EVALUATION THE EFFECTS OF HARVEST STAGE AND SOME POSTHARVEST TREATMENTS ON QUALITY OF BEACH FRUIT CV. "Dixired" DURING COLD STORAGE*

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ABSTRACT

The fruits source of this study was a commercial orchard of peach Dixired cv. located at Sartang village in Semel- Duhok- Kurdistan Region-Iraq, during growing season (2012). Harvested fruit transferred to central laboratory of Agriculture College - Duhok University, to study the effect of harvest stage (first harvest stage at35% red color and second harvest stage at 75% red color) and dipped in water at room temperature (24˚C) as control, 45, 55˚C and 2% fungicide (Bravo) for two minutes then stored in cold storage at 0±1˚C and 85-90% RH for 25 and 55 days period on quality of peach fruit during cold storage. The results revealed that peach fruit harvested at second harvest stage had significantly lower fruit firmness, titratable acidity, higher vitamin C, total sugar, juice % and decay as compared with first harvest stage. Peach fruit dipped at 45 and 55˚C hot water recorded significantly the higher weight loss in compression with control; fruit of postharvest treatment had a significant increase in fruit firmness total acidity and decrease in fruit decay compared to control. Fruit dipped in hot water at 55˚Cand 2% fungicide had a significant increase in fruit vitamin C and total sugar content. The interaction between factors under the study had significantly positive effect on most storage characteristic especially fruit firmness, TA, vitamin C, and decay.

Key Words: peach fruit, hot water, storage period.

INTRODUCTION

Peaches [*Prunus persica* (L.) Batsch] belong to the Rosaceae family and thought to have originated in China (Salunkhe and Desai, 1984). Peach crop is one of the most important stone fruit, due to heavy loading and dietetic value, the fruit is a good source of carbohydrate, protein and vitamins especially (A, B and C) and mineral nutrient and phenolic compounds that are good sources of antioxidants (Bal, 2005). Today, peaches are the third largest commercial fruit in Kurdistan Region, Iraqi after grapes and apples, Duhok is the major producer of peach in Iraq. The main problem which faces the world nowadays is the loss of fresh produce after harvest, the lost happened at various point in the distribution system between harvest and consumption sites especially in Iraq and Kurdistan region.

