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The impact of harvest date and coating type on storage of the Valencia Orange varieties, Bazman, Iran

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ABSTRACT: This study, carried out to investigation of the effect of harvest date and coating type on the storage of the Valencia orange varieties using factional experiment based on a randomized complete block design with three replications. The harvest date (December 6 and 21, January 5 and 20) and coating type (control (without coating), wax and polyethylene) were considered as the first factors in four levels and second factor in three levels, respectively. After harvesting and grooming at the 6 centigrade and 87 relative humidity for two months, the storage of the fruits was detected. Results showed that the harvest date and coating type were affected fruit rot, weight loss, orange Juice content, weight of the skin and dross which were significant at the level of 1%. The harvest date of January 4 was affected fruit decay, weight loss, orange Juice content, weight of the skin and dross more than the other harvest date. Also, the ethylene coating in compression with the wax cover and control one (without coating) was significantly prevented to the reducing of the fruits decay, weight loss, orange Juice content, weight of the skin and dross. This meant that the juice loosing of the fruit with ethylene cover is less than the wax cover. Increasing of the dissolved solid materials and the titratable acidity in the control samples and waxy groomed fruit was significantly more than the ethylene covered samples which could be as a result of the decreasing juice content at these grooms. Therefore, the Valencia orange harvesting from January 4 and warping with the polyethylene cover in order to increasing of the storage and supply period, is recommended.

***Keywords*:** Valencia Orange, Harvest Date, Wax coating, Polyethylene(PE), storage

INTRODUCTION

Citrus are the most important semitropical world fruits. Sirius which belong to the Rotech have the main species including orange, tangerine, limy, lemon, sour orange and kinds of the bigeneric citrus (Shah Beygh, 2003). The world planting area and production rate in 2009 were reported 7.6 million hectare and 103.8 ton, respectively (FAO, 2009). Totally, the Curtis appropriate maintenance and storage methods are more important than the production of them which be able to supplying costs. It is possible that in result of the inappropriate storage, maintenance or incorrect harvest methods, a large volume of product destroyed in a short time (Zarei, 2006). Agricultural product destroying which conducted due to the variety of reasons such as inappropriate harvest date and methods, transportation and storage of them are the most important agricultural issues in Iran. Studies results shows that the Curtis destroying is estimated about 28-31 % (Futuhi Ghazvini, 2011). If this wastes is assumed to average 30 %, about 1.1 million tons of citrus fruits which is produced by huge costs annually is wasted. Post-harvest decay, is the most important factor that limits the lifetime of many of the watery products. All

the products such as fresh fruit and vegetables must be free of dust, pathogens and chemicals before supplying for the local markets and export. The physiological changes during long storage causes to a patient can grow inside of the fruit and increases their vulnerability to disease after harvest (Khatami et al., 2009). According to the excess amount of the orange at the harvest time, it is necessary to storage and gradually supply to the markets. Orange like as the other fruits, may be attacked by a number of pathogens that affect fruit quality before or after harvest. Penicillium digitatum, Penicillium italicum, Colletotrichum gloeosprioides and sour rot caused Candidum geotrichum are the most important post-harvest pathogens, which among them, blue and green molds have the greatest impact and damage.

Therefore, reducing the amount of waste in any stage of harvesting to intake is a national motion which should be consider by researcher using new technology and implementation of projects. So, the main objective of this study was to evaluation of the harvest date effects on the control of post-harvest decay of orange, effects of polish and polyethylene cover to prevent of the post-harvest decay development and putrefaction and comparison of the fruits weight loss between the waxy and polyethylene covered fruit.

Methodology

This study carried out to investigation of the harvest date and type of covers (polyethylene and wax) effects on the Valencia orange storage using factorial randomized complete design with three replications, Bazman, Iran. The harvest date ((December 6 and 21, January 5 and 20) and coating type (control (without coating), wax and polyethylene) are considered as the first factor in four level and second factor in tree levels, respectively with a total of 12 treatments and 36 experimental plots. In order to this investigate, Valencia orang fruits with the same condition and physiological and morphological characteristics randomly was selected and transported to the laboratory to wax and polyethylene coating. The fruit were stored during two month after harvest with 6 centigrade temperature.

