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Pre-harvest effect of AVG on quality of nectarine Misky cv. fruit at harvest and Post harvest

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Abstract

Nectarines are one of the stone fruit which is fruit ripen and deteriorate rapidity at ambient temperature. thus to slow these processes cold storage is used. Beside that apply Products to slow the ripening process such as aminoethoxyvinylglycine (AVG) in term ReTain® (15% AVG) used for prevention of pre-harvest fruit drop and for improving fruit quality in most fruit. This study was carried out in Complete Randomized Block Design with two factors and three replication to determine the effects of preharvest aminoethoxyvinylglycine (AVG) applications in different doses on the fruit quality of local nectarine Misky cv. during cold storage. Trees (leaves and fruits) were sprayed with AVG at four levels (0, 75, 150 and 300 mg.l^{-1}) three weeks before the estimated harvest date. Fruit quality parameters were measured at harvest (fruit width, fruit length and respiration rate) and fruit firmness, TSS, total sugars, titratable acidity(TA), vitamin C, fruit weight loss and decay% parameters were determined after harvest at 4 and 8weeks storage at 0 ±1° C and 85% - 90% RH. Applications of AVG at all doses improved fruit width and length and decreased rate of respiration at harvest, besides significant maintenance of fruit firmness, titratable acidity and vitamin C. However, TSS, total sugars, fruit weight loss and decay significantly decreased compared to untreated fruit during storage AT storage duration the firmness, titratable acidity and vitamin C was reduced, but TSS, total sugars, fruit weight loss and decay significantly increased in fruit. The result of the interaction clarified that fruit treated with 300mg.l^{-1} and 0 week storage had higher fruit firmness, vitamin C and titratable acidity, nevertheless, have lowest TSS and total sugars.

Keywords: AVG, Nectarine and cold storage

Introduction;

Nectarine (*Prunus persica* var. nectarine) has been described for nearly as long as the peach, but its original place is unknown. Because nectarine may have arisen from peach seeds, most peach growing areas worldwide have also introduced nectarine cultivars. Stone fruits are quite popular among customers due to their flavor and nutritional content. Nectarine and peach are high functional fruits as a consequence of their quality, bioactive compounds, and antioxidant content (1). Ripening of fleshy fruits is a dynamic transitional in biochemical and physiological changes that transform the mature fruit into a ready to consumption. Significant progress has been occur in characterizing the molecular components of the fruit ripening process, including ethylene biosynthesis and cell wall de-polymerization, which cause change in texture, flavor, and aroma (2). On other word , we can say; changes in the chemical composition and the physical characteristics of the fruit take place during ripening, which lead to easily perceivable alterations in fruit texture, firmness, color, aroma, and sweetness (3). In general, nectarines harvested at the "well-mature" or riper stages will ripen properly without exogenous ethylene application. Because nectarines are a climacteric fruit, they are harvested at a minimum or higher maturity; they are not ready to eat. Nectarines must be ripened before consumption to satisfy consumers. Peaches and nectarines fruit due to their climacteric properties at room temperature continues ripening which induces fast firmness loss, deterioration and decay of fruit (4). Peaches and nectarines ripen and deteriorate quickly at ambient temperature. Therefore, cold storage is used to slow these processes and decay development (5). Holding stone fruits at low temperatures minimizes losses of fruit, excessive softening, and water losses.

Therefore, cold storage of peaches and nectarines after harvest is necessary to minimize excessive softening, quality loss and decay and to prolong time for marketing (6). The optimum storage temperature is -1 to 0 °C and 90 to 95% RH (7). Several factors have been reported to be associated with postharvest losses of fruit. Diseases or respiration, ethylene and enzyme are the major factors caused postharvest losses (8). Storage life can be prolonged with pre-harvest treatments on the tree or postharvest and pre-storage treatments of AVG (9). Dagar *et. al*. (10) showed that when they stored nectarine mutant 'Yuval' for 8week at 0°C, decrease in fruit firmness and total were decreased However total soluble solid, fruit weight loss and decay with prolong storage period.were increased

AVG is commercially sold under the name of ReTain® as a plant growth regulator. It is an organic product and naturally occurring amino acid. It is also described as a human and environmentally friendly registered for use with apples, pears, peaches, nectarines, plums and other climacteric fruits in several countries (11). Cline *et. al*. (12) Observed that AVG treatments delayed ripening and harvest, increased fruit firmness and prolonged storage life of fruit. Pre-harvest treatment of fruits with AVG decreases ethylene production, delays fruit maturity, and allows fruit to ripen more slowly. Furthermore, it is difficult to directly evaluate the shelf-life of AVG-treated fruit, because AVG affects fruit maturity, which in turn influences shelf-life (13). Aminoethoxy-vinylglycine AVG is known as an ethylene inhibitor, targeting the 1-amino-cyclopro-pane-carboxylate (ACC) synthase in the ethylene biosynthesis pathway which is the immediate precursor of ethylene and the rate-limiting enzyme in ethylene biosynthesis (14).

