

INFLUENCE OF STORAGE ON MASS LOSS AND FIRMNESS CHANGES OF TWO STRAWBERRY CULTIVARS

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Abstract. The paper describes mass losses and fruit firmness changes during the storage of picked fruits, both with stalks and without. The fruits were kept in 'shelf-life' conditions (2°C, 75% humidity) and in a coolhouse (2°C, 95% humidity). Quicker mass and firmness losses were observed during the storage of the fruits picked without stalks. Quick chilling permitted storage of picked fruits for 5 days with not too much quality changes. Fruits kept for 8 hours in 'shelf-life' conditions showed significant mass (10%) and firmness losses.

Key words: firmness changes, mass losses, strawberry, storage

INTRODUCTION

Retaining high after-harvest fruit firmness is one of the most essential freshness and consumption usefulness indexes. The condition of cythoderms determines peel and fruit flesh mechanical endurance (Kączkowski 1985). It is known that proper storage conditions, especially temperature, humidity or storage period, are of great importance for saving the fruits in good quality. Fruits of strawberry have small storage potential, and even under optimal conditions (0°C, 95% humidity) there are really few situations when the fruits are stored for up to ten days (Józwiak 2005).

Quick evaluation of the quality of stored strawberry may be done on the basis of acidity and anthocyanins changes (Lenartowicz *et al.* 1974, Płocharski *et al.* 1978). Storage losses caused by diseases and natural mass losses not higher than 10% (Harvey 1982, Kenny 1979), firmness, colour, odour (Pelayo *et al.* 2003) are the other criteria used in practice. Quick chilling may increase the durability of the very delicate fruit (Krivorot and Dris 2002). Chilling of the strawberry meant for storage (to a temperature close to 0°C) should be done no longer than 5-8 hours from harvest

time (Józwiak 2005). Exceeding this time causes the fruit natural protective barrier to break down and then chilling the fruits does not make economic sense. Storage of fruits causes disadvantageous compositions changes; their quickness depends on cultivar and on the storage conditions (Radajewska and Dejwor-Borowiak 2002). Application of foil wrapping helps to decrease losses during transport and sale period. It reduces mass losses and helps to retain higher firmness of fruits (Nunes *et al.* 1995, Masalkar and Garande 2005).

MATERIAL AND METHODS

The experiment was carried out in 2006 at the Experimental Fruit-growing Station of the Szczecin University of Agriculture on two cultivars of strawberry: Filon and Elsanta. Both were characterized by mass losses and changes of fruit firmness when picked with the petioles and without. The fruit were stored in 'shelf-life' conditions (20°C, 75% humidity) and in a refrigerator (2°C, 95% humidity). For the measurements fruits were taken four times: at the beginning of fruiting, twice during the peak season, and once at the end of fruiting. The measurements were made on 25 fruits from every combination in every test cycle (2 cultivars x 2 storage conditions x 2 picking ways, both with petioles and without = 8 combinations x 25 fruits x 4 harvest periods). Measurements of mass losses and firmness of fruits in the individual periods were made on the same fruits. Firmness was checked by a non-destructive method using the FirmTech 2 device connected to a computer. Received results were worked out by two-factor variance analysis checked separately for every year. Received means were verified by Duncan's test with level of $\alpha = 0,05$.

RESULTS AND DISCUSSION

On the basis of Figure 1 data it may be observed that fruits of strawberry picked without stalks were characterized by quicker mass loss regardless of storage conditions. Losses during storage should not exceed 10% (Harvey, 1982). Fruits stored in a refrigerator for 120 hours lost from 1.6% to 2.6% of their original mass. However, strawberry of Elsanta cultivar stored in the 'shelf-life' conditions lost 10% of the mass just after 8 hours. Fruits of Filon cultivar stored little better.