In each harvest, fruits in early morning randomly picked by scissors from four direct without damaging tree and were arranged in the plastic basket and immediately transported to the laboratory. Afterwards the healthy and uniform fruits were separated and washed by water and dried with paper towels, so categorized into three groups of 30 treatments to apply the coating treatments. After that, ten treatments were selected form every groups and separately placed in the appropriate baskets as a replication. Baskets were kept in the 6 centigrade temperature and 87**±**1 relative humidity. At the end of two month, the samples were brought out the storage and qualitative factors were evaluated.

To apply treatments in regards of the polyethylene coat, thin polyethylene (19 microns diameter) was used. After washing and drying, fruit was wrapped separately in polyethylene cover. In regards of wax cover, the combination of the 18% wax, 2% Aymazalyl fungicide and 5 % Thiabendazole fungicide was used. Fruit was soaked in the wax solution for a 4-5 minutes and drying of them surface coating was performed by the ambient temperature. Afterwards, fruit were inside of the basket to storage. Control samples also after washing and drying were placed in the basket for storage, too. In this study, fruit rot, weight loss, juice percent (weight %), skin and pulp weight were the indicator parameters for evaluation of the fruit insolubility. Obtained results of the fractional experiment based on randomized complete block were analyzed and their meant compared with 5% probability using SAS software and LSD test, respectively.

Results and Discussion

In this study, the effects of storage conditions and coating as well as their interactions on the fruit rot, weight loss, juice weight, fruit pulp and skin were significant at 1 % statistical level. Mean comparisons results showed that the highest percentage of fruit rot was belong to the common stock and polyethylene coating (3.06 %) (Figure 1). Wax and refrigerator treatments significantly reduced the percentage of fruit rot (23.1%). Fruit respiration increasing is caused to the storage life reduction. Warehouse pre-treatments including sterilization, using of the plastic wrap, wax and regulating materials, and the environmental factors of the stock such as humidity, temperature, air velocity and atmospheric composition are the most important parameter which could be act as an acceleration or lowering rat of the respiration. Increased respiration led to reduce in the amount of sugar and acids such as ascorbic acid (vitamin c) in the fruits (Larrigaudiere et al, 2002). Using of the refrigerator has reduced the fruit rot percentage and decreased it up to 1.8 percent. Storage temperature is the most important factors in the fruits and vegetables durability which by decreasing in temperature, the respiration and transpiration are also decreased (Ramin and Khoshbakht, 2008). Totally, optimum condition of storage depending on the type of vaudeville and variety is different and dependent on the fruit resistance to low temperature, high rate humidity, low

oxygen and high carbon dioxide, amount of ethylene and ultimately the mechanical damage to the fruits. The high temperature of the stock cause to the fruit shrinking, accession of the aging on the skin and also fruit rotting in the results of the fungi agents' activity. Application of the polyethylene cover with the keeping of the fruit moisture has increased the percentage rot of fruit in comparison with the waxy cover and control samples. Ben-Yehoshua et al. (1981) reported that the percentage of citrus fruit rot in the plastic bag or covered container increased in result of the secondary infection.

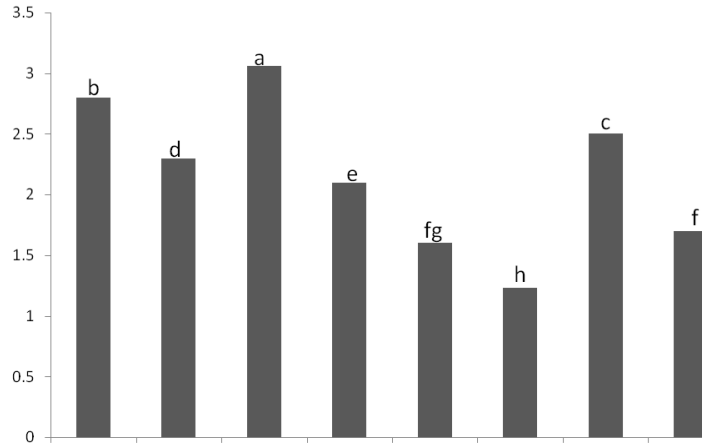

Figure 1. Mutual effects of the storage and coating on the pomegranate rot

Mean comparisons showed that the highest percentage of weight loss was belong to the control sample and the sample which was picked up on December 5. January 4 picked sample and a waxy coating in comparison with the other treatments could be prevented from fruit weight loss (Figure 2). The fruits covered with polyethylene showed less weight loss. According to the reports, Shah Ben (2000) and Ben-Yehoshua et al. (1981), on Valencia oranges, Washington navel, lemon and pomelo, the polyethylene coated delayed fruits aging, maintained the hardness of texture, increase the quality and marketability of the fruits and is prevented from the weight loss.

