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EFFECT OF ETHEPHON ON RIPENING PROCESS OF KELSEY PLUM FRUITS.

EL-kady, M. I.; N. R. Samera.; M. A. EL–Shobaky and Rania A. A. Badawy
Pomology Dept., Fac. Of Agric., Mansoura Univ.

ABSTRACT

The present study was carried out during ٢٠١٠and ٢٠١١seasons to evaluate the effect of dipping Kelsey plum fruits in different concentrations of ethephon (٢٥٠،٥٠٠،٧٥٠ and ١٠٠٠ppm) as post harvest treatment to hasten fruit ripening. The data showed clear that ethephon application increased both loss in fruit weight , decayed fruit and total loss in fruit weight than the control.Yet, higher concentration was superior in this respect furthermore these treatment reduced both fruit firmness and chlorophyll A,B but increased SSC, and total anthocyanin than the control. Also, that data presented that higher concentration (١٠٠٠ and ٧٥٠ ppm) gave a higher effect in this respect.

INTRODUCTION

The Kelsey plum (*Prunus salicina*) is one of the deciduous fruit trees which has low chilling requirements about (٤٠٠-٤٥٠ hr) effective chilling units (Gao Dongsheng *et al*., ٢٠٠١). Since, it is cultivated throughout the warmer parts of the world, e.g., in the China, America, Europe and the Kaukasus.
In Egypt, the cultivated area with plum trees was decreased during the last few years, since it reached about ٢٧٣٦ feddans with an annual fruit production about ٢٥٩٤ tons according to the last statistics of Ministry of Agriculture in Egypt (٢٠١٣).

Plums are high in carbohydrates, low in fats and calories. Plums are an excellent source of vitamin A, calcium, magnesium, iron, potassium and fibers. Plums are free of sodium and cholesterol. Like most fruits, plums contain a substantial amount of vitamin C. The Kelsey plum trees not need pollination trees for fertilization. In Egypt climate, soil and temperature conditions are suitable for it growing trees and to obtained high economical production or yield. For that farmer take high attention to increase the cultivate area with Kelsey plum.

Ethephon, ٢-chloroethylphosphonic acid, is a plant growth regulator with systemic properties. It penetrates the plant tissues, and decomposes into ethylene, which affects the growth processes. It is used to promote pre-harvest ripening in several fruits such as apples, currants, blackberries, blueberries, cranberries and cherries,. Furthermore, it is also used to accelerate post-harvest ripening in bananas, mangoes, and remove green colour in peel of citrus fruit; to facilitate harvesting by apcersion and loosening of the fruit in currants, gooseberries, cherries, and apples**.**
The present investigation was carried out to study the effect of different concentrations of ethephon as post harvest treatments to improve peel colour and quality of Kelsey plum fruits in order to know the normal time and

the suitable concentration of ethephon to hasten fruit ripening help farmer (grower) to avoid un suitable conditions for storage and extend the market period.

MATERIALS AND METHODS

The present study was carried out during the seasons of ٢٠١٠ and ٢٠١١ to evaluate the effect of ethephon application for enhancing ripening process of Kelsey plum fruits.

In this study, Kelsey plum fruits were obtained from a private orchard in kilo ٨٥ Alex-Cairo desert roads near of Dena farm. About ١٠٠ kg of fruits were harvested at maturity stage when the color of fruits was green yellow skin, firmness in fruit about was ٨,٨lbinch according to (Manganaris.*et al*.٢٠٠٨) and immediately transported to the laboratory of Pomology Dept., Fac. Of Agric., Mansoura Univ. Fruits were sorted to discard any defective and mechanical damaged fruits. Therefore, uniform fruits in size and colour were washed with tap water and dried by using air of electric fan. Fruits were divided to five groups; one of each was dipped for ٥ minutes in one of the following solution:

١- Control (dipping in Tap water). ٢- Ethephon at ٢٥٠ ppm.
٣- Ethephon at ٥٠٠ ppm. ٤- Ethephon at ٧٥٠ ppm.
٥ - Ethephon at ١٠٠٠ ppm.

After treatments, fruits were air dried using an electric fan and then were put in ventilated plastic bags and pallets bags, all bags with fruits were weighted and every ٥ bags were put in ventilated carton box (٥٠ X ٣٠X١٢) cm. the total number of carton boxes were ٢٠ for all treatments, each treatment consists for ٤ carton boxes, each box contains ٥ ventilation plastic bags and pallets bags. All boxes were held at room temperature at (٢٩-٣٠ ^{O}C and ٩٠٪RH) and cold temperature at (٣+or-١ and R.H ٩٠٪H) to study the effect of dipping fruits in ethephon solution on ripening process of Kelsey plum. Stored fruits were examined at ٤ days for room temperature and١٥ days under cold storage interval, ٣ bags from each treatment were taken to determine the following parameters:

١-Loss in fruit weight percentage:

It was determined by weighting the plastic bag every ٤ days for room temperature and ١٥ days for cool temperature and percent of weight loss for each bag was calculated in relation to it is initial weight according to the following equation:

$$\text{Weight loss \%} = \frac{\text{Initial weight- Weight at sample date}}{\text{Initial weight}} \times ١٠٠$$

٢- Decay percentage:

It was determined by weighting decayed fruits for each sample during storage using the following equation:

$$\text{Decayed fruits \%} = \frac{\text{Weight of decayed fruits}}{\text{Initial fruit weight}} \times ١٠٠$$

٣- Total loss in fruit weight:

It was calculated by determining loss in fruit weight and decayed fruits.

