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The Effects of Different Packaging Types on Fruit Quality of Quince (cv. Eşme) in Modified Atmosphere Packaging

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Abstract

In this study, investigated the effects of different packaging types on the type of 'EŞME' quince(Cydonia vulgaris L.) in grown under Tokat conditions. Applications, control, polystyrene plates+PVC stretch film, packaging low density polyethylene and the transparent polyamide were taken into consideration. The temperature was 0-2 degrees and relative humidity was between 85-95% in cold storage environment. Fruits stored for 6 months. In fruits, the deterioration began from the fourth month (The transparent poliamite treatment which was excluded from the experiment, was not included to this process). The weight loss of at least approximately was seen as 0.14% in Low-Density Polyethylene packaging. Effects of the type of packaging had significant on the flesh firmness in during storage. At least change, in the implementation of low-density polyethylene were observed. Total soluble solid fell at all packaging applications in during storage. Maximum reduction was seen in application of polystyrene plates+PVC stretch film. In all applications, the acidity increased and the pH fell. The tasting test as a result of the fruits of edible quality until the fourth month. The best results were found from control and the application of low-density polyethylene.

Keywords: Modified atmosphere, packaging films, quince, cold storage, fruit quality

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INTRODUCTION

Homeland of the quince is northwestern Iran, the North Caucasus, the coast of the Caspian Sea and North Anatolia. Wild forms of quince, Eastern Turkistan, has spread to the southern regions of Europe and Northern Africa in the West. Quince culture passed from Anatolia to Greece and Rome in the years before Christ. It is known that It was raised during the years 650 BC in Greece. Subsequently, it spread to Central and Eastern Europe. Now, quince are grown in all of the other countries except for Australia. However, the cultivation of the quince, not preferred more than other types of fruit and production has been limited [1,2].

The amount of production is 630.325 tones in the world. Turkey is the first place and its total amount of production is about 139.311 tones, China is the second place (127.000 tones) and Uzbekistan is the third place (88.000 tones) [3].

Quince of commercially cultured varieties are; Bardak quince, Demir quince, Limon quince, Eşme (Bread) quince. The most common varieties are Eşme and Limon quince [4,5].

Studies are limited in Turkey and the world of quince. Post-harvest studies of the quince is very low. In our study, ESME (bread) quince cultivars was packed with different packaging types and its post-harvest quality changes were examined.

MATERIAL and METHODS

Material

The research material, seedlings grafted on quince cultivars ESME and 12 created the fruits of the old. Fruit were harvested on the date of 16 October 2015. Medium size (311,22±50,07 g), free from diseases and pests fruits were used in the experiment. The packaged fruits were stored under normal atmosphere storage conditions.

Methods

Research was conducted in 2015. The harvested fruits were brought to the laboratory on the same day. Packaged fruits, again on the same day at 0-2 ° C temperature 85-90% relative humidity, was placed into normal atmosphere storage environment. In this environment, fruits were maintained for 6 months [6,7]. During storage, the storage 60. day, 90. day, 120.day,135. day, 150. day, 165. day and 180 days, except for the initial analysis, 7 analysis was performed. Weight loss of fruits were measured immediately extracted from the storage. Other analyses for a day leave it in laboratory conditions (23 - 25 ºC).

APPLICATIONS

-Control (In plastic enclosures were placed on kraft paper)

-Polystyrene plates + stretch film of pvc

-Low density polyethylene application (AYPEK, Product Code: Q107, OTR (OxygenTranmission Rate): 6500-8500 cm3 /m2 x 24 h, WVTR (WetnessVapor Transmission Rate): 10-20 g H2O/m2 x 24 h (90% relativehumidity, 38 0C))

-Transparent polyamide (NAKSAN, 20 micron,OTR (OxygenTranmission Rate): 50 cm3 /m2 x 24h, WVTR (WetnessVapor Transmission Rate): 150-200 g H2O/m2 x 24 h (90% relativehumidity, 38 0C)).

Changes in the humidity and heat of the environment were measured by using a Hobo device. During storage, 7 analysis were performed except for the initial analysis. In the study, 3 replications and 5 fruits in each replication were used. Experiment results were evaluated in randomized block design, and were grouped according to LSD.

Observation and Analyses

1. Weight Loss (%): Weight losses of samples whose pre-storage weights are known, was calculated by precision balance (±0.05 g) after storage considering first weight. The measurements were performed in samples of the same fruit in the storage process.

2. Fruit Fresh Firmness (Libre): Measurements were done with 11.1 mm diameter tip piercing of hand penetrometer

(Effegi FT 327) from 3 different locations of fruits.