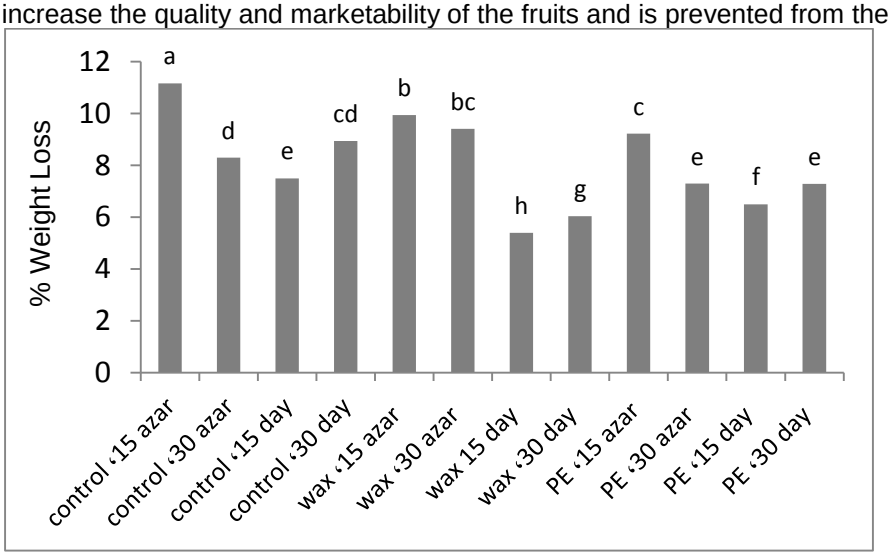

Figure 2. Mutual effects of the harvest time and coating on the weight loss

Variance analysis results showed that the interaction effects of harvest time and coating significantly affected the fruit weights in the 1% statistic level. Also, mean comparison results revealed that the highest and lowest value of juice weight belonged to the 30 January picked sample with polyethylene cover and 6 December picked control

sample, respectively (Figure 3). Ben-Yehoshua et al. (1981) and Camerson et al. (195) were investigated the effects of polyethylene covers on reduction of the fruit water loss and maintenance of the product quality on the large number of fruits. They suggested that in case of many products like as citrus fruits used in the business scale. Theses coating are impermeable to water vapor and by creating a saturated atmosphere with moisture, prevented from the evaporation and shrinkage of the fruits. Also, because of these coating improbability to the molecules of oxygen and carbon dioxide, create a different atmosphere around the fruits, which is led to respiration reduction, a delay in the aging and softening of fruits, especially in the covered fruits as well as further decay presentation and finally reduce the spread of infection among the fruits with together.