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The issues that influence produce quality include obvious things, such as maturity degree at harvesting and cultivar, physiological behavior of fruit during storage. Therefore, understanding of postharvest physiology and postharvest technology was very important to maintain the quality and safety of fresh fruit for consumptions or processing and to elongate the fruits age during the storage (Thompson, 2003). Most postharvest diseases are controlled by fungicides immediately after harvest as a spray or dip application. To minimize the development of pathogens on the fruits during postharvest phase this remains on the fruits as chemical residues. Because of efficacy and feasibility use of these chemicals although are widespread, they are becoming increasingly unpopular as a result of increasing awareness among consumers about fungicide residues **(**Lurie, 1998**)**. So, postharvest heat treatment as environmental friendly method is used for disinfestations of fruits and vegetables. Heat treatments include hot water, vapor heat and hot air. These treatments also are used to improve postharvest quality, delay ripening, and induce resistance to chilling injury and extent the shelf life of many commodities (Lu *et al*., 2010). Among different heat treatments, using of hot water as a disinfestations treatment has been widely adopted because of its efficacy and low cost (Jacobi, *et al.* 1995). Another significant advantage of (HWD) is maintenance of the quality at stored fruit (Malakou and Nanos, 2005). It would be an advantageous method for both preserving the quality of stored peach or nectarine and minimizing storage losses (Jemric *et al*., 2011). Zhang *et al.* (2010) demonstrated that peach fruit dipped in hot water at 50˚C for more than 40s or 55-60˚C for more than 10s. After 21 days of storage at 1˚C and 95% RH, showed significantly reduced fruits decay percentage. Casals *et al* ., (2010) studied that when peach fruits cv. 'Summer Rich', 'Rich Lady', 'Tardibelle', 'Elegant Lady' 'Placido', nectarines 'Big Top' and 'Venus' fruit were incubated for 21 days at 0˚C plus 5 days at 20˚C, then the fruit treated with hot water at 55-70 ˚C for 20-60s . The fruit firmness, TA, TSS, and weight loss% were not affected when fruit dipped in hot water at 20-60˚C for 40s as compared with control in all varieties. Jemric *et al.,* (2011) studied the effect of hot water dips at 40, 44, and 48˚C for 6 and 12 min on peach cv. R'oig' and nectarine cv. 'Venus' after cold storage. Hot water dip at 48˚C for 12 min significantly decreased TA in nectarine fruits. Khalil *et al.,* (2012) reported that peach fruit were dipped in hot water at (40, 45, 50, 55, and 60˚C) for one minute and stored for 12 days the analysis of fruit carried out that weight loss increased with the increase in storage time, TSS increased with the time factor, ascorbic acid decreased with storage time and temperature. Peaches are climacteric fruit, so fruit can be harvested at mature stage and ripened on the plant and they can be harvested when they are still firm by physiologically mature, which means they will continue to ripen after harvest, thus harvest time has influence on fruit sensorial quality (Ahmad *et al*., 2001). Different harvesting stages of peach fruits during harvest season may have significant affected on fruit quality. Peach is a perishable fruit and to ensure the highest fruit quality at the end of storage peaches must be harvested at an appropriate stage of maturity (Robertson *et al.*, 1990), Iglesias and Echeverri, (2009**)** the nectarines were harvested at 8 days intervals on five harvest dates, three of which were before the commercial harvest date; one at commercial harvest and another 1 week after commercial harvest were kept at 0.5 ˚C. Fruit firmness and TA showed constant and significant decline with progressive harvest date. But TSS significantly increased with progressive harvest date. Gupta and Jawandha (2010) reported that 'Eaili Grande' peach were harvested three times at (before, during, and after) predictable optimum harvest stage and kept in cold store at 0-2˚C and 85-90% RH for a period of 21 days. The fruits picked at post-optimum stage showed significantly higher weight loss, sugar content, and vitamin A content than fruit picked pre-optimum during storage period. This increase in the quality parameter was followed by the fruits harvested at optimum stage and pre-optimum stage respectively. Al-Shoffe *et al.* (2011) concluded that 'Coscia' pear fruit were harvested in three different dates by week time interval and stored for 7 months at 0-1ºC and 90-95 % RH in cold storage. The second date of harvest affected significantly by decreasing weight loss percentage, TA and firmness, in addition to that TSS, whereas fruits pH was increased compared with rest harvest dates, but the result showed that there was a significant increase in weight loss, TSS, and decrease in fruit firmness and TA, when storage period prolonged. According to reasons mentioned above furthermore the economical of peach and lack of researches related with cold storage of this crop this study was carried out to determine the effect of different storage times on the sensorial attributes that determines the overall quality of peach fruits, investigate the effect of hot water on quality and storage life of peach fruit and determine the best date for fruit harvesting.