In a study conducted in application of AVG in a 'Arctic

Snow' nectarines, at 125g AVG/ha 7 days before first harvest, perform delay based on harvest and larger fruit size compared to the untreated fruit (15). Application of AVG to 'Monroe' peach tree at (0, 100, 150 and 200 mg *l*-1) before commercial harvest (7, 21 and 30 days)was studied. The results of all AVG concentration showed increasing in fruit weight, fruit firmness, soluble solids content, total acid, sugar content, and reduce respiration rate compared to untreated fruit (16). OlmMstead and Futch(17) reported improve in firmness and fruit storage quality at harvest and through storage, when AVG has been sprayed to peach tree as a pre-harvest treatment. Kucuker *et. al*.(18) reported that when Black Beauty plum trees were sprayed with AVG doses (0, 100 and 200mg.l^{-1}) two weeks before the estimated harvest date delayed the maturation parameters, such as weight loss, firmness and total soluble solid during storage.

The quality and productivity of peaches and nectarines have increased in recent years due to the establishment of larger orchards with imported cultivars. There is no study regarding the postharvest physiology and storage performance of this cultivar. Therefore his study aimed to investigate the storage and shelf life of the Misky nectarine cultivar.

Aim of the study; there are a few studies about post-harvest treatment of AVG (ReTain®) on quality of fruit during storage, but no study regarding the pre-harvest application of AVG on quality and storage performance of the local cultivar Misky nectarine fruit at harvest and through storage , has been reported As well as the absence of any study on this local cultivar in Iraq and Kurdistan region. Therefore, this study was aimed to examine the effects of pre-harvest application of AVG at different concentrations on behavior of local nectarine fruit cultivar Misky at harvest and during cold storage.

Materials and Methods

Perfect local Misky cv. nectarine grafted on peach seedling rootstocks and the experimental trees were planted with 4 x 4 m spacing, trained to a free open-vase system with 7 years old were selected from a commercial orchard in Saadia, Duhok Governorate, during the 2011 seasons, to study the effects of pre harvest spray of (aminoethoxyvinylglycine) AVG under the name of ReTain® on fruit quality characteristics at harvest and during cold storage.

Misky nectarines trees with uniform growth, size and homogeneous fruit load divided to 4 blockes according to the treatment (concentration) of AVG, with (3) replicates for each treatment and one tree / replicate, were selected for experiment. Then trees (fruits and leaves around the fruits) were sprayed early in the morning with (AVG) ReTain® (Valent Biosciences corp, USA), a commercial product containing 15% (w/w) AVG, as an aqueous solution, containing 0.05% (v/v) of a surfactant (Tween-20) until runoff, at doses corresponding to 0, 75, 150 and 300mg.l^{-1} AVG, The spraying was performed with a hand pump sprayer before commercial harvest (21days before harvesting).

Fruit was manual harvested from an early morning, at commercial ripening stage, then immediately and directly transported to cold storage facilities at the Central Laboratory of Agriculture College, Duhok University -Duhok. The uniformly-sized fruits were washed by water at ≈20°C. The following steps were carried out; 15 fruit of each replicate according to each treatment was packed in a 2Kg polyethylene container for each storage period. Then packaged samples were stored at 0±1°C and 85-90%RH in cold storage for

8week, the fruit was removed from cold storage for analysising each analysis period (0, 4 and 8 week) to determine changes in fruit quality parameters.

The experiment was conducted using a factorial experiment with Randomized Complete Block Design (RCBD) with AVG treatment and storage period as the two factors (4pre harvest treatment × 2storage period) with three replications and 15 fruits / replicate for each storage period (19). All the data were tabulated and statistically analyzed using SAS system (2002**)**. An arcsine square-root transformation was performed to meet the assumption of normality

The fruit quality measurements include; fruit width (FWcm), fruit length (FLcm), Respiration rate (mgCO_2 /Kg/h) these parameters measured directly after harvest only, but fruit firmness (Ib), total soluble solid (TSS%), total sugar (TS%), total acid (TA%) , vitamin C (VC. mg/100ml juice), fruit weight lose (FWL%), and fruit decay (FD%) measured at the beginning of storage and during storage period . All fruit quality parameters were determined according to A. O. A. O(20), Fruit juice was extracted by juice extractor for analysis.

Result and Discussion

Fruit properties; Fruit of Misky cv. nectarine sprayed with all concentrations (0, 75, 150, and 300mg.l^{-1}) AVG significantly had higher fruit width, length and lower respiration rate compared with untreated fruit, while the result showed no significant differences between AVG level in fruit width and length (Table 1).