٤- Fruit firmness

It was determined by using a hand Effegi-penetrometers supplemented with a plunger of ٨ mm diameter and estimated as lb/inch.

٥- Change in fruit pigments:

٠.٥ gm of skin fruits was extracted by ١٠ ml methanol for ٢٤ hr under laboratory temperature after adding tract amount from sodium bicarbonate then both chlorophyll and caroteniods were determined by using spectrophometer at the wave length ٤٥٢,٥, ٦٥٠ and ٦٦٠ nm for chlorophyll A, B and caroteniods respectively and the total caroteniods were estimated by **the following equations:-**

Chl.A= ١٦,٥ E٦٦٥ – ٨,٣ E٦٥٠

Chl.B= ٣٣,٨ E٦٥٠ – ١٢,٥ E٦٦٥

Carotene= ٤,٢ E٤٥٢,٥ – ٠,٠٢٦٤chl.A – ٠,٤٩٦chl.B

Carotene mg/١٠٠g f.w= Carotenexvolume of solutionX١٠٠/Weight of sample X ١٠٠

٦-Total anthocyanins content:

Weight of ٠,٥ gm of skin fruits was extracted by ١٠ ml of acidified alcohol solution, for ٢٤ hr under laboratory temperature .The extract was measured at ٥٣٥ nm wave lengths by using spectrophometer according to the methods of **(**Hsia *et al*., ١٩٦٥) **.**The content of total anthocyanin in plum skin was calculated using the following equations:

$$\text{Total absorbance per ١٠٠ gm.skin} = \frac{\text{Absorbance at ٥٣٥ nm} \times \text{Volume made up of the extracts used for color measurement} \times \text{Total volume}}{\text{Ml of the extract used} \times \text{Weight of sample}}$$

$$\text{Total anthocyanins Content mg /١٠٠ gm} = \frac{\text{Total absorbance}}{٩٨,٢\,(E)}$$

The (E) value for ١٪ solution at ٥٣٥ is equal to ٩٨,٢. Therefore, the absorbance of solution containing ١mg is equal to ٩٨,٢.

٥- Soluble solids content (SSC %):

It was measured by using Carlzeiss hand refractometer .

٦- Total titratable acidity:

Ten ml of fruit juice were titrated with ٠,١ N sodium hydroxide solution using phenol phthalein as indicator. Total acidity was expressed as gm malic acid /١٠٠ ml juice according to A.O.A.C (١٩٨٠**)**

Statistical analysis:

All the obtained data for the present study were statistically analyzed according to analysis of variance (ANOVA) for experiment in randomized complete block design according to Gomez and Gomez,(١٩٨٤) and (L.S.D) at ٥ % used to compare the variances between the treatments .

RESULT AND DISCUSSION

This study was carried out to evaluate the effect of dipping Kelsey plum fruits in different ethephon solutions on ripening process of Kelsey plum fruits under room temperature and cold storage, the obtained results are presented as follows:

- **Loss in fruit weight percentage:**

Data from Table (١) presented that loss in fruit weight gradually increased as storage period advanced either under room temperature or at cold storage. Thus, all applied treatments increased the loss in fruit weight than the control. Since the percentage of loss in fruit weight of the untreated fruits was ٢,٤٩ after ٣٠ days of cold storage as mean of both seasons. Dipping Kelsey plum fruits in ethephon at ٢٥٠ ppm significantly increased the loss in fruit weight since it averaged about ٢,٧٧ as a mean of the two seasons after ٣٠ day of cold storage.

On the other hand, treated Kelsey plum fruits with ethephon ١٠٠٠ ppm produced a higher percentage of loss in fruit weight than the other treatments used and reached about ٤,١٥ after ١٢ days during the storage at room temperature, while reached about ٣,٣٧ after ٣٠ days of cold storage as a mean of the two seasons.

Table (١): Effect of postharvest treatments on weight loss percentage of Kelsey plum fruits (mean of two seasons).

Treatments	Room temperature				Cold storage		
	Storage period in days				Storage period in days		
	٤	٨	١٢	mean	١٥	٣٠	mean
Control	١,٥٩	٢,٦٨	٣,١٩	١,٨٦	١,٣١	٢,٤٩	١,٢٦
Ethephon ٢٥٠ppm	٢,٥٧	٣,١٩	٣,٥٦	٢,٣٣	١,٧٠	٢,٧٧	١,٤٨
Ethephon ٥٠٠ppm	٢,٨٣	٣,٣٠	٣,٦٧	٢,٤٤	٢,١٩	٢,٨٦	١,٦٨
Ethephon ٧٥٠ppm	٢,٩٣	٣,٥٩	٤,٠٤	٢,٦٤	٢,٥٨	٢,٨٧	١,٨٢
Ethephon ١٠٠٠ppm	٣,٣٧	٣,٦٥	٤,١٥	٢,٧٩	٣,٠٤	٣,٣٧	٢,١٣
mean	٢,٦٦	٣,٢٨	٣,٧٢	-	٢,١٦	٢,٨٧	-
L.S.D	Ttreatments = ٠,١٤٤				Ttreatments = ٠,١٤٠		
	Sstorage period = ٠,١٤٥				Sstorage period = ٠,١٤٠		