MATERIALS AND METHODS

Source of the fruits was a commercial orchard of peach cv. Dixired located in Sartang village near college of Agriculture and in Semel - Duhok - Kurdistan Region-Iraq, during season 2012. Fruit was hand harvested from homogenous peach tree 7 years old and put carefully into coated plastic box to reduce water loss and mechanical injury during transport. Harvested fruit transferred to central laboratory in Agriculture College. This experiment conducted to investigate the effect of hot water and fungicide on Dixired cv. peach fruit quality harvested at two stages at 30-5-2012 (first harvest stage at 35% red color and second harvest stage at 75% red color). After a day of pre cooling the fruits tacked out from cold room. Before postharvest treatment sound, uniform size and appearance selected and divided into 4 groups. Fruit of each groups dipped in [water at room temperature 24˚C as (control)], hot water45, 55˚C and 2% Bravo as a fungicide its abroad spectrum fungicide the active ingredient is (Chlorot halonil) that have multi side Syngenta company- Switzer land that attack economical crops for 2 minus according to their treatment. Each group divided into 4 replicates and each replicate contained 15 fruit for each storage period. Fruit of each replicate bagged in to polyethylene perforated bag, and then stored at 0± 1ºc and 85-90 % RH in cold storage **(**Gupta and Jawandha (2010). Quality parameter was measured after 25 and 55 day storage. The experiments was laid out as Factorial in Randomized Complete Block Design (RCBD) including three factors (2harvest stage × 4post harvest treatment × 2storage period) with 4 replicates and 15 fruits / replicate for each storage period (Al-Rawi and Khalafallah, 1980). All the data were tabulated and statistically analyzed using SPSS system (1997).

Physical and chemical measurement.

1. Fruit weight loss (%); The weight was determined according to (El-Badawy, 2007).
2. Fruit Firmness (lb. /cm^2); the hand penetrometer was used for the measurement of fruit firmness (Kitinoja and Kadar, 2002).
3. Total soluble solids (TSS %); Total soluble solids were determined with a hand Refractmeter.
4. Titratable acidity (TA %); It was determined by titration of fruit juice according to Sourour (1992). Then total acidity was calculated as percentages of malic acid.
5. Vitamin C (mg $100ml^{-1}$ juice); Vitamin C in peach juice estimated with the titration method by using 2,6 Dichloro phenol indophenols pigments (Pearson, 1976).
6. Total sugar (%); was determined according to Lane and Eynon method, (Joslyn, 1970).
7. Juice (%); Fruits Juice were extracted by juice extractor and juice percentage were calculated according to (Karomi, 2001).

8. Fruits decay (%); Fruit showed any sign of decay were counted. The percentages of fruit decay were calculated on the bases of total fruit number.

RESULTS AND DISCUSSIONS

1- **Fruit weight loss (%);** Results in table (1) revealed that the fruit weight loss decreased with developing fruit in ripening. Dipped fruit in 45 and 55˚C hot water was significantly increased the fruit weight loss in comparison with control. Also dipped fruits in 2% fungicide increased the fruit weight loss, but not significantly when compared with untreated fruit. While the fruit weight loss significantly increased with prolonged the storage period. Interactions between harvest stage, postharvest treatment dip, and storage period showed difference in fruit weight loss compared to the highest fruit weight loss obtained from first harvest stage, 55˚C and 55 days storage. The lowest weight loss was recorded at interaction of first harvest stage, control, and 25 days storage. A significant increase of fruit weight loss in peach dipped in hot water could be due to direct water loss from the fruit tissue and partially from respiration process (Khalil *et al*., 2012), and perhaps due to remove some fuzz by hot water from the skin of the fruits. Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

Table 1. Effect of harvest date, postharvest treatment, storage period and their interactions on fruit weight loss(%) of peach fruit cv. Dixired stored at (0 ± 1°C)

Harvest stage	Postharvest treatment	Storage period (days)		Harvest stage × Postharvest treatment	Harvest stage mean
		25	55		
First Harvest stage	24°C(control)	0.67 f	3.56 c-e	2.12 b	4.08 a
	45°C	1.98 ef	6.15 bc	4.06 ab	
	55°C	3.69 c-e	9.15 a	6.42 a	
	2%fungicide	1.97 ef	5.45 bc	3.71 ab	
Second Harvest stage	24°C(control)	2.24 ef	5.42 bc	3.83 ab	3.89 a
	45°C	2.60 d-f	7.97 ab	5.28 ab	
	55°C	1.44 ef	4.05 c-e	2.74 b	
	2%fungicide	2.24 ef	5.14 cd	3.69 ab	
Storage period mean		2.10 b	5.86 a	Postharvest treatment mean	
Postharvest treatment × storage period	24°C(control)	1.46 d	4.49 bc	2.97 b	
	45°C	2.29 d	7.06 a	4.67 a	
	55°C	2.57 c	6.60 ab	4.58 a	
	2%fungicide	2.11 d	5.30 ab	3.70 ab	
Harvest stage × storage period	First harvest stage	2.08 b	6.08 a		
	Second harvest stage	2.13 b	5.64 a		