Fruits for the measurements were always picked very early in the morning to be chilled after the night. Firmness checking was made directly after harvest and then the fruits were stored in the set conditions. Fruits kept in the refrigerator in the next measurements were characterized by higher firmness than just after the harvest (Fig. 2). This was caused by chilling. Both cultivars showed the highest firmness after spending one hour in a refrigerator and then followed a low continuous drop of the firmness. Fruit kept in 'shelf-life' conditions showed very

quick fall of firmness in the measurements made just after harvest. Elsantra cultivar fruits, considered to be resistant on transport conditions, after 30 minutes lost 16-18% of their firmness. Filon cultivar turned out to be more tolerant of unfavourable storage conditions. 24 hours later fruits of both cultivars lost about 50% of the firmness in comparison to fresh fruits.

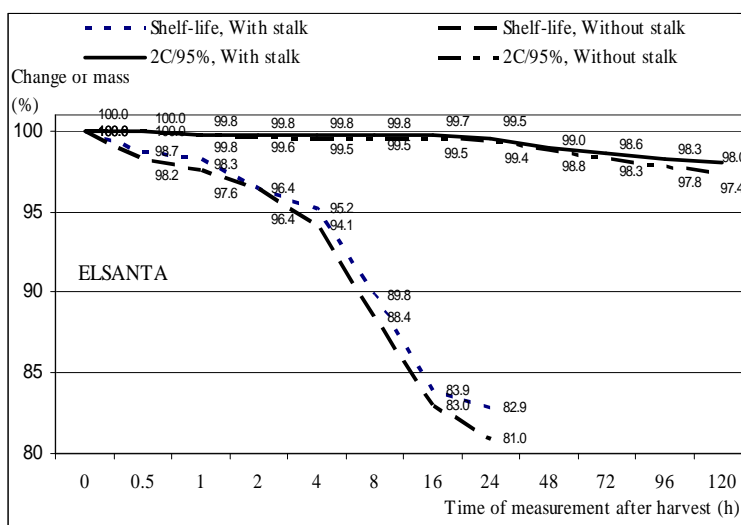


Fig. 1. Mass losses of two strawberry cultivars during storage

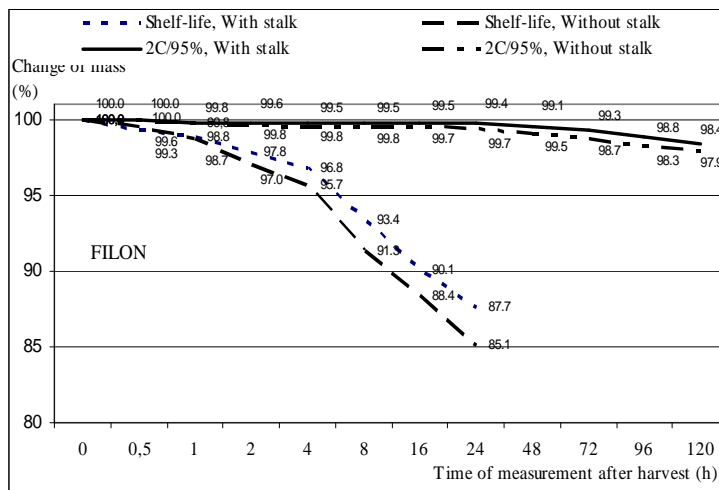


Fig. 2. Fruit firmness changes of two strawberry cultivars during storage

*Temperature of fruits just after harvest (0 h) was 18-24°C

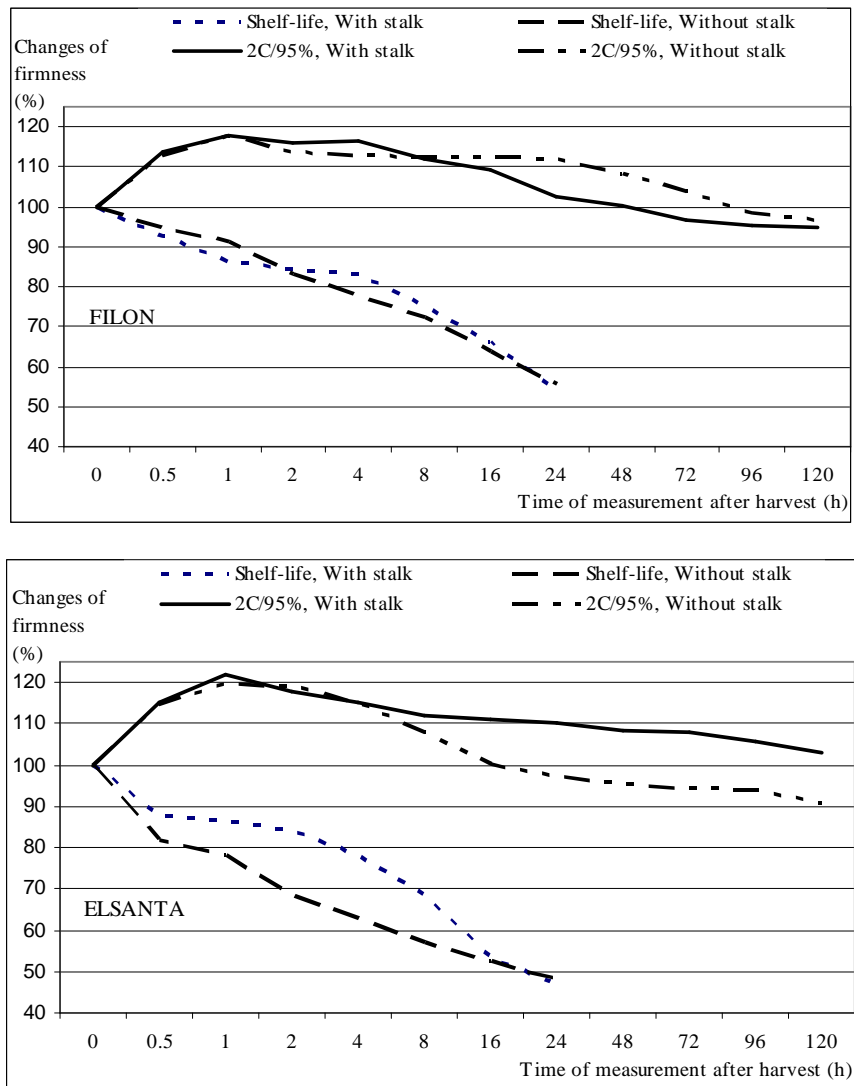


Fig. 2. Cont. Fruit firmness changes of two strawberry cultivars during storage
 *Temperature of fruits just after harvest (0h) was 18-24°C