3. Total Soluble Solid (%): It was calculated directly as a percent (%) value by digital refractometer (Atago/Pocket Refractometer Pal-1).

4. pH: The pH value of fruit juice was measured by a pH meter.

5. Titratable Acidity (TA-%): Total acidity was measured by a pH meter with titratable acidity method as malic acid.

6. Total Dry Matter (%): The initial weight of a certain fruit in the oven (60 -100° C) dried and then, by considering the initial weight was calculated.

7. Changes Of Fruit Flesh Colour: Changes in fruit flesh colour were observed by photograph after harvest and in the analysis period.

8. Fruit Ground Colour: Changes in fruit ground colour were observed by photograph after harvest and in the analysis period.

9. Internal Browning Rate (%): Fruit flesh browning was determined in all fruits which were measured. Fruits which have fruit flesh browning were proportioned.

10. Tasting Test: Tasting tests were made by 5-persons taste team in terms of characteristics in, developed by Gercekcioglu [8] scale, modified was used by us (Table 1 and Table 2). The results were evaluated as in these scale.

Table 1. Developed by Gercekcioglu (1992) of internal quality scale (modified for quince was used by us).

Internal Quality Characteristics					
	-Very Good-	**-Good-**	**-Bad-**	**-Very Bad-**	**-Rotten-**
Darkening of The Fruit Flesh	100	80	60	40	20
Darkening of The Core House	100	80	60	40	20
Have Sandy Flesh	100	80	60	40	20
Fruit Fiber	100	80	60	40	20
Taste (Smell And Aroma)	100	80	60	40	20
Total	500	400	300	200	100

Table 2. Developed by Gercekcioglu (1992) of external quality scale (modified for quince was used by us).

External Quality Characteristics					
The Ground Color of The Fruit	Dark Yellow	Yellow	Light Yellow	Yellow- Brown	Brown
	25	25	20	16	8
Status Figure	Normal	Normal	Normal	Depressıons Started In The Shell	Figure Damaged And Depressions Marked
	25	25	25	16	8
Shell Damage	No Wrinkle And Damage	Damage 1/4	Damage 1/3	Damage 2/4	Damage 3/4
	25	20	10	5	3
Shell Stapled*	No Disease And Black Spots	Black Spots (1-5 Pices)	Black Spots (6-10 Pices)	Black Spots (10-15 Pices)	Black Spots (15-20 Pices)
	25	10	5	3	1
Total	100 (Very Good)	80 (Good)	60 (Bad)	40 (Very Bad)	20 (Rotten)
*: 0,5 mm and smaller spots have not been taken into account.					

RESULTS

In transparent polyamide (Naksan, 20 micron) application, after the 2nd month of storage, fruits were excluded from the study. Because there was a spoilage in taste and fruitflesh. Results are shown in the following figures.

Weight Loss(%)

According to the results, Weight loss in all applications was statistically significant. The most weight loss was in control practise and Polystyrene plate +PVC stretch film technique while the least weight loss was in AYPEK (DYPE).

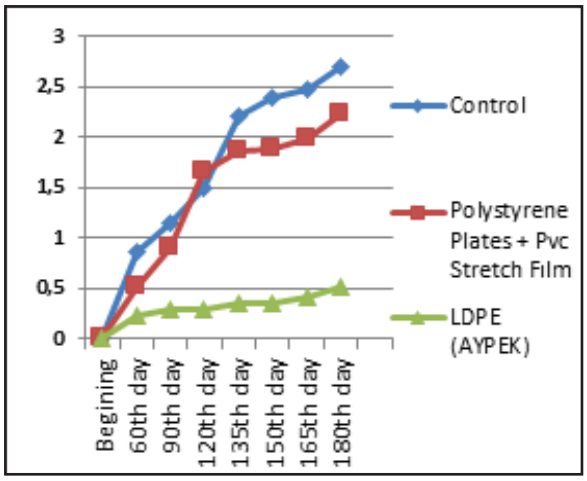

Figure 1. Weight loss changes during storage.

Flesh Firmness (Libre)

Fruit flesh firmness gradually decreased and after the 6 month storage there was a significant decrease. During the storage period, LDPE (Aypek) technique was the best for preserving firmness.