2- Fruit firmness (lb./ cm²); It is obvious from table (2) that fruit firmness in the first harvest stage was significantly higher than fruit harvested in the second harvest stage**.** Dipped fruit in 45˚C water showed the maximum firmness, but the lowest firmness obtained at control. Fruit firmness significantly decreased with increasing the storage period from 25 to 55 days. In respect with the interaction of the three studied factors, the interaction between first harvest stage, 45˚C and 25 days storage gave the highest fruit firmness, while the lowest fruit firmness was at the interaction of control, second harvest stage and 55 days storage. Significant decrease in fruit firmness with progress fruit ripening could be due to the changes in cell walls of fruit and their degradation by pectolitic enzymes (Sancho and Yahia, 2010). Other studies have reported that firmness loss is caused by the action of pectin methyl esterase that remove methyl groups from esterifies galacturonic acids that increase with fruit ripening and enhance the accessibility of polygalacturonase to its pectic substrate and β-galactosidase activity that increased during the last stages of ripeness (Karakurt and Huber, 2003).

Table 2. Effect of harvest date, postharvest treatment, storage period and their interactions on firmness (lb. /cm²) of peach fruit cv. Dixired stored at (0 ± 1 ºC)

Harvest stage	Postharvest treatment	storage period (days)		Harvest stage × Postharvest treatment	Harvest stage mean
		25	55		
First Harvest stage	24ºC(control)	8.79 b	5.91 e-g	7.35 bc	8.53 a
	45ºC	10.99 a	7.71bc	9.35 a	
	55ºC	10.17 a	7.35 cd	8.76 ab	
	2%fungicide	10.61 a	6.74 c-e	8.68 ab	
Second Harvest stage	24ºC(control)	5.61 e-h	4.36 i	4.98 d	5.43 b
	45ºC	6.35 d-f	5.26 f-i	5.80 cd	
	55ºC	5.81 e-h	4.68 hi	5.24 d	
	2%fungicide	6.36 d-f	5.06 g-i	5.71 cd	
Storage period mean		8.09 a	5.88 b	Postharvest treatment mean	
Postharvest treatment × storage period	24ºC(control)	7.20 a-c	5.14 c	6.17 c	
	45ºC	8.67 a	6.49 a-c	7.58 a	
	55ºC	7.99 ab	6.01 bc	7.00 b	
	2%fungicide	8.49 a	5.90 bc	7.19 ab	
Harvest stage × storage period	First harvest stage	10.14 a	6.93 b		
	Second harvest stage	6.03 c	4.84 d		

Peach fruit that treated with hot water recorded significantly the higher fruit firmness and lowest fruit decay may be associated with redistribution of natural epicuticular wax on the fruit surface closing numerous microscopic cuticular cracks (Rodov *et al*., 1997), and the delay of fruit softening might be due to inactivation of cell wall hydrolytic enzymes, mainly polygalacturonase (Lurie, 1998). Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

Fruit firmness at harvest: First harvest = 11.28 lb. cm^2; Second harvest = 10.00 lb. cm^2

3- Total Soluble Solids (TSS %); Table (3) clearly showed that there was not significant effect for harvest stage on fruit TSS%, or postharvest treatment. The recorded data shows that fruit TSS% significantly decreased with increasing the storage period from 25 to 55 days (table 3). Fruit TSS was higher significantly in the interactions of the first harvest, all postharvest treatments and 25 days storage than the interaction of same factors and 55days storage. The increase in TSS during fruit development is normally linked with change in fruit ethylene production (Gouble *et al*., 2005).

