

The Condition Chain in the Exporting of Empire Apples

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The internal condition of Empire apples is especially susceptible to weak links in the storage and marketing chain. The condition chain for Empire apples is even more problematic as the major market for the variety is overseas and therefore as much as two weeks longer, due to the overseas freight that is required. The Empire apple is particularly suitable for overseas markets due to its excellent flavor, texture, size, and good firmness on the shelf, but that good firmness on the shelf is only achieved when all the links of the chain are solid. Maintaining good solid links does not require doing anything that we don't now know. All that is required is careful execution of things that we already know, things that many apple pro-

ducers already practice, but things that must be done right to get desired results. That objective is to ship Empires in the spring of the year that are no more than one pound softer than they were at harvest, and to ship them in such a manner that they will not soften further during shipment. When we do things right, we accomplish this. When we don't, the result is often juice apples.

Grower's Responsibilities in the Condition Chain

1. Start picking at the right time. The right time is when the starch tests at 2.5 to 3.5, Brix test is 12 or higher, pressure test is 17 lbs or higher, and internal ethylene production has not

The condition of an apple on a grocery store shelf is the result of a chain of many events that start on the tree and last through picking, trucking, storage, packing, and delivery to the stores. A weak link in this chain and the apple's condition suffers. With the competitive situation in apple marketing today, any such weak link will have negative consequences for all those involved in the production of those apples, the most important of which is reduced income for producers.

reached the climacteric. The Lake Ontario Fruit Program's *Harvest Fax* provides seasonal updates on ethylene production in Western New York. Color should be above 60 percent and the characteristic Empire flavor present at harvest.

2. Don't delay harvest for color. Waiting will give more red apples, but also apples that produce more ethylene, and become softer. This will result in even more soft apples coming out of storage. Spot picking for color is necessary to get hard apples out of storage. Failure to do this dramatically weakens the condition chain.
3. Pick all the apples with 60 percent color or more.
4. Get the apples into cold storage on the same day they are picked. Those harvested late in the day should be waiting at the storage door first thing in the morning. Bins containing apples left out overnight should be identified and exported early or marketed domestically. They will not make the trip overseas successfully.
5. A timely second picking will usually



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Empire apples should be harvested at the proper maturity and moved to cold storage the same day.



Minimize bruising during harvest.



Harvest apples with a minimum of 60 percent red color. Leave greener fruit for a second harvest.

meet all the conditions in Item #1 and be suitable for export. They will certainly be suitable for domestic shipment.

Storage Operator's Responsibilities in the Condition Chain

1. Leak test every room every summer. Leaky rooms will not keep a consistent atmosphere. Fluctuating oxygen levels can lead to out-turns of soft apples and greater risk of low oxygen-related storage disorders. Each room should hold pressure for a half time of 30 minutes.
2. Test and record starch, pressure, brix, average size, and average color of each lot coming into storage. This information helps the packer select lots for different customers and different times to pack.
3. Segregate and store soft fruit separately, so it is not mixed with fruit for export. Even though it is too soft to stand the overseas shipment, such fruit is usually suitable for domestic shipment.
4. Treat with DPA even though Empires do not get superficial scald. Research shows that DPA treated fruit are harder than untreated fruit.
5. Do not stack more bins of apples in a room than can cool down overnight. Stack fruit two bins high in a room pre-cooled to 32 degrees with good air circulation. If the air temperature is not 32 degrees in the morning, too many warm apples were put in the room.

Precooling before room loading is often an overlooked practice, but is essential to good storage. If apples are stacked warm it can be three to four weeks before getting down to storage temperature, with high levels of ethylene resulting and associated fruit softening.

6. If the air in the precooling room is down to 32 degrees by morning, the apples, now cooled to about 45 degrees, can be permanently stacked in another room with other apples similarly cooled, and will cool adequately from there.
7. Fill each room in five days; three days is better.
8. Seal the room. Leak test the door with an air pressure of 1 inch of water and apply soapy water to ensure that a good door seal exists.
9. Flush the room with nitrogen. About 2,000 cubic feet of nitrogen per 1,000 bushels of apples flushed over a 24-hour period, will bring a room down to 5 percent oxygen.
10. Hold the room at 32 to 34 degrees, 2.0 to 2.5 percent oxygen, 2.0 percent carbon dioxide. A steady oxygen level is necessary for good storage of the apples.

Packer's Responsibilities in the Condition Chain

1. After a room is opened, pack the room out in three weeks or less. If the fruit cannot be exported within three weeks, then fruit should be marketed domes-

tically. It will not make the overseas shipment successfully. Do not expect fruit from resealed rooms to ship successfully overseas.

2. Pressure test all sizes when packing. Larger fruit sizes may not test 16 lbs and should not be exported. Use this fruit for domestic markets and save the agony of a rejection.
3. Minimize warming of the fruit during the packing process. Apples should be through the packing process in three hours or less. Bring only small quantities from the cooler at a time, and return packed fruit to the cooler as soon as packed.
4. Force-air cool fruit after packing. This has been one of the biggest recent improvements in packing fruit. Cool the packed cases after packing by forcing cool air through the packed case until the fruit reaches a core temperature of 32 to 34 degrees. If this is not possible, keep the packed fruit in the cooler at least three days at 32 degrees or cooler, with good air circulation around the fruit. Tests show that even under these conditions, fruit in packed cases is very slow to cool because corrugated cardboard is such a good insulator.
5. Cool the shipping container before loading. Set the container thermostat at 32 degrees. Fruit must not be loaded into a warm container! Open the container vents to the three-quarter position.

Conclusion

Growers, storage operators, and packers all have major roles in the condition chain for export apples. A letdown in performance by any one of these parties will negate the good efforts of the other parties and result in poor condition apples on the grocery shelf. None of the steps listed here is new and none of them are difficult to accomplish. Each is necessary to achieve acceptable condition for export Empires.

If these steps help us deliver a firm, cold apple, "with legs," instead of a soft, warm apple that will soon be worn out, to the export markets, think how delivering the same quality apple to domestic markets would boost domestic consumption, too, and help all involved in producing apples.

Additional Reading

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