Moreover, the loss in fruit weight from harvested horticultural crops is a major cause of deterioration in storage and results not only in loss in salable weight but also in less attractive produce of poorer texture and lower quality. This loss is due to the water loss, through transpiration, while some weight loss is due to loss of carbon in respiration but this is only a minor part of the total loss. The high storage temperature causes a high respiration rate which lead to a fruit weight loss. The results of the present study and associated discussion are supported by the findings of (Hardenburg *et al*., ١٩٩٠)

٢- Decay percentage :

It is clear from Table (٢) that all treatments significantly increased the percent of decayed fruits than the control fruits after ١٢ days at room temperature or ٣٠ days of cold storage during both seasons.

Yet, dipping "Kelsey' plum fruits in ethephon at ٧٥٠ or ١٠٠٠ ppm significantly increased decay percentage during storage period and after ١٢days at room temperature than the other treatments used or the control. Since, ethephon application at ١٠٠٠ ppm was effective in this respect since, it presented ١٢.٢٥ decayed fruits, while fruits treated with ethephon at ٧٥٠ ppm existing ١١,٤٧ decayed fruits after ١٢ days at room temperature as a mean of both seasons. Thus, the control presented ٩,٦٠ decayed fruits as a mean of the two seasons of study.

Table (٢): Effect of postharvest treatments on Decay percentage of Kelsey plum fruits (mean of two seasons).

Treatments	Room temperature				Cold storage		
	Storage period in days				Storage period in days		
	٤	٨	١٢	mean	١٥	٣٠	mean
Control	٨,٠١	٨,٥٥	٩,٦٠	٦,٥٣	٨,٢٥	٨,٦٥	٥,٦٣
Ethephon ٢٥٠ppm	٤,٣٥	٩,٠٠	٩,٩٥	٥,٨٢	٨,٢٨	٩,١١	٥,٧٩
Ethephon ٥٠٠ppm	٨,٦٧	٩,٧٢	١٠,١	٧,١٢	٩,٣٨	١٠,٤٠	٦,٥٩
Ethephon ٧٥٠ppm	٩,٨٢	١٠,٥٠	١١,٤٧	٧,٩٤	١٠,٤	١١,٢٥	٧,٢١
Ethephon ١٠٠٠ppm	١٠,٣٧	١١,١٧	١٢,٢٥	٨,٤٣	١١,١٥	١١,٧٢	٧,٦٢
mean	٨,٢٤	٩,٨٣	١٠,٦٧	-	٩,٤٣	١٠,٢٢	-
L.S.D	Ttreatments = ٠,٣٥٦				Ttreatments = ٠,٣٢٩		
	Sstorage period = ٠,٣٥٦				Sstorage period = ٠,٣٢٩		

Furthermore, ethephon application at ٢٥٠ ppm reduced the percent of decayed fruits, since it averaged ٩,٩٥ during the two seasons respectively, than those treated with ethephon at ٥٠٠ ppm or the control after ١٢ days at room temperature.

Fruits which stored at cold storage for ٣٠ days showed a reduction in decayed fruits than the fruits which stored at room temperature in both seasons. Yet, fruits treated with ethephon at ٧٥٠ and ١٠٠٠ ppm gave a lower decayed fruit percent than the other treatments or the control stored at room temperature. Since, the percentage of decayed fruits due to ethephon application at ٧٥٠ averaged ١١,٢٥ and reached ١١,٧٢ when treated with ethephon ١٠٠٠ ppm after ٣٠ days cold storage as a mean of two seasons.

٣- Total loss in weight percentage:

Total loss in fruit weight is mainly due to the loss in fruit weight and decayed percentages are presented in Table (٣) .It is clear that dipping "Kelsey" plum fruits in ethephon at ٧٥٠ or ١٠٠٠ ppm significantly increased the percent of total loss in fruit weight at the both seasons than the other treatments or the control. Since, ethephon application at ٧٥٠ or ١٠٠٠ ppm presented a losses about ١٥,٥٢ and ١٦,٤٠ respectively, after ١٢ days at room temperature. Whereas, the total loss percentage reached about ١٤,١٢ and ١٥,٠٩ after ٣٠ days under cold storage as a mean of two seasons. These

results may be due to that ethephon at ٧٥٠ and ١٠٠٠ ppm significantly increased the loss weight and decayed fruits through storage period than dipping in ٢٥٠ or ٥٠٠ ppm of ethephon or the control under room temperature or cold storage.

Table (٣): Effect of postharvest treatments on Total loss percentage of Kelsey plum fruits (mean of two seasons).

