

# SmartFresh™ Maintains Firmness and Delays the Onset of Senescent Breakdown in Macoun Apples

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Macoun, a high-value apple cultivar in New England, has high consumer appeal because of its flavor, but loses its appeal within a few months of harvest because of rapid softening. In addition to softening, Macoun is prone to senescent breakdown, typically succumbing after two to three months in regular air storage. As a result, production remains less than 10% of the total in New England. We tested SmartFresh effectiveness in maintaining firmness of Macoun harvested at different maturities and stored in regular air.

## ***Materials & Methods***

Macoun apples were harvested at two different dates in three years: September 24 and October 4 in 2001, October 7 and 15 in 2002, and October 1 and 8 in 2003. Fruit were harvested from trees on various dwarf rootstocks. Flesh firmness and starch index were measured on ten fruit at each date. The Cornell Starch Chart was used where 1 = all starch remaining and 8 = no starch. Internal ethylene concentration at harvest was measured in ten fruit in 2002 and 2003.

Apples were exposed to 1 ppm of SmartFresh within 24 hours of harvest. Fruit were stored at 37°F in regular air for 100 days in 2001. In 2002 and 2003, fruit were stored at 34°F in regular air for 50 and 90 days. Following storage, fruit were kept at 68°F for one and seven days when firmness and disorders were measured.

## ***Results***

In 2001, starch index was 3.0 at the first harvest

and 5.6 at the second. Following four months storage and seven days at 68°F, SmartFresh maintained firmness in fruit from the first harvest (12 lbs.) above the firmness of untreated fruit (11 lbs.). This did not occur with the second harvest when firmness was 10 lbs. in both treated and untreated fruit. Fruit from the second harvest were too mature for SmartFresh to be effective for as long as 100 days in regular air. The effect of SmartFresh is temporary, becoming undetectable after several months in regular air storage. In this study, the effect on firmness did not last 100 days in overmature fruit.

In 2002, starch index was 3.1 at the first harvest and 4.9 at the second. Internal ethylene was undetectable at the first harvest and 29 ppm at the second. An apple is considered too mature for long-term storage when the internal ethylene rises above 1 ppm. In 2002, SmartFresh maintained firmness above that of untreated fruit after 50 and 90 days, but was more effective in fruit from the first harvest (Figure 1). After 50 days, firmness was greater by 4 lbs. in first-harvest fruit, but only by 2 lbs in second-harvest fruit. After 90 days, firmness of first harvest fruit was greater by 3 lbs., but only by 1 lbs. in second harvest fruit.

In 2003, starch index was 2.7 at the first harvest and 3.5 at the second. Ethylene was 4 ppm at the first harvest and 1 ppm at the second. Firmness in 2003 followed a similar pattern as in 2002. Firmness was maintained 4-5 lbs. above untreated fruit with the first harvest and 2-3 lbs. with the second.

Minimum acceptable firmness by consumers is considered to be about 12 lbs. and optimum firmness about 15 lbs. SmartFresh maintained firmness near