For fruit firmness (lb./cm^2); Result in Table (2) showed that pre-harvest application of AVG affected significantly on fruit firmness. Fruit treated with 300 mg.l^{-1} AVG maintained higher fruit firmness significantly compared to the other treatment. The result in the same table showed that the fruit firmness significantly decreased when storage period prolonged from (0 - 4 to 8week). About the interaction between AVG and storage period, the results revealed that fruit firmness of the interaction between 150 or 300 $mg.l^{-1}$ and 0 week storage significants higher than all other interaction, while the minimum firmness was in the interaction between control and 8week storage period.

Table (1): Effect of pre-harvest spray of AVG, on some properties of nectarine fruit Misky cv..

AVG ($mg.l^{-1}$)	F. Width (cm)	F. Length (cm)	Respiration rat $Mgco_2. Kg^{-1}. h^{-1}$
0	5.130 c	5.277 b	6.850 a
75	5.263 bc	5.463 ab	6.070 ab
150	5.470 ab	5.51 ab	5.343 b
300	5.577 a	5.730 a	3.793 c

Means followed by the same letters do not differ significantly from each other according

to Duncan's Multiple Range Test at 0.05 level.

For total soluble solids (TSS %); No significant differences in TSS of the fruits found as a result of foliar spray with 75 $mg.l^{-1}$ AVG and control fruits, on other hand fruit sprayed with AVG at 150 and 300 $mg.l^{-1}$ gave a significant decrease in the TSS of the Misky cv. fruit (table 3). Progress storage of fruit from 4 to 8 weeks caused increase in TSS of fruit but no reached to significant. The highest

TSS was in fruit from the interaction between control and 4

Table (2): Effect of pre-harvest spray of AVG, storage periods and their interactions on fruit firmness (Ib)of nectarine Misky cv. stored at (0 ±1°C).

AVG (mg.l^{-1})	Storage periods (week)			Means of AVG
	0	4	8	
0	7.767 b	5.867 cd	4.400 f	6.011 c
75	8.000 b	6.100 c	4.667 ef	6.256 c
150	8.700 a	6.467 c	5.000 ef	6.722 b
300	9.100 a	7.333 b	5.300 de	7.244 a
Means of Storage periods	8.392 a	6.442 b	4.842 c	

Means followed by the same letters do not differ significantly from each other according to

Duncan's Multiple Range Test at 0.05 levels.

week storage period, whereas the lowest TSS was obtained from the interaction between 300 mg.l^{-1} AVG and 0 week storage period. It was clear that fruit sprayed with 300 mg.l^{-1} AVG at all stored period had a lower TSS than all other interactions

For total sugar (%); Fruit sprayed with AVG in 150 and 300mg.l^{-1} had significantly lower total sugar as compared with untreated and 75 mg.l^{-1} AVG. Regarding the storage period, the total sugar significantly increased with increasing storage period from 0 to 4weeks or 8 weeks. Nevertheless the results showed that no significant differences between the two (4 and 8weeks) storage periods in fruit total sugars. Tabulated results recorded that fruit total sugar significantly influenced by the combination between the both factors AVG and storage period. The maximum total sugar, obtained at interaction between 0mg.l^{-1} AVG and 4weeks storage period, while the minimum total sugar was at interaction between 300mg.l^{-1} AVG and storage period (Table 4).

Table (3): Effect of pre-harvest spray of AVG, storage periods and their interactions on fruit TSS (%) of nectarine Misky cv. stored at (0 ± 1 °C).

AVG (mg.l^{-1})	Storage periods(week)			Means of AVG
	1	2	3	
0	12.667 a-c	13.167 a	13.000 ab	12.944 a
75	12.290 bc	12.833 a-c	12.667 a-c	12.597 a
150	11.423 e	12.300 bc	12.100 cd	11.941 b
300	11.000 e	11.500 de	11.333 e	11.278 c
Means of Storage periods	11.845 b	12.450 a	12.275 a	

Means followed by the same letters do not differ significantly from each other according to Duncan's Multiple Range Test at 0.05 levels.

For total acidity (TA %); Results in Table (5) indicated that fruit treated with AVG concentrations was surpassed as it gave significantly the highest fruit TA compared to 0mg.l^{-1}AVG. According to storage period, data declares that the differences between the studied storage periods (0, 4 and 8wee) were obvious to be significant. TA was significantly highest in fruits stored for 0 week, while the lowest TA % was in fruits stored for 8 weeks. The interaction between AVG concentration and storage period showed a significant difference in TA. The highest TA was obtained when fruits sprayed with 300mg.l^{-1}AVG and 0 week storage period, while the lowest TA showed by the interaction between 0mg.l^{-1}AVG and 8 weeks storage. Obviously, the fruits sprayed with all concentrations of AVG have significantly higher acidity in cooperation with untreated fruit in each period of storage.

