Harvest and Storage to Optimize Quality and Prevent Losses of Apples

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Harvest and storage practices are largely determined by our expectations for storage life and eating quality. When we expect apples to last a long time in storage, the general rule is to pick them in an under ripe state, but we sacrifice flavor to prevent losses. Apples that are picked fully ripe have better eating quality but a short life span and should marketed soon after harvest. These are the general guidelines for varieties we currently grow. Honeycrisp, to some extent, is like other varieties, but also has traits that make it unique in its harvest and storage requirements. Its flesh remains firm even when picked nearly ripe, but it loses flavor and becomes insipid in storage if picked too late. Its extreme susceptibility to storage disorders makes it tricky to judge when to harvest and how to store it preserve quality.

Honeycrisp is prone to bitter pit. Bitter pit is a well-studied problem, and we have reasonably successful methods of preventing it. Being associated with low levels of calcium in the fruit, repeated calcium applications can prevent or reduce it. However, methods we employ to prevent soft scald can worsen bitter pit despite our best efforts at applying calcium.

Honeycrisp is also prone to the chilling disorders soft scald and soggy breakdown. Symptoms of soft scald are external and resemble bruising. Soggy breakdown occurs internally. As fruit advance in maturity, they become more likely to develop soft scald. These disorders can develop within the first two months of cold storage. Temperatures used in storing other varieties, 32 to 33 ºF, cause chilling injury in Honeycrisp. To prevent soft scald, it may be necessary to store them separately from other varieties.

Soft scald and soggy breakdown are not new problems. Historically, they caused losses in susceptible varieties as the apple industry began to use cold storage in place of common storage. In the early 1900's, storage temperatures above 32 ºF and rapid cooling were the only solutions recommended when it first became a problem. Many of the highly susceptible varieties are no longer cultivated, and this susceptibility to chilling injury may be the reason. Today many of us are increasing production of Honeycrisp, so a method of preventing its postharvest disorders is becoming increasingly important.

Currently, harvest at early maturity, before a starch index of 5.0, storage at temperatures above of 36 ºF, or delayed cooling are recommendations for minimizing losses. In early studies, researchers discovered that delayed cooling, holding fruit at about 50 ºF for several days, increased soft scald and soggy breakdown. Decades later, this technique was used by researchers as way to induce the disorder in Honeycrisp. Seven to ten days of delayed cooling had the opposite effect when it was first tested on Honeycrisp. Unfortunately, delayed cooling and other methods have not always prevented soft scald, and some people have lost apples in to soft scald, soggy breakdown and bitter pit.

In research trials at the University of Maine, we have had good luck with delayed cooling when we did the same thing year after year. We harvested fruit at the same maturity each year.

For the delayed cooling treatment, we held fruit in the same location at the same temperature and then put them in the same cold storage room at the same temperature each year. The only thing that changed from year to year was the duration of the delayed cooling needed to prevent soft scald. When soft scald was severe, seven days was needed. In years with mild severity, shorter durations were effective.

Delayed cooling has not been effective in some Ontario studies, and in one instance has actually increased chilling injury. Why it works for some and not for others still unknown. One of the factors that differed in Ontario was the temperature during delayed cooling. In my studies, delayed cooling occurred at a temp of 60 to 68 ºF, but in Ontario, at temperatures of 50 ºF. A recent study in Nova Scotia has shown that delayed cooling is more effective if the temperature is above 70 ºF. At this time, it is not certain that temperature variation was the cause of failures, but this should be tested to a greater extent.

Maturity at harvest is another factor that varies between research labs. In 2008, we tested delayed cooling with different harvest dates to see if it contributed to the failure of delayed cooling. We harvested fruit from two different farms at the beginning of harvest period and again a week or two later, when fruit were nearly ripe. The delayed cooling and storage conditions were the same as in previous years. Fruit are less susceptible with an earlier harvest, so soft scald was not severe, but more than expected. Delayed cooling did not prevent soft scald with the first harvest. With the second harvest, it prevented soft scald in fruit from one farm. Soft scald was very low at the second farm. Soggy breakdown was not as prevalent as soft scald, but delayed cooling worsened it with the first harvest in fruit from both farms and with the second harvest at one farm. Delayed cooling was ineffective with fruit picked at the early stage of maturity. In this year, fruit maturity interfered with the use of delayed cooling to prevent soft scald.

Delayed cooling is an unpredictable technique when implemented under many different conditions such as harvest dates, and orchard factors or storage facilities, so it should be tested on small lots of fruit under individual conditions in a number of years before being implemented on a large scale.