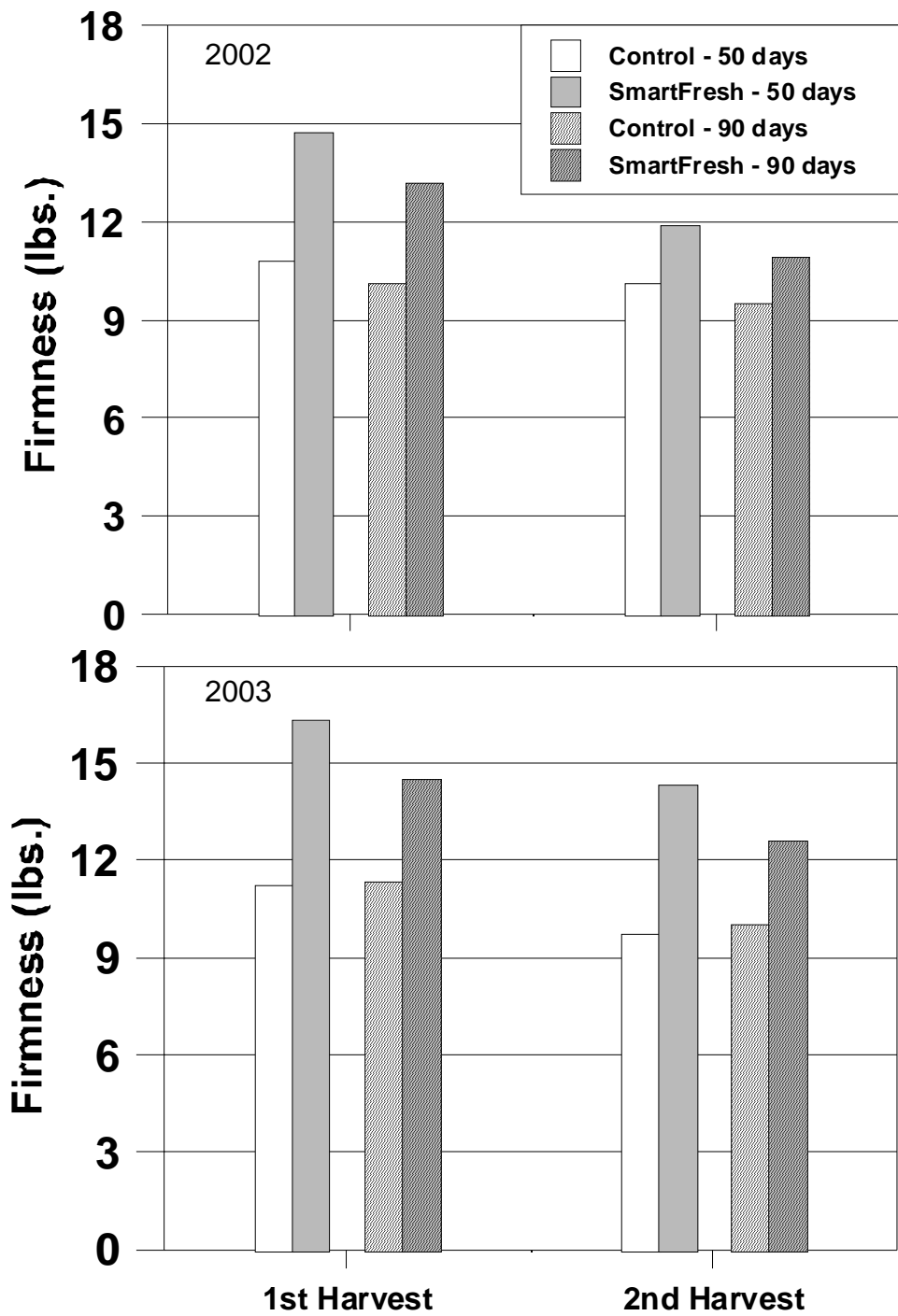
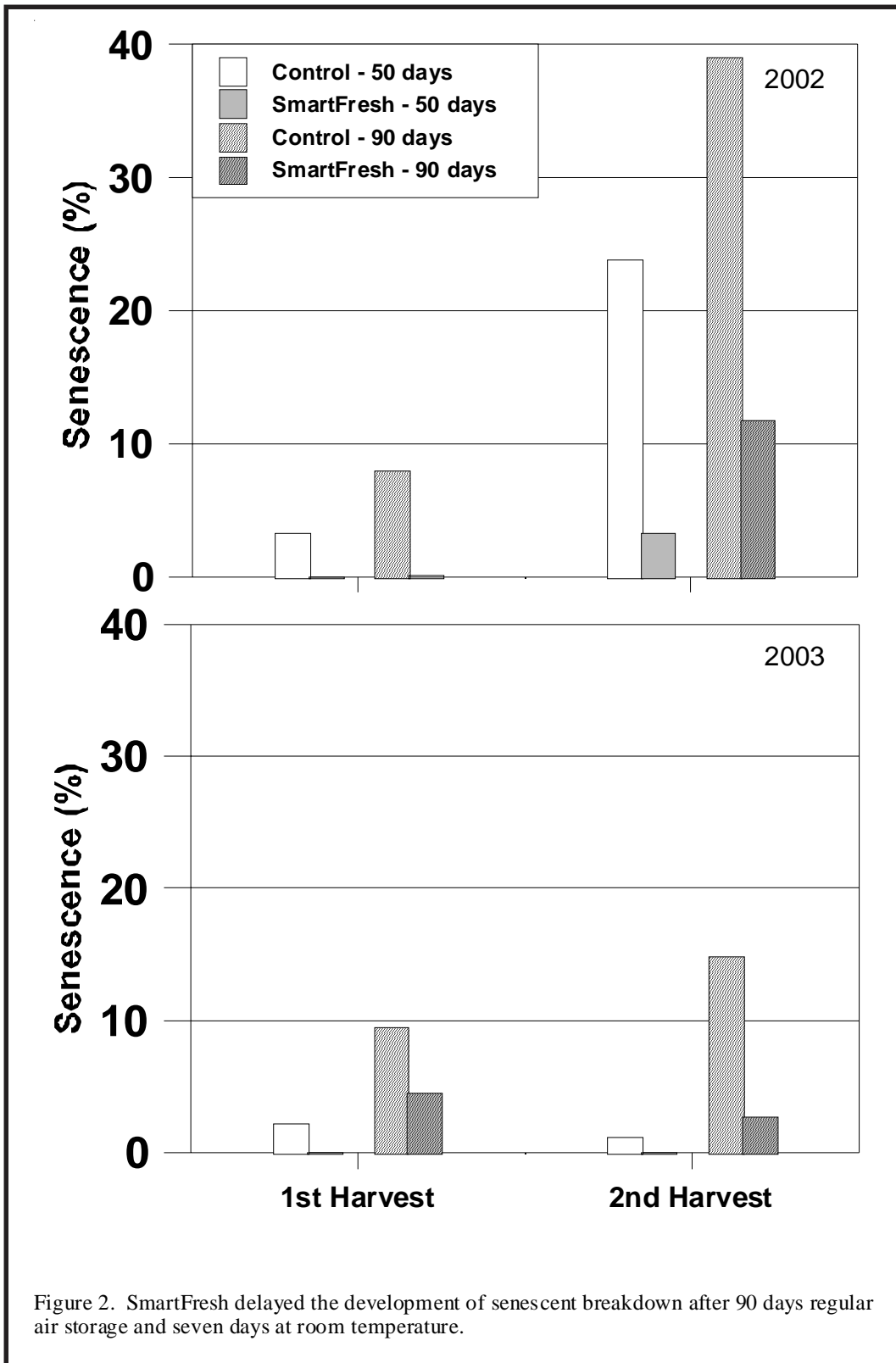