Table(4): Effect of pre-harvest spray of AVG, storage periods and their interactions on fruit total sugar (%) of nectarine Misky cv. stored at (0±1° C).

AVG (mg.l^{-1})	Storage periods (week)			Means of AVG
	0	4	8	
0	10.730 a-c	11.193 a	11.040 ab	10.988 a
75	10.380 bc	10.887a-c	10.730 a-c	10.666 a
150	9.577 e	10.387 bc	10.213 cd	10.059 b
300	9.180 e	9.647 de	9.490 e	9.439 c
Means of Storage periods	9.967 b	10.528 a	10.368 a	

Means followed by the same letters do not differ significantly from each other according to Duncan's Multiple Range Test at 0.05 levels.

Table (5): Effect of pre-harvest spray of AVG, storage periods and their interactions on fruit total acidity (%) of nectarine Misky cv. stored at (0 ± 1 °C).

AVG ($mg.l^{-1}$)	Storage periods(week)			Means of AVG
	0	4	8	
0	0.89 b	0.71 c	0.56 d	0.72 c
75	1.00 a	0.80 b	0.65 c	0.82 b
150	1.05 a	0.82 b	0.70 c	0.86 ab
300	1.09 a	0.87 b	0.73 c	0.89 a
Means of Storage periods	1.01 a	0.80 b	0.66 c	

Means followed by the same letters do not differ significantly from each other according to Duncan's Multiple Range Test at 0.05 levels.

For vitamin C (mg. $100ml^{-1}$ juice); Fruit vitamin C content increased significantly with increasing concentration of AVG spray from (0, 75, 150, and 300 $mg.l^{-1}$ AVG). On the contrary, the storage period affected negatively on fruit vitamin C content, so observed from the results that the fruits vitamin C content decreased significantly with increasing duration of cold storage from (0, 4, and 8weeks). Results recorded that fruit vitamin C significantly influenced by the interaction between the both factors. The maximum vitamin C obtained at the interaction between 300 $mg.l^{-1}$ AVG and week storage period, which was significantly higher than all other interaction treatments, while the minimum vitamin C was at control and 8weeks storage period (Table 6).

Table (6): Effect of pre-harvest spray of AVG, storage periods and their interactions on fruit Vitamin C (mg.100ml^{-1} juice) of nectarine Misky cv. stored at (0 ± 1 °C).

AVG (mg.l^{-1})	Storage periods(week)			Means of AVG
	1	4	8	
0	4.173 bc	3.360 d	1.833 e	3.122 c
75	4.67 bc	3.460 d	2.0170 e	3.382 bc
150	4.827 b	4.000 cd	2.040 e	3.622 b
300	5.683 a	4.320 bc	2.330 e	4.111 a
Means of Storage periods	4.838 a	3.785 b	2.055 c	

Means followed by the same letters do not differ significantly from each other according

to Duncan's Multiple Range Test at 0.05 levels.

For fruit weight lose (%); It is clear from Table (7) that nectarine fruit Misky cv. sprayed with 300mg.l^{-1} AVG significantly recorded the lowest fruit weight lose, compared with all other levels of AVG(0, 75, and 150 mg.l^{-1}). The storage period when prolonged from 4 to 8 weeks caused a significant increase in fruit weight loses. The result of the interactions between the AVG spray and storage period indicated, that the fruit weight loses of all concentrations of AVG spray and 4 week storage had significantly lowest , fruit weight loses in cooperation with all levels of AVG application and 8weeks storage period. It is worth to mention that the interaction between 300 mg.l^{-1}AVG and 4weeks gave significantly lowest fruit weight loss compared to all interaction treatments.

Table (7): Effect of pre-harvest spray of AVG, storage periods and their interactions on fruit weight lose (%) of nectarine Misky cv. stored at (0 ± 1 ^{o}C).

AVG (mg.l^{-1})	Storage periods(weeks)		Means of AVG
	4	8	
0	3.063 b	5.683 a	4.373 a
75	3.013 b	5.507 a	4.26 ab
150	2.660 b	4.927 a	3.793 b
300	1.827 c	4.927 a	3.377 c
Means of Storage periods	2.641 b	5.261 a	

Means followed by the same letters do not differ significantly from each other according to Duncan's Multiple Range Test at 0.05 levels.