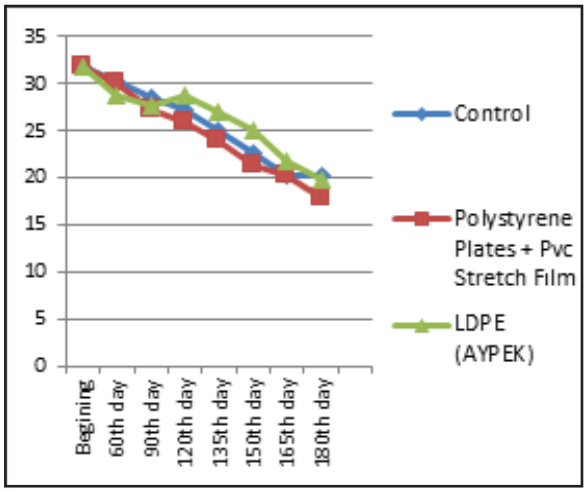

Figure 2. Fresh firmness changes during storage.

Total Soluble Solid (%)

According to the results, total soluble solid became irregular in during storage.

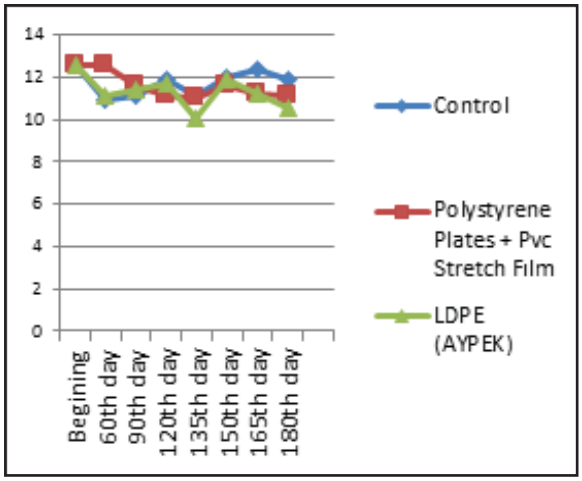

Figure 3. Total soluble solid changes during storage.

pH

In the beginning, pH values were low, however, after the 6 month storage period pH values increased unsurprisingly. It was statistically determined that different packing techniques were not significant, however, storage period was significant.

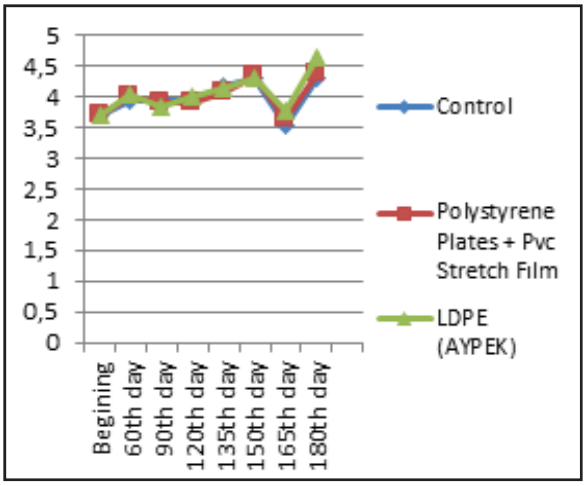

Figure 4. pH changes during storage.

Titratable Acidity (TA-%)

According to the results of analysis, titratable acidity rate was decreased significantly after the 2nd month.

This situation is effective in forming of taste and aroma. There was not a statistically significant result in different packing techniques.

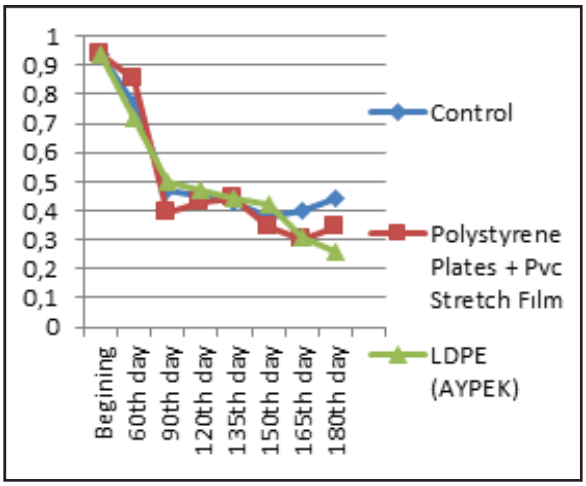

Figure 5. Titratable acidity changes during storage.

Total Dry Matter(%)

During the 6 months storage period, total dried matter rate increased continuously by water loss. After 135th day, it was observed that storage period was statistically important with the level of 1%.