Treatments	Room temperature				Cold storage		
	Storage period in days				Storage period in days		
	٤	٨	١٢	mean	١٥	٣٠	mean
Control	٩,٥٩	١١,٢٣	١٢,٧٩	٨,٤٠	٩,٥٦	١١,١٤	٦,٩
Ethephon ٢٥٠ppm	٦,٩٢	١٢,٣١	١٣,٥١	٨,١٨	٩,٩٨	١١,٨٧	٧,٢٨
Ethephon ٥٠٠ppm	١١,٥٠	١٣,٠٣	١٣,٧٧	٩,٥٧	١١,٥٧	١٣,٢٧	٨,٢٨
Ethephon ٧٥٠ppm	١٢,٧٥	١٤,٠٩	١٥,٥٢	١٠,٥٩	١٢,٩٨	١٤,١٢	٩,٠٣
Ethephon ١٠٠٠ppm	١٣,٧٤	١٤,٨٢	١٦,٤٠	١١,٢٤	١٤,١٩	١٥,٠٩	٩,٧٥
mean	١٠,٩	١٣,٠٩	١٤,٣٩	-	١١,٦٥	١٣,١٠	-
L.S.D	Ttreatments = ٠,٣٩٣				Ttreatments = ٠,٤١٦		
	Sstorage period = ٠,٣٩٣				Sstorage period = ٠,٤١٦		

Furthermore, dipping Kelsey plum fruits in ethephon at ٥٠٠ ppm gave a lower percentage of total loss in fruit weight than dipping fruits in ethephon ٧٥٠ or ١٠٠٠ ppm through storage period. Since, the loss percentage averaged about ١٣,٧٧ after ١٢ days at room temperature whereas, the loss percentage reached ١٣,٢٧ after ٣٠ days of cold storage as mean of both seasons under study.

٤- Changes in Fruit firmness (lb/inch) :

Data from Table (٤) show clearly that, fruits firmness was reduced as storage period advanced under room temperature or at cold storage. In this respect the data also showed that all treatments significantly reduced changes in fruit firmness than the control at room temperature or under cold storage through the two seasons. However, the reduction in fruit firmness was higher during room temperature compared with the fruits under cold storage. That is not astonishing since, the temperature was higher at room temperature, and thus so the respiration rate was almost higher than under cold condition.

Table (٤):Effect of postharvest treatments on firmness (lb/inch) percentage of Kelsey plum fruits (mean of two seasons)..

Treatments	Room temperature					Cold storage			
	Storage period in days					Storage period in days			
	٠	٤	٨	١٢	mean	٠	١٥	٣٠	mean
Control	٨,٩٠	٨,٤٠	٧,٩٥	٧,٦٢	٨,٢١	٨,٩٠	٧,٩٥	٦,٥٦	٧,٨٠
Ethephon ٢٥٠ppm	٨,٩٠	٨,٢٥	٧,٧٠	٧,٠٢	٧,٩٦	٨,٩٠	٧,٨٥	٦,٦٥	٧,٧٩
Ethephon ٥٠٠ppm	٨,٩٠	٧,٨٥	٧,٤٠	٦,٨٢	٧,٧٤	٨,٩٠	٧,٦٥	٦,٥٢	٧,٦٩
Ethephon ٧٥٠ppm	٨,٩٠	٧,٥٥	٦,٨٢	٥,٨٠	٧,٢٦	٨,٩٠	٧,٠٧	٥,٩٥	٧,٣٠
Ethephon ١٠٠٠ppm	٨,٩٠	٧,٣٥	٦,٣٢	٥,٨٠	٧,٠٩	٨,٩	٧,٠٥	٥,٥٢	٧,١٥
mean	٨,٩	٧,٨٨	٧,٢٤	٦,٦٢		٨,٩٠	٧,٥١	٦,٢٤	-
L.S.D	Ttreatments = ٠,٣٤٥					Ttreatments = ٠,٢٦٩			
	Sstorage period = ٠,٣٤٥					Sstorage period = ٠,٢٦٩			

Furthermore, treated fruits with ethephon at ٧٥٠ or ١٠٠٠ ppm produced lower fruit firmness than dipping fruits in ethephon at ٥٠٠ ppm or control during the two seasons of study. Since, the firmness percentage averaged about ٥,٨٠-٥,٨٠ Ib/inch after ١٢ days at room temperature while, it averaged ٥,٩٥ - ٥,٥٢ Ib/inch from fruits at cold storage as a mean of two seasons respectively.In this respect, the reduction attributed in fruit firmness due to these mainly due to decomposition of enzymatic degradation of insoluble protopectins to more soluble pectins, solubilization of cell wall contents as a result of increasing in pectin esterase activity and subsequent development of juiciness and the loss in peel and pulp hardness. (Deshpande and Salunkhe., ١٩٦٤).

٥- SSC percentage in fruit juice :

Concerning to the effect on SSC, Data from Table (٥) showed that soluble solid content in fruit juice of "Kelsey" plum was gradually increased as storage period prolonged advanced either at room temperature or during cold storage. These results agree with that description by El- Sheikh (٢٠٠٢) who reported that the soluble solids content of Le Conte pear fruits was increased according to the extension of the storage period. This may be due to the losses in water through the respiration and evaporation during storage. The data also disclose that, ethephon at ١٠٠٠ ppm was superior for increasing the values of SSC in fruit juice so, it presented ١٤,٤٥ after ١٢ days storage at room temperature than the other treatments used or the control as a mean of both seasons.