For physiological injury (decay %); AVG sprayed treatment (75, 150, and 300 mg.l^{-1}) was effective significantly in reducing decay % of the stored nectarine fruit Misky cv. comparing with control fruits. It is clear from our results that prolonged storage period from 4 to 8 weeks of nectarine fruit Misky cv. caused significant increase in fruit decay. Regarding the interaction between AVG level spray and storage periods, it is important to point out that the decay of the fruits appeared only in non treated fruit when stored 4 weeks. But the decay appears in the interaction of all AVG treatments and 8weeks storage. It is clear that the percentage of fruit decay in the fruit with all AVG concentrations were lower significantly compared to untreated fruits when stored for 8 weeks (table 8).

Table (8): Effect of pre-harvest spray of AVG, storage periods and their interactions on fruit Physiological injury (decay %) of nectarine Misky cv. stored at (0 ± 1 °C).

AVG ($mg.l^{-1}$)	Storage periods(week)			Means of AVG
	0	4	8	
0	0 e	3.710 d	17.043 a	6.918 a
75	0 e	0 e	13.867 b	4.622 b
150	0 e	0 e	6.173 c	2.058 c
300	0 e	0 e	3.433 d	1.144 d
Means of Storage periods	0 c	0.928 b	10.129 a	

Means followed by the same letters do not differ significantly from each other according to Duncan's Multiple Range Test at 0.05 levels.

Discussion;

The results achieved by AVG in our study are in agreement with the findings of Cetinbas *et. al.* (21) on peach fruit . Cano-Salazar *et. al.* (22) studied the effect of AVG on fruit physiochemical characteristics of all stone fruit. With respect to the effect of storage period our results were similar to those found in the studies reported in the literature about peaches and nectarines (23 and 24). Different strategies have been used to study the effects of ethylene on fruit development and ripening and the use of ethylene inhibitors, such as aminoethoxyvinylglycine (AVG). The AVG can strongly inhibit the S-adenosylmethionine (SAM) to ACC conversion and therefore, can inhibit ethylene production, reduce respiration rat, delay ripening and prolong fresh age of fruits (25), other study also reported that the ethylene production and the respiration rate decreased with the applications AVG to peach fruit. (26) These effect of AVG on fruit ripening behavior might be clarifying our results (increase fruit width, length and decrease respiration rate) which presorted in (Table1).

AVG sprayed (75, 150 and 300 mg l^{-1}) significantly maintenance fruit firmness and reduced fruit weight loss and decay development in this trial mainly at 300 mg l^{-1}. This effect was related to the delay of ripen and to possible inhibition of ethylene production (27). Aminoethoxyvinylglycine (AVG) inhibits ethylene production during fruit ripening by blocking the conversion of S-adenosylmethionine (SAM) to 1-aminocyclopropane-1-carboxylic acid (ACC). This delay in fruit ripening was mainly due to inhibition of ethylene biosynthesis, followed by reduced softening in flesh firmness (28).

Considering to high acidity and vitamin C as a response to AVG treatment could explain that AVG treatment delaying ripening process and reducing respiration of fruit which reduced the utilization acidity (29), as obvious in Table (1) results of respiration rate of fruits. It has also been found in our study a decrease in TSS and total sugars in Misky nectarine fruit treated with AVG compared to untreated fruit during storage, This results could be explained according to the AVG ability to reduce ethylene production, respiration rate, cell wall softening enzyme activities (30), because the increase of TSS and sugars during fruit development is normally linked to change in fruit ethylene production (31). We can support the interpretation of our results through the influence of AVG on the rate of respiration in (Table 1).

About Storage period; our results imply a decrease in "Misky" nectarine fruit firmness, tetratable acidity, and vitamin C. But, the percentage of TSS, total sugar, fruit weight loss and decay was gradually increased as storage period advanced or we can say that when storage period was prolonged from (0 to 4 or 8weeks) cold storage. The decrease in fruit firmness and increase in decay% significantly with increasing storage period might be due to fruit softening which closely connected with cell wall modification caused by some cell wall degrading enzymes (32). Or related to pectin chains dissolving during ripening and storage (33) also could be due to increase respiration rate, enzyme activities and dissolution of cell wall which ultimately led to softening and ripening of fruits during storage (34). The reason of the increase TSS significantly with increasing storage period could be due to components which are produced from hydrolyzing sucrose to glucose and fructose during fruit dehydration with advanced fruit ripening (35). The significant increase in total sugar in Misky nectarine fruit with prolonged storage time could be attributed mainly due to breakdown of starch into simple sugars during ripening. Also, it could be attributed to the increase activity of amylase and other enzymes converted starch into simple sugars during storage (36). The significant reduction in tetratable acidity of fruit of nectarine cultivar Misky during storage might be due to utilize the organic acid in respiration process during fruit ripening in other were the conversion of acids into sugars and further utilization in the metabolic process of the fruit respiration (37). A significant decrease of vitamin C in fruit with prolonged cold storage period may be attributed to the destruction of ascorbic acid which is associated with activity of ascorbic acid oxidise, which is high in ripe fruits (38). The increase in fruit weight loss when storage period advanced from 4 to 8 weeks might be related to the level of free water content, which was higher in ripe fruit than unripe ones and might be due to more transpiration and respiration during storage period (39).