Table 3. Effect of harvest date, postharvest treatment, storage period and their interactions on total soluble solid (%) of peach fruit cv.Dixired stored at (0± 1 °C)

Harvest stage	Postharvest treatment	Storage period (days)		Harvest stage × Postharvest treatment	Harvest stage mean
		25	55		
First Harvest stage	24°C(control)	10.00 a	8.50 bc	9.25 a	9.33 a
	45°C	10.17 a	8.50 bc	9.33 a	
	55°C	10.17 a	8.67 bc	9.42 a	
	2%fungicide	10.00 a	8.67 bc	9.33 a	
Second Harvest stage	24°C(control)	10.50 a	9.00 b	9.75 a	9.46 a
	45°C	10.17 a	8.50 bc	9.33 a	
	55°C	10.33 a	8.00 c	9.17 a	
	2%fungicide	10.67 a	8.50 bc	9.58 a	
Storage period mean		10.25 a	8.54 b	Postharvest treatment mean	
Postharvest treatment × storage period	24°C(control)	10.25 a	8.75 b	9.50 a	
	45°C	10.17 a	8.50 b	9.33 a	
	55°C	10.25 a	8.33 b	9.29 a	
	2%fungicide	10.33 a	8.58 b	9.46 a	
Harvest stage × storage period	First harvest stage	10.08 a	8.58 b		
	Second harvest stage	10.42 a	8.50 b		

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

TSS at harvest: First harvest = 9.0%; Second harvest = 11.0%

4-Titratable acidity (TA%); The recorded data showed that fruit TA in the first harvest stage significantly higher than fruit harvested in the second harvest stage (Table 4).Tabulated data declared that dipped fruit in 45˚C water was significantly minimize the reduction of fruit TA in comparison with control. While, TA of fruit significantly decreased with prolonged the storage period. The obtained results indicated that the interaction between harvest stage, postharvest treatment and storage period had significant effect on TA, the highest TA was obtained between first harvest stage, 45˚C and 25 days storage, while the minimum TA was obtained in the interaction between second harvest stage, control and 55 days storage period. In ripe peaches the main soluble acids are malic acid, a significant decrease in fruit acidity with progress fruit in ripening might be due to the reduction in malic acid which utilizated in respiration in the fruit (Garriz *et al*., 2008). The increasing in TA in fruit dipped in hot water might be due to the degradation of biochemical constituents of the fruits during respiration resulting in certain acids (Shahnawaz *et al*., 2012), or reduced respiration, delayed ripening and senescence (Lal *et al*., 2002).

Table 4. Effect of harvest date, postharvest treatment, storage period and their interactions on titratable acidity (%) of peach fruit cv. Dixired stored at (0 ± 1 °C)

Harvest stage	Postharvest treatment	Storage period (days)		Harvest stage × Postharvest treatment	Harvest stage mean
		25	55		
First Harvest stage	24°C(control)	2.28ab	1.11de	1.70a	1.75 b
	45°C	2.32a	1.30d	1.81a	
	55°C	2.29ab	1.22de	1.75a	
	2%fungicide	2.16a-c	1.31d	1.74a	
Second Harvest stage	24°C(control)	2.09 bc	1.07e	1.58a	1.63 b
	45°C	2.11 bc	1.20 de	1.65 a	
	55°C	2.10 bc	1.16 de	1.63 a	
	2%fungicide	2.02 c	1.27 de	1.64 a	
Storage period mean		2.17 a	1.21b	Postharvest treatment mean	
Postharvest treatment × storage period	24°C(control)	2.19 a	1.09 c	1.64 b	
	45°C	2.22 a	1.25 b	1.73 a	
	55°C	2.19 a	1.19 bc	1.69 ab	
	2%fungicide	2.09 a	1.29 b	1.69 ab	
Harvest stage × storage period	First harvest stage	2.26 a	1.24 c		
	Second harvest stage	2.08 b	1.18 c		