Table (٥): Effect of postharvest treatments on SSC percentage of Kelsey plum fruits (mean of two seasons).

Treatments	Room temperature					Cold storage			
	Storage period in days					Storage period in days			
	٠	٤	٨	١٢	mean	٠	١٥	٣٠	mean
Control	٨,٨٧	١١,٠٢	١١,٥٥	١٢,٠٥	١٠,٨٧	٨,٨٧	١١,٢	١٢,٤٧	١٠,٨٥
Ethephon ٢٥٠ppm	٨,٨٧	١٢,١٥	١٢,٩٢	١٣,٣٢	١٠,٦٨	٨,٨٧	١١,٥٧	١٢,٥٢	١٠,٩٩
Ethephon ٥٠٠ppm	٨,٨٧	١٢,٠٥	١٢,٧٧	١٣,٦٧	١١,٨٤	٨,٨٧	١٢,٦٥	١٣,٩٢	١١,٨١
Ethephon ٧٥٠ppm	٨,٨٧	١٢,٤٧	١٣,١٢	١٣,٨٠	١٢,٠٦	٨,٨٧	١٢,٦	١٣,٩٧	١١,٨١
Ethephon ١٠٠٠ppm	٨,٨٧	١٣,٢٠	١٣,٨	١٤,٤٥	١٢,٥٧	٨,٨٧	١٢,٧٢	١٤,٤٥	١٢,٠١
mean	٨,٨٧	١٢,١٨	١٢,٨٣	١٣,٤٦	-	٨,٨٧	١٢,١٥	١٣,٤٧	-
L.S.D	Ttreatments = ٠.٥٨٩					Ttreatments = ٠,٥٦٦			
	Sstorage period = ٠,٥٨٩					Sstorage period = ٠,٥٦٦			

The data also presented that dipping fruits in ethephon at ٧٥٠ ppm significantly increased the percentage of SSC in juice of Kelsey plum fruits in both seasons but the values was almost lower than ethephon at ١٠٠٠ ppm. Since, ethephon application at ٧٥٠ ppm presented about ١٣,٨٠ after ١٢ days at room temperature whereas, the SSC percentage reached ١٣,٩٧ after ٣٠ days under cold storage . In this respect, Mann and Baljit Singh (١٩٩٠**)** presented that treated Pyrus pyrifolia fruits with ٢٥٠, ٥٠٠ or ١٠٠٠ ppm ethephon for ١ min after harvest ,found that at higher concentrations of ethephon reduced the values of fruit firmness decreased more rapidly than in the controls. SSC tended to increase during ripening. The increase being greater with high Ethephon concentrations, while total acidity reduced than the other concentration. Starch content decreased sharply during the initial ٥ to ١٠ days with both harvesting dates. Pigments were increased while phenolics decreased during ripening.

٦-Total titratable acidity in juice of Kelsey plum fruits:

Data from Table (٦) presented that the total titratable acidity in juice of plum fruits decreased as storage period advanced. In this respect, Paul *et al.,* (١٩٩٣) found that titratable acidity of Columbia and Gebhard strains of red d' Anjou pear fruit was significantly decreased during storage. Furthermore, ethephon at ١٠٠٠ ppm produced lower acidity in fruit juice than all treatments used or the control, since it averaged ٠,٤٣ after ١٢ days during stored at room temperature, while ethephon at ١٠٠٠ ppm presented ٠,٤١ after ٣٠ days of cold storage as mean of two seasons, but the reduction was unpronounced. Moreover, there are no clear effect had obtained between the applied treatments and the control at cold storage or during storage period in both seasons.

Table (٦): Effect of postharvest treatments on Total titratable acidity in juice of Kelsey plum fruits.

Treatments	Room temperature					Cold storage			
	Storage period in days					Storage period in days			
	٠	٤	٨	١٢	mean	٠	١٥	٣٠	mean
Control	٠,٩٢	٠,٨٩	٠,٨٢	٠,٧٠	٠,٨٠	٠,٩٢	٠,٧٠	٠,٦٢	٠,٧٥
Ethephon ٢٥٠ppm	٠,٩٢	٠,٧٧	٠,٦٩	٠,٦١	٠,٧٤	٠,٩٢	٠,٦٧	٠,٥٩	٠,٧٢
Ethephon ٥٠٠ppm	٠,٩٢	٠,٧٥	٠,٦٦	٠,٥٥	٠,٧٢	٠,٩٢	٠,٦٠	٠,٥٣	٠,٦٨
Ethephon ٧٥٠ppm	٠,٩٢	٠,٦٨	٠,٦٠	٠,٤٨	٠,٦٧	٠,٩٢	٠,٥٥	٠,٤٨	٠,٦٥
Ethephon ١٠٠٠ppm	٠,٩٢	٠,٥٨	٠,٤٥	٠,٤٣	٠,٦٠	٠,٩٢	٠,٤٥	٠,٤١	٠,٥٩
mean	٠,٩٢	٠,٧٤	٠,٦٤	٠,٥٥	-	٠,٩٢	٠,٥٩	٠,٥٣	-
L.S.D	Ttreatments = ٠,٠٦٥					Ttreatments = ٠,٠٥٩			
	Sstorage period = ٠,٠٦٥					Sstorage period = ٠,٠٥٩			

In this aspect, Abd EL –Magid (١٩٨٦) stored "Le Conte" pear fruit for ١٣،١٢،٤ and ٢ weeks at ٠،٥،١٠ and ٢٠ C, respectively, found that malic acid is a respiratory substrate and its consumption in respiration increased with the progress of storage period and this may be responsible for the observed decrease in acidity during the last days of storage.