Conclusion

This study reveals that AVG was relatively more effective in improve fruit width, length and decrease respiration rate after harvest and ripening process during storage, since it play an important role in many of the physico-chemical changes occur during ripening such as, maintain firmness, TA, vitamin C. Besides, AVG were more effective on reduced TSS, sugars, weight loss and decay% of fruit during cold storage. AVG considered a material with promising future in prolonging the storability of local nectarine fruits cultivar Misky and maintaining the highest possible quality during marketing. On other hand, prolonged fruit in the cold storage had minus effect on firmness, TA, and vitamin C of fruit. TSS, total sugars weight loss and decay in fruit rising coincided with increasing duration of cold storage. Therefore , I recommend to performance studies about this local cultivar of various aspects, such as use of other methods of storage, treatments also improve the quality and quantity of fruits and planting because it considered to be best and appropriate cultivars to the governorate.

References

1- Leong SY, and I. Oey. 2012. Effects of processing on anthocyanins, carotenoids and vitamin C in summer fruits and vegetables. Food Chem., 133:1577–1587.

2- Giovannoni JJ. 2004. Genetic regulation of fruit development and ripening. The Plant Cell. 16: 170–180.

3- Trainotti L, C. Bonghli; F. Ziliotto; D. Zanin; A. Rasori; G. Casadoro; A. Ramina and Tonutti P. 2006. The use of microarray lPEACH1, to investigate transcript me changes during transition from preclimacteric to climacteric phase in peach fruit. Plant Science. 170, 606–613.

4- Fruk G.; L. Niševiç; Z. Sever; T. Miliçeviç and Jemriç T. 2012. Effects of different post harvest heat treatments on decreasing decay, reducing chilling injury and maintaining quality of nectarine fruit. Agriculturae conspectus Scientifics, 77 (1): 27-30.

5- Crisosto, C. H.; F. G. Mitchell, and Ju Z. 1999. Susceptibility to chilling Jury of peach, ectarine, and plum cultivars grown in California. HortScience, 34: 1116–1118.

6- Buescher, R. W. and D. L. Griffith .1976. Changes in fresh market quality of Redhaven peaches during storage. Arkansas Farm Res., 25: 5.

7- Crisosto, C. H.; E. J. Mitcham and Kader A. A. 2000. Peaches and nectarines. Recommendations for Maintaining Post harvest Quality. Post harvest Technology Research and Information Center.

ttp//www.Postharvest.ucdavis.edu/Produce/producefacts/fruit/necpch.

8- Singh D. and G. Mandal. 2006. Improved control of *Rhizopus stolonifer* induced storage rot of peach with hot water and antagonistic yeast, *Debaryomyces hansenii*. Ind Phytopath. 59:168-173.

9- Asrey R.; C. Sasikala and Singh D. 2012. Combinational impact of *Debaryomyces hansenii* bioagent and 1-MCP on shelf life and quality attributes of

Kinnow mandarin. Hor.tFlor Res Spec., 1(2):103-109.

10- Dagar A.; A. Wekslera; H. Friedmana; E. A. Ogundiwinc; C. H. Crisostoc, R. Ahmadc and Luriea S. 2011. Comparing ripening and storage characteristics of ‘Oded’ peach and its nectarine mutant ‘Yuval’. J. Postharvest Biology and Technology. 60: 1- 6.

11- Greene DW. and JR. Schupp.2004. Effect of aminoethoxy-vinylglycine (AVG) on preharvest drop, fruit quality, and maturation of ‘McIntosh’ apples. II. Effect of timing and concentration relationships and spray volume. HortSci., 39:1036–1041.

12- Cline, J. A. 2006. Effect of aminoethoxyvinylglycine and surfactants on preharvest drop, maturity, and fruit quality of two processing peach cultivars. HortScience, 41:377–383.

13- Garner D.; CH. Crisosto and Otieza E. 2001. Controlled atmosphere storage and aminoethoxyvinylglycine postharvest dip delay post cold storage softening of ‘Snow King’ peach. Hort. Tech., 11:598–602.

14- Bregoli, A. M.; S. Scaramagli; G. Costa; E. Sabatini; V. Ziosi, S. Biondi, and Torrigiani P. 2002. Peach (*Prunus persica*) fruit ripening aminoethoxyvinylglycine (AVG) and exogenous polyamines affect ethylene emission and flesh frimness. Physiologia Plantarum, 114:472- 481.