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.
TA% at harvest: First harvest = 3.36%; Second harvest 2.96%

5- Vitamin C (mg 100ml^{-1} juice); Data in table (5) revealed that fruit vitamin C content significantly increased with progressing fruit ripening. The obtained results indicated that there were significant differences among postharvest (hot water and fungicide) treatments dip. Dipped fruit in 2% fungicide and 55˚C significantly increased fruit vitamin C as compared to control and 45˚C. Fruit vitamin C content significantly decreased with increasing storage period from 25 to 55days. Concerning the interaction of the three studied factors the effects were significant, the highest was obtained from interaction between second harvest stage, 2% fungicide and 25 days storage, while the interaction between first harvest stage, control and 55 days storage gave the lowest fruit vitamin C content. The reason of the significant increase of vitamin C in fruits harvested at second harvest stage might due to that the enzymatic system is very sensitive to high and low temperature, so the reason of significant increase in vitamin C of treated fruits might be due to inhibition the activity of L- ascorbic acid oxidase enzyme as response to hot water treatment (Taiz and Zeiger, 2002).

Table 5. Effect of harvest date, postharvest treatment, storage period and their interactions on vitamin C (mg 100ml^{-1} juice) of peach fruit cv. Dixired stored at (0±1 °C).

Harvest stage	Postharvest treatment	Storage period (days) 25	55	Harvest stage × Postharvest treatment	Harvest stage Mean
First Harvest stage	24°C(control)	1.30 de	1.01 e	1.15 cd	1.28 b
	45°C	1.01 e	1.01 e	1.01 d	
	55°C	1.44 de	1.30 de	1.37 b-d	
	2%fungicide	1.73 cd	1.44 de	1.59 b	
Second Harvest stage	24°C(control)	1.73 cd	1.44 de	1.59 b	1.91 a
	45°C	1.73 cd	1.30 de	1.52 bc	
	55°C	2.30 ab	2.02 bc	2.16 a	
	2%fungicide	2.59 a	2.16 a-c	2.38 a	
Storage period mean		1.73 a	1.46 b	Postharvest treatment mean	
Postharvest treatment × storage period	24°C(control)	1.51 b-d	1.23 cd	1.37 b	
	45°C	1.37 b-d	1.15 d	1.26 b	
	55°C	1.87 ab	1.66 a-d	1.77 a	
	2%fungicide	2.16 a	1.80 a-c	1.98 a	
Harvest stage × storage period	First harvest stage	1.37 c	1.19 c		
	Second harvest stage	2.09 a	1.73 b		

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.
Vitamin C at harvest: First harvest = 2.6 (mg. 100ml^{-1} juice); Second harvest = 2.6 (mg. 100ml^{-1} juice).

6- Total sugar (%); It was appeared from table (6), that the harvest stage had a significant effect on the fruit total sugar. Fruit harvested at second harvest stage had significantly higher total sugar content. The obtained results revealed that postharvest dipping fruits in 2% fungicide and 55° C water were increased significantly fruit total sugar as compared to control. Fruit total sugar significantly increased as the storage period extended. The highest fruit total sugar was obtained from the interaction of second harvest stage, 2% fungicide and 55 days storage period, while the lowest fruit total sugar was showed at the interaction between first harvest stages, 2% fungicide and 25 days storage period. A significant increase of total sugar in fruit harvested at the second harvest stage attributed to the degradation of complex insoluble compounds, like starch to simple soluble compounds like sugars (Selvaraj *et al.*, 1989).

