

# Effects of Modified Atmosphere Packaging and 1-Methylcyclopropene during Storage and Shelf Life of Sweet Cherry Cv. 0900 Ziraat

**Dündar O\* and Ölmez A**

Cukurova University, Agriculture Faculty, Horticulture Department, Sarıçam, Adana, Turkey

\*Corresponding author: Omur Dündar, Cukurova University, Agriculture Faculty, Horticulture Department, Sarıçam, Adana, Turkey, Email: odundar@cu.edu.tr

**Research Article**

Volume 3 Issue 4

**Received Date:** July 12, 2018

**Published Date:** August 10, 2018

## Abstract

In this research, modified atmosphere packaging (MAP) as stand art commercial treatment, combination with consumer size trays (T) MAP+500 g T, and 1-Methylcyclopropene combinations with both treatments as MAP+1-MCP and MAP+1-MCP+500 g T were compared during storage and shelf life of sweet cherry cv. 0900 Ziraat. Fruits were hydro cooled after harvest and divided into mentioned treatments. Treatments were stored at 0°C, 90-95% relative humidity conditions for 35 days and subsequently they were waited at 20°C 2 days for shelf life evaluation. Quality analyses were done weekly intervals. Weight loses, TSS, peel elasticity, total decay, L\*, a\*, b\*, C\*, pH and antioxidant amounts were increased where as there were decrease in stem chlorophyll, TA and h<sup>o</sup>. The amount of total phenolic components was preserved. As a result, MAP and MAP+500 g T were maintained fruit quality equal as MAP+1-MCP and MAP+500g T +1-MCP.

**Keywords:** Map; 1-Mcp; 0900 Ziraat; Sweet Cherry; Storage

## Introduction

Cherries are within the Rosaceae family and belong to the genus Prunus. Cherries are thought to be native to South Caucasus, Caspian Sea and Northeast Anatolia and are now grown widely around the world [1]. Accordingly, our country is one of the origin centers of cherries. Cherries are grown almost everywhere in our country, especially in Black Sea Region, Central Anatolia Region, Marmara Region, Inner West Anatolia Division, Aegean Region and Lake District. Cherry shows a wide

distribution in the world. However, commercial production is made in countries such as Turkey, USA, Iran and Italy. Cherry producing areas in the world in the first place, Turkey is one of the leading countries in the export cherries. Turkey's geographical and climatic conditions are suitable for breeding quality cherries in many regions. In both domestic and foreign markets, early and late cherries are sold at higher prices than medium season cherries. According to TUIK, 637.132 tonnes production quantity of cherries has increased in 2016 [2]. Izmir is the first in the cherries produced in Turkey. 11.7 percent of the cherry production was exported. The most breeding

made in the first five cv. such as 0900 Ziraat, Early Burlat, Van, Bing and Lambert in Turkey. Cherry is the kind of fruit that has an important place in our country's economy. Although stone fruit species do not have the greatest share in terms of aquaculture, they are among our most important products for export. The problems encountered in the scope of aquaculture are largely overcome, but the problems encountered especially during the harvesting and storage stages decrease the continuity of the product at high quality in export and inner market. Total fruit and vegetable production: 43 million tons, postharvest loss rate: 25-40%, loss amount: 10-16 million tons, export amount: 4-5%; the importance of post harvest technologies is rapidly increasing. Especially increasing the preservation period by preserving the quality and avoiding the losses that may occur during transportation, is of great importance in terms of our country which is the leading position in exports.

The main objective of this research is to examine the different applications that will affect the fruit quality criteria positively during storage and shelf life, to reduce the chlorophyll breakdown of fruit stem and to minimize drying.