15- Rath, A. C. and A. J. Prentice. 2004. Yield increase and higher flesh firmness of arctic snow nectaries both at harvest in Australia and after export to Taiwan following pre-harvest application of ReTain plant growth regulator (Aminoethoxyvinylglycine, AVG). Aust. J. Exp. Agric., 44: 343-351.

16- Çetinbaş, M. and F. Koyuncu. 2011. Effects of aminoethoxy- vinylglycine on harvest time and fruit quality of ‘Monroe’ peaches. J. Agri. Sci., 17: 177-189.

17- OlmMstead M. and S. Futch. 2012. Using an Ethylene Inhibitor to Increase Fruit Size, Firmness, and Storage Quality in Florida Peach Production. Proc. Fla. State Hort. Soc., 125:13–16.

18- Kucuker, E. ; B. Ozturk; H. Aksit and Genc N. 2015. Effect of pre-harvest aminoethoxyvinylglycine (AVG) application on bioactive compounds and fruit quality of plum (*Prunus salicina* Lindell cv. Black Beauty) at the time of harvest and during cold storage. J. Animal and Plant Scie., 25 (3): 763-770

19- Al-Rawi, K. M. and A. Khalafalla.1980. Analysis of Experimental Agriculture Disgen. Dar Al-Kutub for Printing and Publishing. Mosul University, Ministry of Higher Education and Scientific Rrsearch, Iraq. (In Arabic).

20- A. O. A. C. 1995. Official Methods of Analysis. Association of Official analytical Chemists. Washington D. C. U. S. A.

21- Çetinbaş, M.; S. Butar; C. E. Onursal and Koyuncu M. A. 2012. The effects of pre-harvest ReTain [aminoethoxyvinyl-glycine (AVG)] application on quality change of ‘Monroe’ peach during normal and controlled atmosphere storage. Sci. Hort., 147: 1–7.

22-Cano-Salazar J.; ML. López and Echeverría G. 2013. Relationships between the instrumental and sensory characteristics of four peach and nectarine cultivars stored under air and CA atmospheres. Postharvest Biol. Technol., 75:58–67.

23- Martins RN.; BH. Mattiuz; LO. Santos; CMA. Morgado and Mattiuz CFM. 2011. Preservation of minimally processed "Aurora-1" peaches using additives. Rev Bras Frutic., 33:1229–1239.

24- Pace B., M. Cefola; F. Renna and Attolico G. 2011. Relationship between visual appearance and browning as evaluated by image analysis and chemical traits in fresh-cut nectarines. Postharvest Biol Technol., 61:178–183.

25- Capitani, G.; D. L. McCarthy; H. Gut; M. G. Grutter and Kirsch J. F. 2002. Apple 1-Aminocyclopropane-1-carboxylate synthase in complex with the inhibitor l-aminoethoxyvinyl-glycine. Evidence for a ketimine intermediate. J. Biol. Chem., 227: 49735-49742.

26- Kim, I. S; C. D. Choi; H. J. Lee and Byun J. K. 2004. Effects of aminoethoxyvinylglycine on preharvest drop and fruit quality of 'Mibaekdo' peaches. Proc 9th IS on Plant Bioregulators, Acta Horticulturae, 653: 173-178.

27- D'Aquino, S.; M. Schirra; M.G. Molinu; M. Tedde and Palma A. 2010. Preharvest aminoethoxyvinylglycine treatments reduce internal browning and prolong the shelf-life of early ripening pears. Sci. Hortic., 125: 353-360.

28-Torrigiani, P.; A. M. Bregoli; V. Ziosi; S. Scaramagli and Ciriaci T. 2004. Pre-harvest polyamine and aminoethoxyvinyl-glycine (AVG) applications modulate fruit ripening in Stark Red Gold nectarines (*Prunus persica* L. Batsch). Postharvest. Biol. Tech., 33: 293-308.

29- Fallahi, E. 2007. Influence of 1-aminoethoxyvinylglycine hydro-chloride and α-naphthalene acetic acid on fruit retention, quality, evolved ethylene, and respiration in apples. International J. Plant Prod., 1:53-61.

30- Eduardo V. B. and A. A. Kader. 2007. Effect of 1-methyl-ecyclopropen on softening of fresh cut kiwifruit, mango and persimmon slices. Posthar Biol Tech., 43(2):238-244.

31- Gouble, B.; S. Bureau; M. Grotte; M. Reich; P. Reling and Audergon J. M. 2005. Apricot postharvest ability in relation to ethylene production: Influence of picking time and cultivar. Acta Horticulturae, 682: 127-134.