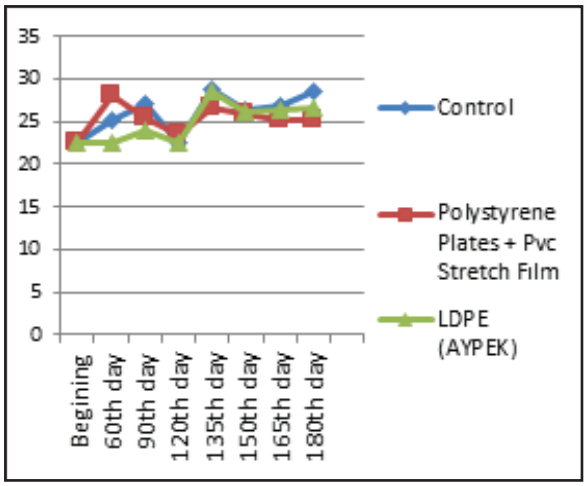

Figure 6. Total dry matter changes during storage.

Internal Browning

Before 120th day, there weren't any internal browning . And then it was started and increased significantly from the 120th day. Control aplication is affected mostly.

Table 3. Internal browning rate seeing the start from the 120th day in the fruits.

	İnternal Browning Rate (%)		
Storage Period (time)	**Control**	**Polystyrene Plates + Pvc Stretch Film**	**LDPE (Aypek)**
120th day	06,67	33.00	33.00
135th day	80.00	40.00	46,70
150th day	73,33	73,33	53,33
165th day	66,67	66,67	53,33
180th day	66,67	93,33	60.00

Sensory Analysis

Each analysis period, by 5 panelist according to the scale, the taste just did a test. This process took at the end of storage. My taste test results are given in Table 5 are the average of 5 panelists.

Table 4. Five panelists average of the score about quality of internal and external components after a tasting test in each analyses period.

	Analysis	**Control**	**Polystyrene Plates + Pvc Stretch Fılm**	**LDPE (Aypek)**
Internal Quality Characteristics •Darkening Of The Fruit Flesh •Darkening Of The Core House •Have Sandy Flesh •Fruit Fiber •Taste (Smell And Aroma) (Total Score 0 – 500) -500-401 Very Good -400-301 Good -300-201 Bad -200-101 Very Bad -100-0 Rotten	1.	488 (Very Good)	492 (Very Good)	500 (Very Good)
	2.	424 (Very Good)	432 (Very Good)	484 (Very Good)
	3.	412 (Very Good)	356 (Very Good)	388 (Good)
	4.	376 (Good)	348 (Good)	400 (Very Good)
	5.	320 (Good)	260 (Bad)	340 (Good)
	6.	288 (Bad)	228 (Bad)	300 (Good)
	7.	268 (Bad)	232 (Bad)	280 (Bad)
External Quality Characteristics •The Ground Color Of The Fruit •Shell Damage •Shell Staıning (Total Score 0 – 100) -100-81 Very Good -80-61 Good -60-41 Bad -40-21 Very Bad -20-0 Rotten	1.	100 (Very Good)	100 (Very Good)	100 (Very Good)
	2.	100 (Very Good)	100 (Very Good)	100 (Very Good)
	3.	85 (Very Good)	85 (Very Good)	85 (Very Good)
	4.	76,4 (Good)	77,2 (Good)	82 (Very Good)
	5.	73 (Good)	70,2 (Good)	74 (Good)
	6.	64,6 (Good)	55 (Bad)	64,6 (Good)
	7.	59 (Bad)	45,8 (Bad)	54,6 (Bad)

CONCLUSIONS

Our findings are summarized as follows.

1. When both external and internal quality characteristics were considered, the fruits in the transparent polyamide (Naksan) packaging were removed from the experiment due to significant deterioration (fruit fresh browning, softening, etc.) on the 60th day of storage, and the experiment was conducted with the other treatments. It can be considered that without pre-cooling, fruit fresh temperature for packaged products, becomes cool slower and the possibility of the weight loss and deterioration can increase. However, it is considered that early deterioration on these products, is not only resulted from without pre-cooling treatment, the other features of the package (e.g. gas and water vapor permeability is lower in comparison with other packages) could have an effect as well.

2. The effects of the other packaging materials on the fruit quality changes, shared similarity during the 180 days storage period.

3. When internal and external quality changes on the fruits and weight losses were considered, the best result was obtained from Low-density polyethylene (LDPE) packaging

treatment.

4. As a result of the study, 120 days of storage is recommended as a maximum for the ESME cultivar in the Low-density polyethylene (LDPE) package.

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