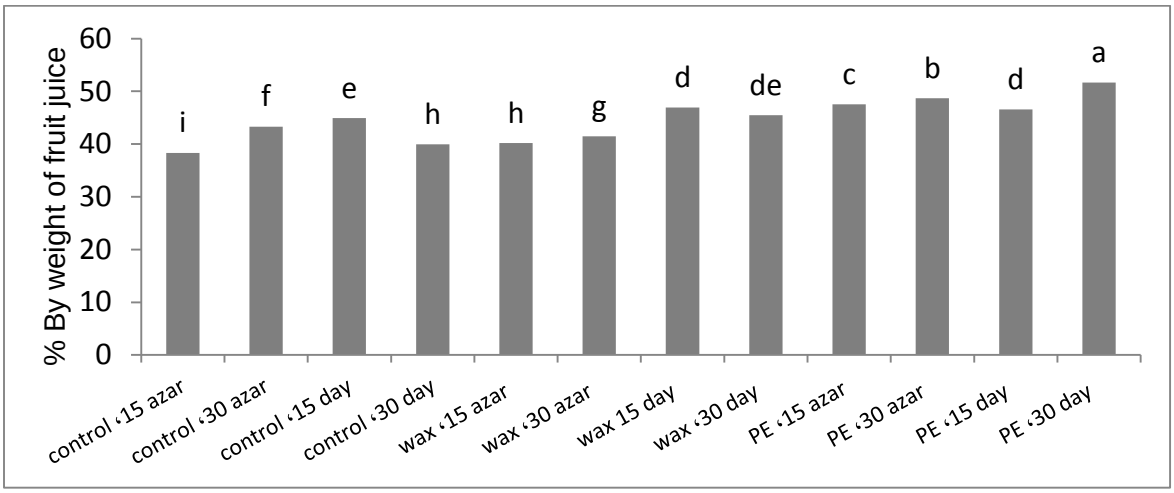

Figure 3. Mutual effects of the harvest time and coating on the orange juice weight loss

The comparison of the means showed that the highest weight of fruit skin belonged to the January 5 picked polyethylene covered sample. Although it hadn't significantly different from the grabbed sample on December 20 and coating by polyethylene (Figure 4). Determining the best harvest time is one of the most important Curtis harvesting issues which majorly affected the fruit quality during storage period. Late harvest led to the short storage and early harvesting also cause to the fruits be sensitive to the frost. Results indicated that the polyethylene cover could be a better protective rather than waxes and control samples in the fruit weight loss. The study on the comparison between the polyethylene and waxes covers in the fruit weight reducing shows that polyethylene sheets are much better than the wax coating to evapotranspiration control and reduction.

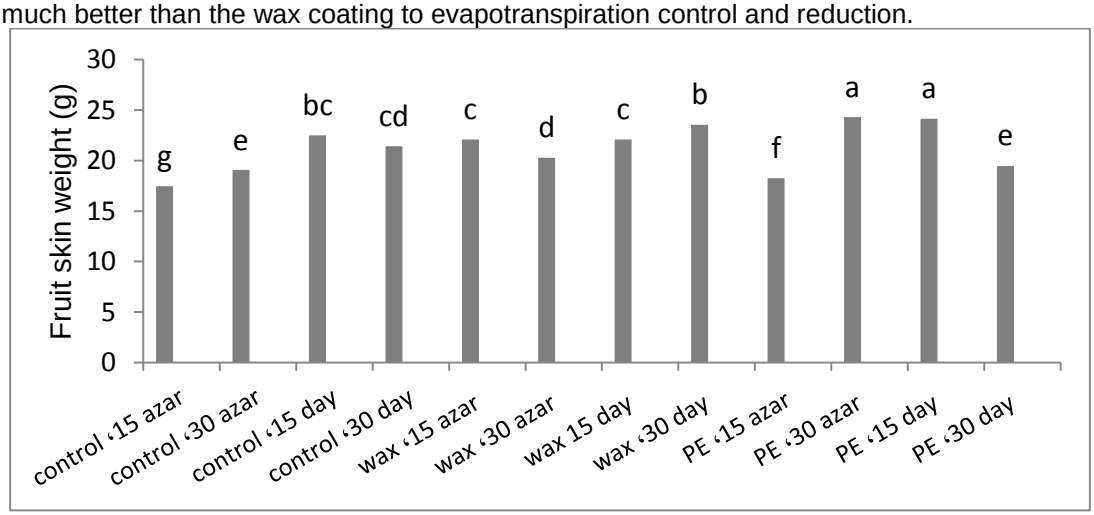

Figure 4. Mutual effects of the harvest time and coating on the orange skin weight

The comparison of the means showed that the highest percentage of fruit waste weight belonged to the January 4 picked polyethylene covered sample (Figure 5). Although it hadn't significantly different from the grabbed sample

on January 19 and coating by polyethylene with the 4 January picked waxy covered sample. Also the lowest percentage of weight belonged to the control sample which grabbed on December 20.