32- Fischer, R. L. and A. B. Bennett. 1991. Role of cell wall hydrolases in fruit ripening

Annual Review of Plant Physiology and Plant Molecular Biology, 42: 675-703

University of California, Davis. http://www.annualreviews.org/doi/abs.

33- Peirs, A.; V. Parmentier; H. Wustenberghs and Keulemans J. 2000. Comparison of quality evolution during storage between different cultivars of plums. Acta Horticulturae, 518: 145–150.

34- Juan, J. L.; J. Frances; E. Montesinos; F. Camps; J. Bonany and Michalchuk L. 1999. Effect of harvest date on quality and decay losses after cold storage of ‘Golden Delicious apple in Grona (Spain). Acta Horticulturae, 485:195-201.

35-Arena, M. E. and N. S. Curvetto .2008. Berberis buxifolia fruiting: kinetic growth behavior and evolution of chemical properties during the fruiting period and different growing seasons. Scientia Horticulturae, 18: 120–127.

36- Shahnawaz, M.; S. A. Sheikh; A. A. Panwar; Sh. G. Khaskheli and Awan F. A. 2012. Effect of hot water treatment on the chemical, sensorial properties and ripening quality of cmaunsa Mango (*Mangifera indica* L.) J. Basic Applied Sci., 8: 328-333.

37-Abbasi, N. A.; Z. Iqbal; M. Maqbool and Hafiz I. A. 2009. Postharvest quality of mango (*Mangifera indica* L.) fruit as affected by chitosan coating. Pak. J. Bot., 41: 343-357.

38- Chempakam, B. 1983. Distribution of Ascorbic Acid and Ascorbic Acid Oxidise Activity in the Developing Cashew Apple (*Anacardium occidentale* L.). J. HortSci., 58: 447-448.

39- Seymour, G. B.; J. E. Tayllor and Tuker A. 1996. Biochemistry of Fruit Ripening. Chapman and Hall, UK., pp. 151-187.

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تأثير معاملة AVG قبل الجني على نوعية ثمار الخوخ الاملس صنف مسكي عند الجني وبعد الجني

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المستخلص:

نكتارين واحدة من ثمار النواة الحجرية والتي تنضج وتتدهور ثمارها بسرعة في الدرجات الحرارية المحيطة. لتقليل هذه العمليات يستخدم التخزين البارد وبجانب ذلك تستخدم المركبات التي تؤخر من عمليات النضج مثل امينو ايثوكسي فينايل كلايسين (AVG) تحت مصطلح ReTain® والمحتوية على 15% AVG لتقليل تساقط الثمار قبل الجني وتحسين النوعية في معظم انواع الثمار اجريت هذه الدراسة في تصميم القطاعات العشوائية الكاملة بعاملين وشجرة واحدة / مكرر. لمعرفة تاثيررش اوراق وثمار الاشجار بتراكيز مختلفة من AVG (صفر، 75، 150و 300ملغم.ليتر$^{-1}$ قبل الجني بـ 21 يوم في نوعية ثمار الخوخ الاملس المحلي صنف مسكي (Misky) خلال التخزين المبرد.

الصفات النوعية للثمار متمثلة في طول الثمرة وعرضها ومعدل التنفسقدرت بعد الجني مباشرة وصفات صلابة الثمار، ونسبة المواد الصلبة الذائبة والسكريات الكلية والحموضة القابلة للتسحيح وفيتامين ج وفقدان وزن الثمار ونسبة التدهور قدرت بعد الجني وبعد 4و 8 أسابيع من التخزين في درجة صفر+1 °م ورطوبة نسبية 85-90%. جميع مستويات AVG حسنت من صفات طول وعرض الثمار وخفضت من معدل تنفسها بعد الجني. الى جانب ذلك احتفظت الثمار بصلابتها وحموضتها ومحتواها من فيتامين ج ولكن انخفضت فيها نسبة المواد الصلبة الذائبة والسكريات الكلية وفقدان الوزن ونسبة التدهور بصورة معنوية مقارنة بالثمار غير المعاملة خلال التخزين المبرد. الصلابة والحموضة وفيتامين ج للثمار انخفضت عند تقدم الثمار في التخزين، ولكن نسبة المواد الصلبة الذائبة والسكريات الكلية وفقدان الوزن ونسبة التدهور بصورة معنوية ازدادت باطالة مدة التخزين. ثمار معاملة التداخل بين 300ملغم.ليتر$^{-1}$ وصفر مدة التخزين امتلكت اعلى صلابة وحموضة وفيتامين ج واقل نسبة مواد صلبة الذائبة وسكريات الكلية.

كلمات مفتاحية: امينو ايثوكسي فينايل كلايسين AVG، نكتارين Nectarines ، الخزن البارد.