Table 6. Effect of harvest date, postharvest treatment, storage period and their interactions on total sugar (%) of peach fruit cv. Dixired stored at (0 ± 1°C)

Harvest stage	Postharvest treatment	Storage period (days)		Harvest stage × Postharvest treatment	Harvest stage mean
		25	55		
First Harvest stage	24°C(control)	9.70 de	9.99 de	9.84 d	10.33 b
	45°C	10.52 de	10.77 c-e	10.65 cd	
	55°C	10.18 de	11.06 c-e	10.62 cd	
	2%fungicide	9.58 e	10.84 c-e	10.21 cd	
Second Harvest stage	24°C(control)	10.81 c-e	12.26 b-e	11.53 b-d	13.31 a
	45°C	11.40 c-e	13.42 bc	12.41 bc	
	55°C	12.38 b-e	14.96 b	13.67 ab	
	2%fungicide	12.51 b-d	18.77 a	15.64 a	
Storage period mean		10.88 b	12.76 a	Postharvest treatment mean	
Postharvest treatment × storage period	24°C(control)	10.25 b	11.12 b	10.69 c	
	45°C	10.96 b	12.10 ab	11.53 bc	
	55°C	11.28 b	13.01 ab	12.15 ab	
	2%fungicide	11.04 b	14.81 a	12.92 a	
Harvest stage × storage period	First harvest stage	10.00 c	10.66 bc		
	Second harvest stage	11.77 b	14.85 a		

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

The reasons of a significant increase of total sugar in fruits treated with postharvest treatment could be attributed to the decrease of respiration process through retarding or inhibit the activity of respiration enzyme (oxidase) which was responsible to use the sugar for product energy to continues repining process activity and other enzymes (Singh, 2003).

7- Fruits juice (%); Results in table (7) revealed that the juice percentage not influenced significantly by harvest stage and postharvest treatment. The recorded data also showed that the juice percentage was significantly increased with increasing storage period. There were no significant effects for the interaction between harvest stage and all postharvest treatments on juice %. The highest juice percentage was obtained from the interaction of first harvest stage, 2% fungicide and 55 days storage period which differ significantly from the lowest juice percentage resulted from the interaction among second harvest stage, 55˚C and 25 days storage period only.

Table 7. Effect of harvest date, postharvest treatment, storage period and their interactions on fruit juice (%) of peach fruit cv. Dixired stored at (0 ± 1˚C)

Harvest stage	Postharvest treatment	Storage period (days)		Harvest stage × Postharvest treatment	Harvest stage mean
		25	55		
First Harvest stage	24°C(control)	55.32 ab	59.34 ab	57.33a	57.65 a
	45°C	56.40 ab	59.76 ab	58.08 a	
	55°C	54.86 ab	57.54 ab	56.20 a	
	2%fungicide	56.43 ab	61.52 a	58.98 a	
Second Harvest stage	24°C(control)	54.18 ab	55.45 ab	54.82 a	55.45 a
	45°C	56.20 ab	57.32 ab	56.76 a	
	55°C	49.88 b	54.81 ab	52.34 a	
	2%fungicide	55.99 ab	59.77 ab	57.88 a	
Storage period mean		54.91 b	58.19 a	Postharvest treatment mean	
Postharvest treatment × storage period	24°C(control)	54.75 ab	57.40 ab	56.07 a	
	45°C	56.30 ab	58.54 ab	57.42 a	
	55°C	52.37 b	56.17 ab	54.27 a	
	2%fungicide	56.21 ab	60.65 a	58.43 a	
Harvest stage × storage period	First harvest stage	55.75 ab	59.54 a		
	Second harvest stage	54.06 b	56.84 ab		

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

8- Fruits decay (%); Results in table (8) illustrated that the decay (%) in fruit significantly increased from the first harvest stage to second harvest stage. All postharvest treatments significantly decreased fruits decay percentage as compared to the control. While the fruits decay percentage increased with increasing storage period. Results of harvest stage, postharvest treatments and storage periods interaction indicated that the interaction between first harvest stage, all postharvest treatments and 25 days storage period was the most potent treatment as it inhibit fruit decay (0.00%), nevertheless the highest fruit decay was recorded from the interaction of second harvest stage, control treatment and 55 days storage. A significant increase of decay in peach fruit harvested at second harvest stage might occur as a result of increased respiration rate, enzyme activities and dissolution of cell wall which ultimately lead to ripening and softening of fruits (Kviklienė and Valiuškaitė (2009).