They also lost much of their original mass, so their storage was not continued. Fruits of both cultivars were stored in the refrigerator for five days. Mass and firmness losses were not too high, but storage disease began to appear due to very limited chemical protection; loss of fruit gloss was observed, too.

CONCLUSIONS

1. Fruits picked with stalks were characterized by lower mass losses during storage in comparison to fruits without stalks.
2. Regardless of the cultivar, mass losses of the fruits stored in 'shelf-life' conditions were about 5%, while fruits kept in a refrigerator lost only up to 2.5% after 120 hours of storage.
3. Storage conditions had an influence on fruit firmness. Fruits kept in 'shelf-life' conditions lost their firmness very quickly, while lowering storage temperature to 2°C increased it.

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WPŁYW PRZECHOWYWANIA NA UBYTKI MASY ORAZ ZMIANY
JĘDRNOŚCI OWOCÓW DWÓCH ODMIAN TRUSKAWKI

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Streszczenie. W trakcie przechowywania owoców truskawki określono ubytki masy oraz zmiany jędrności owoców, zbieranych z szypułką i bez szypułki. Owoce przechowywano w warunkach shelf-life (20°C, wilgotność 75%), oraz w chłodni (2°C, wilgotność 95%). Stwierdzono szybsze ubytki masy oraz jędrności w trakcie przechowywania owoców zbieranych bez szypułki. Szybkie schłodzenie owoców pozwoliło na przechowanie ich, bez większego wpływu na jakość, przez okres 5 dni. Owoce przechowywane 8 godzin w warunkach shelf-life miały znaczne ubytki masy (ok. 10%) oraz ubytki jędrności.

Słowa kluczowe: truskawka, przechowywanie, ubytki masy, zmiany jędrności