## Materials and Methods

### Material

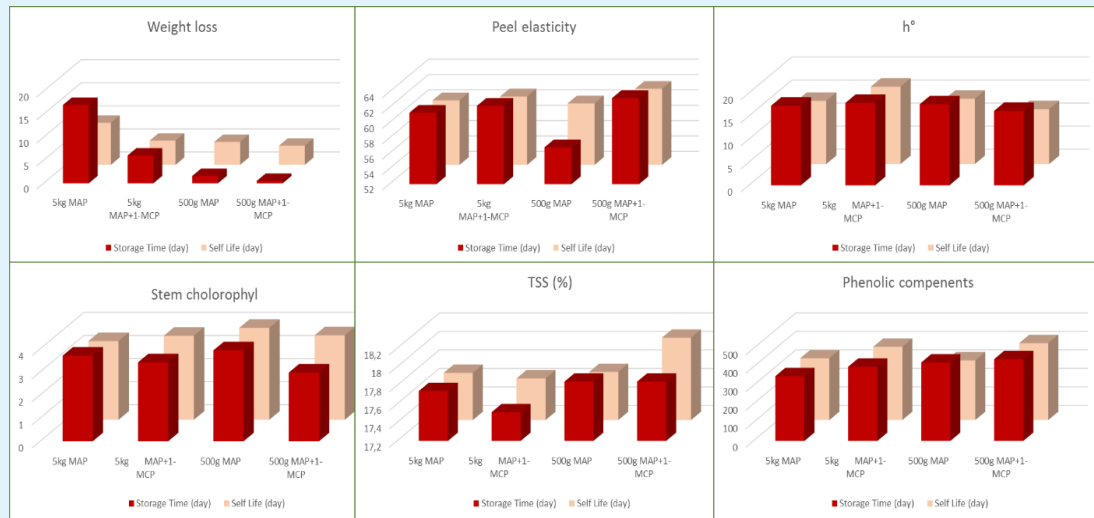
This study was carried out in the cold storage in July-August in 2014, Çukurova University, Faculty of Agriculture, and Department of Horticulture. Cherries (*Prunus avium* L. cv. '0900Ziraat') grown in Ulukışla-Darboğaz, Niğde, Turkey, were randomly harvested from multiple trees at commercial maturity stage (26-28 mm). After the cherries were passed through the pre-cooling process, the cherries were transported to the packaging house by refrigerated trucks, and the undamaged-handled 26 to 28 mm diameter cherries were passed through the front element and separated according to applications. In this research, modified atmosphere packaging (MAP) as stand art commercial treatment, MAP combined with consumer size trays (T) 500 g T and 1-Methylcyclopropene (1-MCP) combined with both treatments as MAP+1-MCP and MAP+1-MCP + 500 g T were compared during storage and shelf life of sweet cherry cv. 0900 Ziraat. Fruits were hydro cooled after harvest and divided into four parts for mentioned treatments. The treated cherries were stored at 0°C, 90-

95% relative humidity conditions for 35 days and subsequently they were kept at 20°C for 2 days to determine the effect of different applications on fruits after shelf life. Quality analyses were done weekly intervals. Weight loss, TSS, peel elasticity, total decay, L\*, a\*, b\*, C\*, h°, pH, stem chlorophyll, TA, amount of total phenolic and antioxidant content of cherries were determined.

The data obtained from the experiment were subjected to variance analysis using the JUMP 7 statistical package program and the LSD multiple comparison test was applied to the differences between the storage period and the application means ( $P < 0.05$ ).

## Results and Discussion

Peel color, peel elasticity and size of Cherry fruit are the main parameters directly affecting the purchasing decision of the consumer. Due to no climacteric properties, the cherry quickly losses to fruit peel elasticity and fruit color, depending on the high respiratory rate after harvest. Figure 1 show that weight loss increased for all treatment and control cherries during storage. Weight loss and peel elasticity values were found to be positive, the highest weight loss was found in the control group (5 kg MAP application) and the peel elasticity ratio increased during the trial. The fact that weight losses are kept at a lower level than the control application is an important result for later application of water loss and softening in these applications. Stem chlorophyll analysis results showed that while the initial values of applications outside the 500 g MAP were maintained, the green color remained largely preserved for 5 weeks, although there was a decrease in all ratios during the shelf life (Figure 1). It is also important to protect the green color of the stem besides blandishments and appearance in cherries. The loss of water during storage causes the color of the fruit to change as well as the change of the green stem color. Although chlorophyll ratios of all the applications in this study were decreased by baseline, there was no statistically significant difference between the groups. However, when the storage periods are considered; most chlorophyll loss was seen at 37th day. The value of 'h°' angle in the fruits did not show a statistically significant change over the initial values during storage and shelf life (Figure 1). MAP also has positive results especially in peel elasticity, color and taste, shelf life and appearance [3].