Table 8. Effect of harvest date, postharvest treatment, storage period and their interactions on decay (%) of peach fruit cv. Dixired stored at (0 ± 1°C)

Harvest stage	Postharvest treatment	Storage period (days)		Harvest stage × Postharvest treatment	Harvest stage mean
		25	55		
First Harvest stage	24°C(control)	0.00 c	18.18 ab	9.09 a	3.03b
	45°C	0.00 c	3.03 c	1.52 a	
	55°C	0.00 c	3.03 c	1.52 a	
	2%fungicide	0.00 c	0.00 c	0.00 a	
Second Harvest stage	24°C(control)	0.00 c	21.21 a	10.61 a	7.95a
	45°C	0.00 c	15.15 ab	7.58 a	
	55°C	0.00 c	15.15 ab	7.58 a	
	2%fungicide	0.00 c	12.12 b	6.06 a	
Storage period mean		0.00 b	10.98 a	Postharvest treatment mean	
Postharvest treatment × storage period	24°C(control)	0.00 c	19.70 a	9.85 a	
	45°C	0.00 c	9.09 b	4.55 b	
	55°C	0.00 c	9.09 b	4.55 b	
	2%fungicide	0.00 c	6.06 bc	3.03 b	
Harvest stage × storage period	First harvest stage	0.00 c	6.06 b		
	Second harvest stage	0.00 c	15.91 a		

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

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تقيم موعد الحصاد ومعاملات مابعد الحصاد في نوعية ثمار الخوخ صنف "Dixired" أثناء الخزن المبرد

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المستخلص

مصدر ثمار هذه الدراسة بستان تجاري في قرية سرطنك – سميل في محافظة دهوك – كردستان العراق. خلال فصل النمو 2012 تم جني الثمار ونقلها الى المختبر المركزي في كلية الزراعة جامعة دهوك لدراسة تاثير مرحلة الجني (الجنية الاولى عند تلون 53% من الثمرة باللون الاحمر والجنية الثانية عند تلون 75% من الثمرة)، ثم نقعت الثمار في ماء درجة حرارته 24 °م (مقارنة) و45 °م و55 °م، و 2% مبيد فطري (Bravo) لمدة دقيقتين، ثم خزنت الثمار في المخزن المبرد بدرجة حرارة صفر ±1 °م و85 إلى 90% رطوبة نسبية لمدة 25 و 55 يوما لدراسة تاثيرها في نوعية ثمار الخوخ خلال مدة الخزن المبرد. بينت النتائج ان الثمار التي تم جنيها في المرحلة الثانية تميزت بانخفاض معنوي في صلابتها، والحموضة القابلة للتسحيح، وارتفاع في فيتامين ج والسكريات الكلية، ونسبة العصر ونسبة تدهور الثمار مقارنة مع موعد الحصاد الاول، والثمار التي نقعت في ماء حار بدرجة 45°م و55°م سجلت ارتفاعا معنويا

في فقدان الوزن مقارنة مع ثمار معاملة المقارنة. معاملات الثمار بعد الحصاد ادت الى زيادة معنوية في صلابة الثمار والحموضة الكلية وانخفاض في تلف الثمار مقارنة بمعاملة المقارنة، والثمار التي نقعت في مار حار 55°م و2% مبيد فطري ادت الى زيادة معنوية في محتوى الثمار من فيتامين ج والسكريات الكلية. التداخل بين عوامل الدراسة ادى الى تاثير معنوي ايجابي في اغلب الصفات الخزنية خصوصا صلابة الثمار والحموضة القابلة للتسحيح وفيتامين ج وتدهور الثمار.

الكلمات المفتاحية: الخوح، ماء حار، فترة الخزن.