٧- Total chlorophyll content:

Data from Table (٧ and ٨) showed the effect of various treatments used on changes of both chlorophyll A and B during storage under room temperature and cold storage.

From Table (٧) data presented that chlorophyll A in plum fruits decreased with storage period advanced during cold storage or under room temperature. Since, all treatments presented a lower content of chlorophyll A in the skin of plum fruits than control either at room temperature ٠,٠٩١ mg/١٠٠g or ٠,٠٩٢mg/١٠٠g skin fresh weight under cold storage Whereas, the values of chlorophyll A during storage period at room temperature were almost lower than those obtained at cold storage. In addition, color is the main factor for the consumer; if it is unappearing the consumers are unlikely to judge the flavor or texture (Francis, ١٩٨٠). Moreover, ethephon application either at ١٠٠٠ ppm or ٧٥٠ ppm produced a lower chlorophyll A than all the other treatments or the control after ١٢ days at room temperature and ٣٠ days of cold storage in both seasons. The reduction due to using ethephon either at ١٠٠٠ ppm or ٧٥٠ ppm reached about ٠,٠٤٨ and ٠,٠٥٦ mg/١٠٠mg fresh weight after ١٢ days at room temperature, respectively. While, after ٣٠ days of cold storage the values averaged ٠,٠٧٢and ٠,٠٨٠ mg/١٠٠mg fresh weight in both concentrations, respectively.

Table (٧):Effect of postharvest treatments on chlorophyll A content (mg/١٠٠g) of Kelsey plum fruits (mean of two seasons).

Treatments	Room temperature					Cold storage			
	Storage period in days					Storage period in days			
	٠	٤	٨	١٢	mean	٠	١٥	٣٠	mean
Control	٠,١٣٧	٠,٠٩٠	٠,٠٩٣	٠,٠٩٠	٠,١٠٤	٠,١٣٧	٠,٠٩٧	٠,٠٩٢	٠,١٠٨
Ethephon ٢٥٠ppm	٠,١٣٧	٠,٠٨١	٠,٠٧٦	٠,٠٧٠	٠,٠٩١	٠,١٣٧	٠,٠٩٣	٠,٠٨٨	٠,١٠٦
Ethephon ٥٠٠ppm	٠,١٣٧	٠,٠٧٥	٠,٠٧١	٠,٠٦٤	٠,٠٨٦	٠,١٣٧	٠,٠٩٠	٠,٠٨١	٠,١٠٣
Ethephon ٧٥٠ppm	٠,١٣٧	٠,٠٦٨	٠,٠٦٣	٠,٠٥٦	٠,٠٨١	٠,١٣٧	٠,٠٨٤	٠,٠٨٠	٠,١٠٠
Ethephon ١٠٠٠ppm	٠,١٣٧	٠,٠٦٣	٠,٠٥٥	٠,٠٤٨	٠,٠٧٥	٠,١٣٧	٠,٠٧٩	٠,٠٧٢	٠,٠٩٦
mean	٠,١٣٧	٠,٠٧٧	٠,٠٧١	٠,٠٦٥	-	٠,١٣٧	٠,٠٨٨	٠,٠٨٢	-
L.S.D	Ttreatments = ٠,١٣٢					Ttreatments = ٠,١٤٨			
	Sstorage period = ٠,١٣٢					Sstorage period = ٠,١٤٨			

Data from Table (٨) showed that chlorophyll B content decreased as storage period advanced from harvest till ١٢ days at room temperature and at ٣٠ days at cold storage. Yet the reductions of chlorophyll B during storage period were higher than those obtained at cold storage during the both seasons of study. In this respect, all treatments used produced a lower value of chlorophyll B than the control. Yet, ethephon at ١٠٠٠ ppm gave lower values of chlorophyll B than the other treatments used at room temperature or at cold storage .Since the values reached about ٠,٠٥٣ mg/١٠٠mg after ١٢ days at room temperature and ٠,٠٥٦ mg/١٠٠mg fresh weight after ٣٠ days of cold storage as means of both seasons .

Table (٨): Effect of postharvest treatments on chlorophyll B content (mg/١٠٠g) of Kelsey plum fruits (mean of two seasons).