**Figure 1:** Effect of different applications on weight loss, peel elasticity,  $h^{\circ}$ , stem chlorophyll, TSS and phenolic compounds during 5 week storage and +2 day shelf life of 0900 Ziraat Cherry.

TSS ratio increased during storage for all applications (Figure 1). During cold storage TSS cause of the increase occurring in the content of sugars in the juice as a result of water loss can be caused by increase proportionally [4]. Titratable acid (TA) decreased in all applications during storage and shelf life [5]. During shelf-life, the highest decrease occurred in 500 g MAP+1-MCP application. The amount of antioxidant is increased over the initial period, storage and shelf life. Among the applications, the highest antioxidant increase at the end of storage period was observed in 500 g MAP+1-MCP application. Under normal conditions, polypropylene-based and biocompatible bags and modified packages of cherry in atmosphere packaging; weight loss, TSS, maturity index, anthocyanin ratio, pH, microbial disorder and fruit quality were investigated and positive results were obtained [6-7].

As a result of the analysis during storage, the highest average pH value was observed at 500 g MAP on day 35, showing an increase in all applications (Not given data). Similar findings were reported by Kappel F, et al. [8] and Padilla-Zakour OI, et al. [9].

The amount of phenolic content fluctuated during storage and shelf life, with almost all applications showing a decrease relative to initial value (Figure 1). The phenolic content values of the fruit vary widely depending on the variety, ecological conditions, maturity level and storage conditions. The total amount of phenolic material is thought to be a consequence of reduced phenol oxidase

enzyme activity due to the slower internal chemical changes in the fruits. Total anthocyanin, phenolic content and antioxidant activity trends were found to change depending on cherry type [10].

On the sucrose rate, it cannot be said that the applications have any positive or negative effect on the storage process. At the end of shelf life, an increase in sucrose ratio was observed compared to initial value. The glucose ratio decreased during the trial to 5 kg in all other applications except MAP application. During shelf-life, glucose ratios increased in all applications except 500 g MAP+1-MCP application. The fructose ratio was observed throughout the experiment, showing fluctuations in all applications. At the end of the 35th day, the rate remained at about the same level in all applications. There was no difference between applications in shelf life. There was no significant difference between all treatments at the end of the 35th day of sorbitol ratio, but there were differences between the periods. For example, on the 14th day the sorbitol ratio is the highest. During shelf-life, all applications except for 500 g MAP+1-MCP application increased. The malic acid ratio has declined considerably in all applications. In the shelf-life process, all applications increased. Citric acid increased in all treatments except 5 kg MAP administration during both storage and shelf life. The rate of succinic acid decreased significantly in all treatments. During shelf life 500 g MAP+1-MCP application increased, while in other applications the quantities were preserved in the same ratio (Not given

data). L-Ascorbic acid decreased significantly in all treatments. L-Ascorbic acid content increased during 500 g MAP+1-MCP application throughout the shelf life and decreased in other applications. '0900 Ziraat' began to be seen in the cherry variety, from the 14th day onwards, and the lowest decay rate of storage and shelf life was seen in MAP+1-MCP of 5 kg (Not given data). Wang, et al. [11] found that firmness, soluble protein, sugar content, polyphenol oxidase and peroxidase activity were significantly delayed in cherry stored in intense O<sub>2</sub> medium and that the content of vitamin C was decreased with respect to the control group.

One of the most important factors limiting the stored period of cherry fruits is loss caused by fungal disease and physiological deterioration (Not given data). As a result of the variance analysis on the values of shell color change determined during the storage and shelf life analysis of the fruits, the differences between the applications were found to be statistically significant.

### Conclusion

In this study, '0900 Ziraat' was determined to be physically and chemically more suitable to store cherry varieties in MAP and small portions. It has been found that when combined with 1-MCP, the green stem and antioxidant capacity are better preserved but generally give similar results in terms of other criteria. As a result, it was determined that '0900 Ziraat' cherry varieties were suitable for storage within the MAP, and that the 1-MCP shelf form used in the MAP contributed to preservation of the green stem during storage and shelf life. However, in addition to all these results, it is recommended that 1-MCP sachet application be assessed taking into consideration difficulties in using cherry storage and shelf life, cost price, consumer preference, and future outcomes from different types of studies.

### Acknowledgments

The authors thank the financial support of the Agrofresh agency and CUBAP (Project no. FYL- 2015-3453).

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