، كما بينت النتائج انخفاض محتوى الثمار من كل من الحموضة الكلية والصلابة وفيتامين ج والمواد التانينية والكلوروفيل الكلى وذلك كلما ازداد اكتمال نضج الثمار وأيضاً بزيادة مدة التخزين. كما أوضحت النتائج زيادة محتوى الثمار من المواد الذائبة الكلية والكاروتين فى مواعيد الجمع المتأخرة وكذلك بزيادة مدة التخزين.