Treatments	Room temperature					Cold storage			
	Storage period in days					Storage period in days			
	٠	٤	٨	١٢	mean	٠	١٥	٣٠	mean
Control	٠,٢٣٥	٠,١٢٣	٠,٠٩٩	٠,٠٨٦	٠,١٣٥	٠,٢٣٥	٠,٠٩٥	٠,٠٨١	٠,١٣٧
Ethephon ٢٥٠ppm	٠,٢٣٥	٠,١١٣	٠,٠٩٢	٠,٠٨١٥	٠,١٣٠	٠,٢٣٥	٠,٠٨٧	٠,٠٧٨	٠,١٣٣
Ethephon ٥٠٠ppm	٠,٢٣٥	٠,٠٩١	٠,٠٨٦	٠,٠٧٦	٠,٠٩٥	٠,٢٣٥	٠,٠٨٧	٠,٠٧٣	٠,١٣٢
Ethephon ٧٥٠ppm	٠,٢٣٥	٠,٠٨٤	٠,٠٧٥	٠,٠٦٧٥	٠,١١٥	٠,٢٣٥	٠,٠٧٩	٠,٠٦٥	٠,١٢٦
Ethephon ١٠٠٠ppm	٠,٢٣٥	٠,٠٧٣	٠,٠٦٢	٠,٠٥٣	٠,١٠٥	٠,٢٣٥	٠,٠٦٩	٠,٠٥٦	٠,١٢٠
mean	٠,٢٣٥	٠,٠٩٧	٠,٠٨٢	٠,٠٦٤	-	٠,٢٣٥	٠,٠٨٣	٠,٠٧٠	-
L.S.D	Ttreatments = ٠,٢٦١					Ttreatments = ٠,٢٧٠			
	Sstorage period =٠,٢٦١					Sstorage period = ٠,٢٧٠			

Furthermore, the untreated fruits produced higher values of chlorophyll B in both seasons than all treatments used either after ١٢ days at room temperature averaged ٠,٠٨٦ mg/١٠٠mg or after ٣٠ days of cold storage

presented ٠,٠٨١mg/١٠٠mg. In this respect Hussein *et al.* (١٩٩٧) stored "Le conte" pear fruits at ٠, ١٠ and ٢٠ ^{O}C and found that, changes in peel coloration from green to yellow were related to storage temperature.

٨ - Total carotenoids content:

It is clear from Table(٩) that, carotenoids content in Kelsey plum fruits increased as storage period advanced from harvest till ١٢ days at room temperature or at ٣٠ days at cold storage. Yet the values of total caroteniods during the storage at room temperature were higher than those obtained at cold storage during the both seasons of study.

Table (٩): Effect of postharvest treatments on Total carotenoids content of Kelsey plum fruits. .(mean of two seasons).

Treatments	Room temperature					Cold storage			
	Storage period in days					Storage period in days			
	٠	٤	٨	١٢	Mean	٠	١٥	٣٠	mean
Control	٠,٦٦٣	٠,٣٥٦	٠,٢٠٥	٠,١٨١	٠,٣٥١	٠,٦٦٣	٠,١٨٣	٠,١٧٩	٠,٣٤١
Ethephon ٢٥٠ppm	٠,٦٦٣	٠,٣٨٢	٠,٢٣٠	٠,١٩٩	٠,٣٦٨	٠,٦٦٣	٠,٢٢٣	٠,١٩٣	٠,٣٥٩
Ethephon ٥٠٠ppm	٠,٦٦٣	٠,٤٢٣	٠,٣٢٤	٠,٢٤٣	٠,٤١٣	٠,٦٦٣	٠,٢٨٤	٠,٢٧٢	٠,٤٠٦
Ethephon ٧٥٠ppm	٠,٦٦٣	٠,٤٦٣	٠,٤٠٩	٠,٣١٦	٠,٤٦٢	٠,٦٦٣	٠,٣٤٠	٠,٣١٠	٠,٤٣٧
Ethephon ١٠٠٠ppm	٠,٦٦٣	٠,٥١٥	٠,٤٢٧	٠,٣٣٣	٠,٤٨٤	٠,٦٦٣	٠,٣٥٠	٠,٣١٨	٠,٤٤٣
mean	٠,٦٦٣	٠,٤٢٨	٠,٣١٩	٠,٢٥٤	-	٠,٦٦٣	٠,٢٧٦	٠,٢٥٤	-
L.S.D	Ttreatments =٠,٢٨٠					Ttreatments =٠,٢٠٥			
	Sstorage period =٠,٢٨٠					Sstorage period =٠,٢٠٥			

Data from these tables also reveal that all ethephon treatments gave higher values of total caroteniods than the control under room temperature or cold storage. Ethephon at ١٠٠٠ ppm after ١٢ days at room temperature increased the total caroteniods since it gave about ٠,٣٣٣ mg/١٠٠mg than the other treatments used or the untreated fruits which presented ٠,١٨١ mg/١٠٠mg fresh weight as means of both seasons. Furthermore, Ethephon at ٧٥٠ or ٥٠٠ ppm gave a higher effect in this respect, but almost lower than those obtained from the ethephon application at ١٠٠٠ ppm. Since it averaged about (٠,٣١٦) mg/١٠٠mg or (٠,٢٤٣) mg/١٠٠mg fresh weight after ١٢ days at room temperature as means of both seasons under the study. Simon (١٩٩٧) found that caroteniods protect the chlorophyll from photo-oxidation and are accessory, light harvesting pigments and photoreceptors.

٩-Anthocyanin content in Kelsey plum fruits:

The results in Table disclosed that, anthocyanin content in skin of Kelsey plum fruits was significantly increase with storage period advanced from harvest till ١٢ days at room temperature and ٣٠ days of cold storage. Yet the values of anthocyanin during the storage at room temperature were higher than those obtained at cold storage during the both seasons of stud. Also, ethephon at ١٠٠٠ ppm after ١٢ days at room temperature increased

anthocyanin content averaged about (٠,٦٢١) mg/١٠٠mg fresh weight than the other treatments used or the untreated fruits which presented (٠,٥١٦) mg/١٠٠mg fresh weight as means of both seasons.