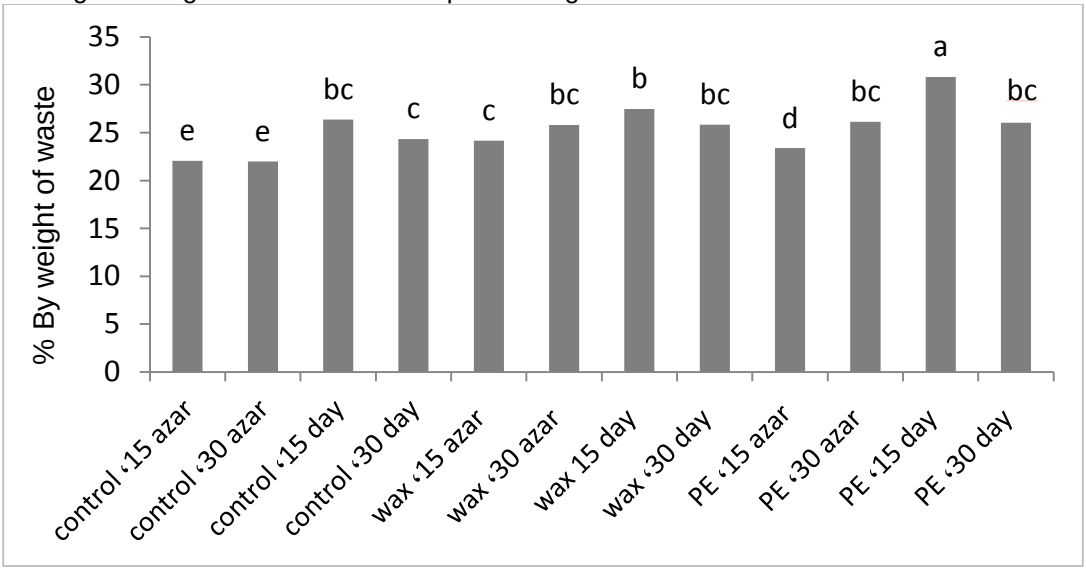

Figure 5. Mutual effects of the harvest time and coating on the orange pulp weight

Recent study results showed that post-harvest transpiration reduction is the most important factor in the citrus stock life time expanding. Water losing in result of transpiration not only causes to wilting, softening and drying up of citrus but also causes to the balance of Toddlers (GA) changes to the aging (ethylene) and led to deterioration of the fruits. Today, the plastic sheets are used to extend product shelf life. In the developed countries in order to increase shelf life and better marketing, the majority of the citrus is wrapped individually in thin sheets of plastic. Choose a plastic sheet with different densities is an important factor (Ben-Yehoshua, 1969). The other study results, which conducted by Safi Zadeh and Rahemi (1383) on comparing fruits weight loss coating by polyethylene bags with polished fruits, showed that the polyethylene sheets are much better than the waxy coat in reduction of the evapotranspiration. These study results are accordance with Bagdady et al. (1987) which their study results declared that increased amount of dissolved solids in wax treatment was happened in result of the released carbon dioxide from the flesh and happened due to the high amount of lost water in the wax covered fruit (Bagdady et al. 1987).

According to the various studies results, polyethylene coating in the case of Valencia oranges, Washington navel, lemon and pomelo delayed fruits aging, maintained the hardness of texture, increased the quality and marketability of the fruits and is prevented from the weight loss. Warehouse pre-treatments including sterilization, using of the plastic wrap, wax and regulating materials, and the environmental factors of the stock such as humidity, temperature, air velocity and atmospheric composition are the most important parameter which could be act as an acceleration or lowering rat of the respiration. Increased respiration led to reduce in the amount of sugar and acids such as ascorbic acid (vitamin c) in the fruits (Larrigaudiere et al, 2002).

Conclusion

Harvest date and proper storage condition can be a good strategy to maintain the quality and quantity of fruit after harvesting. This study results showed that the harvest date affected the juice weight, skin weight, total suspended solids, lost weight percentage, dross weight percentage at 1 % statistical level. So, the third harvest date (January 4) is the best harvesting date to the Valencia orange storage in Bazman. The thin polyethylene cover significantly affected reduction of the juice, skin, dross and whole fruit weights in comparison with the other treatments. This meant that polyethylene sheets are able much better than a wax coat in fruit evapotranspiration reduction. However, suspended solids and treatable acid in wax treated was higher than the polyethylene one, so the higher water lost in the wax-treated fruits can be one of the reasons. Also, the interaction of the harvest date and type of coverage on all traits were significant at the 1 % statistic level. The results revealed that polyethylene coating can be suitable protective in reducing fruit weights in comparison with the wax one.

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