Figure 1. Macoun apple firmness was maintained by SmartFresh after 50 and 90 days regular air storage and seven days at room temperature.



optimum for 50 days and near the minimum acceptability for 90 days when fruit were picked before starch index reached 4.0. When fruit were picked after a starch index of 4.0, SmartFresh maintained firmness near minimum acceptability for 50 days. In untreated fruit, firmness fell below 12 lbs. by 50 days with little difference between the two harvest dates.

Senescent breakdown was not affected by SmartFresh in 2001 when incidence was approximately 10%. Occurrence of senescent breakdown in 2002 was slight in fruit from the first harvest, so SmartFresh had no effect on its occurrence (Figure 2). In fruit from the second harvest, senescent breakdown was more prevalent, and was reduced by SmartFresh after both 50 and 90 days storage. In 2003, there was almost no senescent breakdown in either treatment after 50 days, so SmartFresh had no effect on its occurrence. After 90 days, senescent breakdown was more prevalent, and SmartFresh reduced its occurrence. Macoun is very prone to senescent breakdown, which occurred in each year of the study, but was most severe in 2002. It began to develop in untreated fruit as early as 50 days in storage. SmartFresh reduced the occurrence of senescent breakdown, but did not completely prevent it, since SmartFresh-treated fruit eventually developed it, as well.