Table (١٠): Effect of postharvest treatments on Anthocyanin content (mg/١٠٠g) of Kelsey plum fruits.(mean of two seasons)..

Treatments	Room temperature					Cold storage			
	Storage period in days					Storage period in days			
	٠	٤	٨	١٢	mean	٠	١٥	٣٠	mean
Control	٠,٢٤٧	٠,٣٤٨	٠,٤٢٤	٠,٥١٦	٠,٣٨٤	٠,٢٤٧	٠,٥٢٩	٠,٥٣٧	٠,٤٣٧
Ethephon ٢٥٠ppm	٠,٢٤٧	٠,٣٥٣	٠,٤٣٠	٠,٥٤٠	٠,٣٩٢	٠,٢٤٧	٠,٥٣٣	٠,٥٣٩	٠,٤٣٩
Ethephon ٥٠٠ppm	٠,٢٤٧	٠,٣٦٤	٠,٤٤٩	٠,٥٤٨	٠.٤٠٢	٠,٢٤٧	٠,٥٤٨	٠,٥٥٣	٠,٤٤٩
Ethephon ٧٥٠ppm	٠,٢٤٧	٠,٤٠٣	٠,٤٦٧	٠,٥٩٦	٠,٤٢٨	٠,٢٤٧	٠,٥٨٣	٠,٥٨٨	٠,٤٧٣
Ethephon ١٠٠٠ppm	٠,٢٤٧	٠,٤٤٢	٠,٥٣٤	٠,٦٢١	٠,٤٦٠	٠,٢٤٧	٠,٦١١	٠,٦٣٠	٠,٤٩٦
mean	٠,٢٤٧	٠,٣٨٢	٠,٤٦٠	٠,٥٦٤	-	٠,٢٤٧	٠,٥٦٠	٠,٥٦٩	-
L.S.D	Ttreatments =٠,٠١٦					Ttreatments =٠,٠١٨			
	Sstorage period =٠,٠١٦					Sstorage period =٠,٠١٨			

Yet, ethephon application at ٧٥٠ ppm gave higher values of anthocyanin content in both seasons than ethephon application at ٥٠٠ ppm or the control. Since, ethephon application at ٧٥٠ ppm presented about (٠,٥٩٦) after ١٢ days at room temperature whereas, anthocyanin content percentage reached (٠,٥٨٨) after ٣٠ days of cold storage as a mean of the two seasons. Shaden& Davarynejad (٢٠١٠) investigated influences of preharvest ethephon spray on fruit quality attributes and certain nutritional compounds of 'Cigany' sour cherry (*Prunus cerasus*). Trees were sprayed with ٢٥٠ ppm ethephon one week before anticipated commercial harvest. Fruits from ethephon-sprayed trees had significantly lower soluble solids concentration (SSC), anthocyanin content, antioxidant activity, and firmness than those from non-sprayed control. The ethephon spray did not affect in total phenolic content, although its content tended to be higher in fruits from non-treated control. Titratable acidity (TA), pH and SSC/TA ratio were not affected by ethephon spray. There was a significantly positive correlation between anthocyanin content and SSC (r = ٠,٩٩).

From this data it is clear that, in spite of the ethephon treatments increased loss in weight, decayed fruits and total loss in fruit weight of Kelsey plum fruits, these treatments enhanced fruit ripening due to their effect on reducing fruit firmness and Chlorophyll A, B with increasing both soluble solids and anthocyanin contents. So, it is possible to recommend using ethephon at ١٠٠٠ ppm to accelerate fruit ripening of Kelsey plum fruits and cold stored at (٣+or-١^{o}C and ٩٠٪ R.H).

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تاثير الايثفون على انضاج ثمار البرقوق صنف كلسى.

محمود ابراهيم القاضى،نبيل رشاد سمره، محمد عاطف الشوبكى ورانيا عبده على بدوى

قسم الفاكهة – كلية الزراعة – جامعة المنصورة

اجريت هذه الدراسة خلال موسمى الدراسة ٢٠١٠ ، ٢٠١١ لتقييم غمس ثمار البرقوق صنف كلسى فى تركيزات مختلفة من الايثفون بغرض تحسين عملية نضج ثمار البرقوق الكلسى .

مما سبق يتضح انه على الرغم من نقع ثمار البرقوق فى الايثفون ادى لزيادة الفقد فى الوزن ونسبة الثمار التالفة الا انها تعمل على الاسراع من نضج الثمار وكذا تحسين التلوين وزيادة محتوى عصير الثمار من المواد الصلبة الذائبة الكلية وصبغة الانثوسيانين مقارنة بتلك الغير معاملة لذلك فمن الممكن ان يوصى باستخدام الايثفون بتركيز ١٠٠٠ جزء فى المليون حيث اعطى افضل نتيجة فى تحسين التلوين وكذا درجة نضج الثمار مع المحافظة على صفات الثمار االاكلية

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