SmartFresh increased the occurrence of coreline browning in 2001, but this was slight and insignificant in fruit from the first harvest (Figure 3). In fruit that were very mature at harvest, SmartFresh increased the incidence of coreline browning. Incidence of coreline browning was highly variable from year to year, being very prevalent in 2002 and almost nonexistent in 2003. In these two years, SmartFresh reduced the incidence of coreline browning. It is not clear why

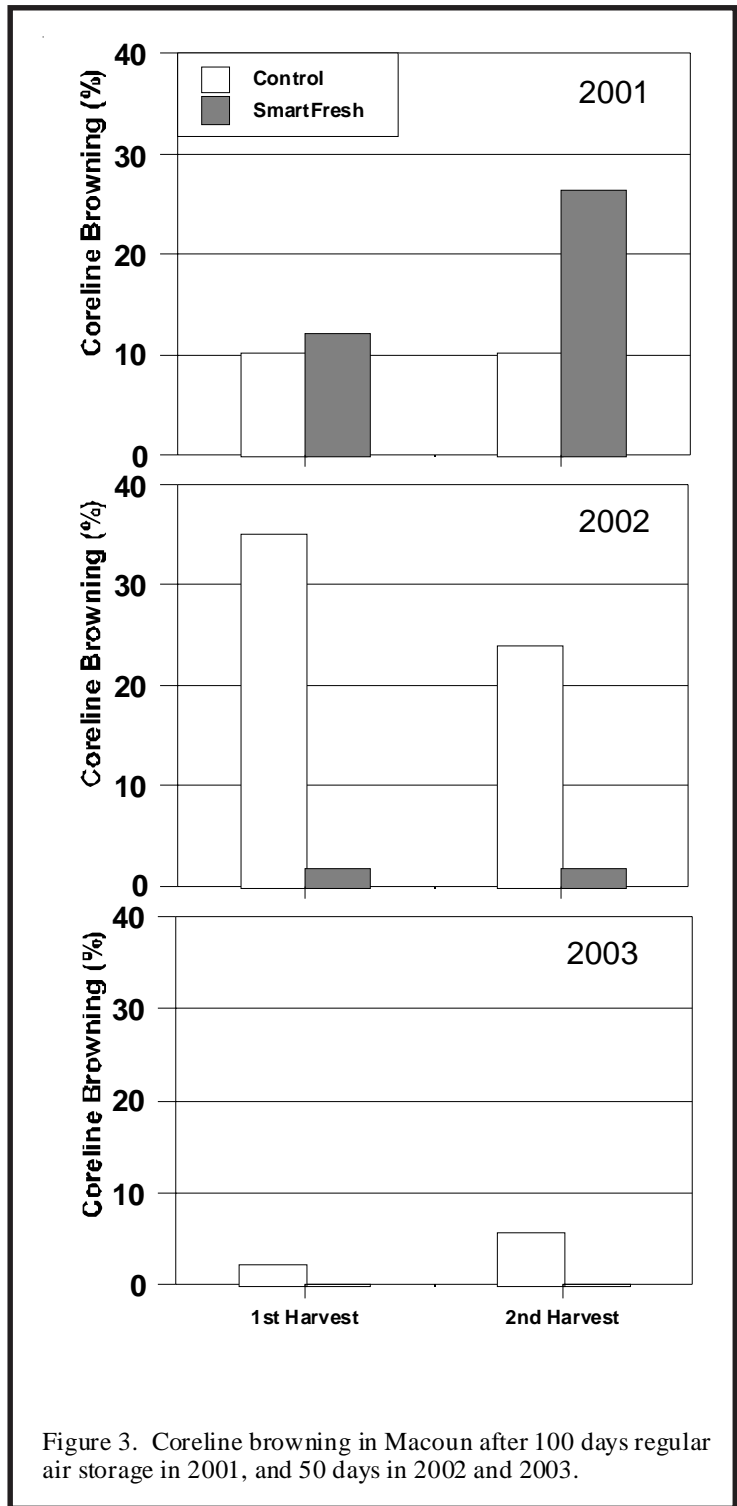


Figure 3. Coreline browning in Macoun after 100 days regular air storage in 2001, and 50 days in 2002 and 2003.

coreline browning was increased by SmartFresh in 2001, but could have been due to the advanced maturity with the second harvest since these fruit were harvested more mature than in later years.

In 2002, stem-end browning did not occur until 90 days when SmartFresh reduced its occurrence from 7% to less than 1% with the first harvest, and from 4% to 2% with the second harvest. In 2003, stem-end browning did not occur.

### ***Conclusions***

For Macoun, SmartFresh has the potential to maintain optimum firmness during the normal two-month marketing window. SmartFresh did not completely prevent senescent breakdown or coreline browning, but in most instances these disorders were reduced to a very low level.

