Tri-State Horticulture Meeting

Peach and Nectarine Fruit Ripening, Mealiness and Internal Breakdown

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Overview

- Measuring Peach Maturity
  - Picking on color and firmness
  - Do they tell us what we need to know?
- Postharvest Problems
  - Mealiness and internal browning
  - Understanding the problem(s)
  - Uncoordinated ripening?
- Are There Solutions?
  - Management
  - Genetics

Peach Maturity

- Measuring Peach Maturity
  - Picking on color and firmness
  - Do they tell us what we need to know?

Color Chips

Used to estimate ground color during maturation.

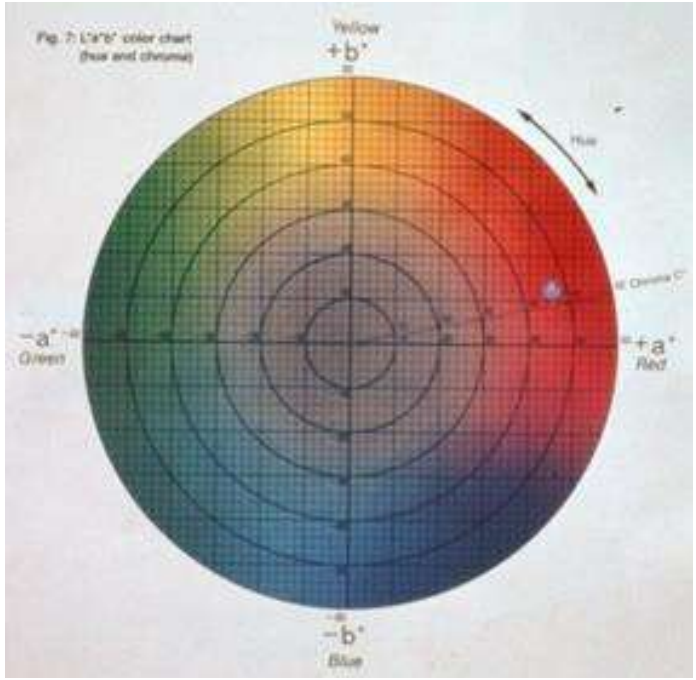
Color Difference Meter

Fast electronic measurements measure light reflected from the fruit peel.

Color Difference Meter

Rapid and repeatable measurements of ground color (and surface color).

Color Difference Meter

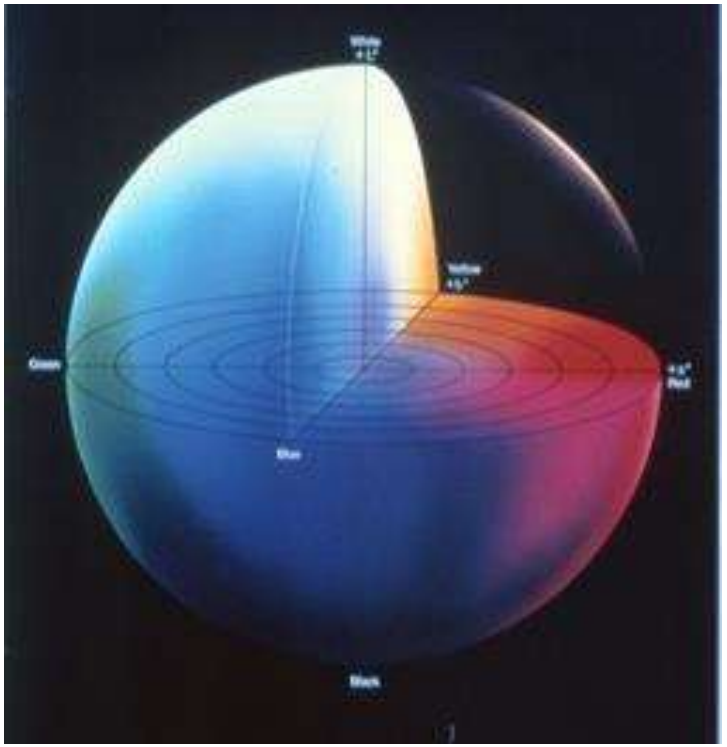


Color Difference Meter reports two scales:

The ‘a’ value ranges from green (-a) to red (+a).

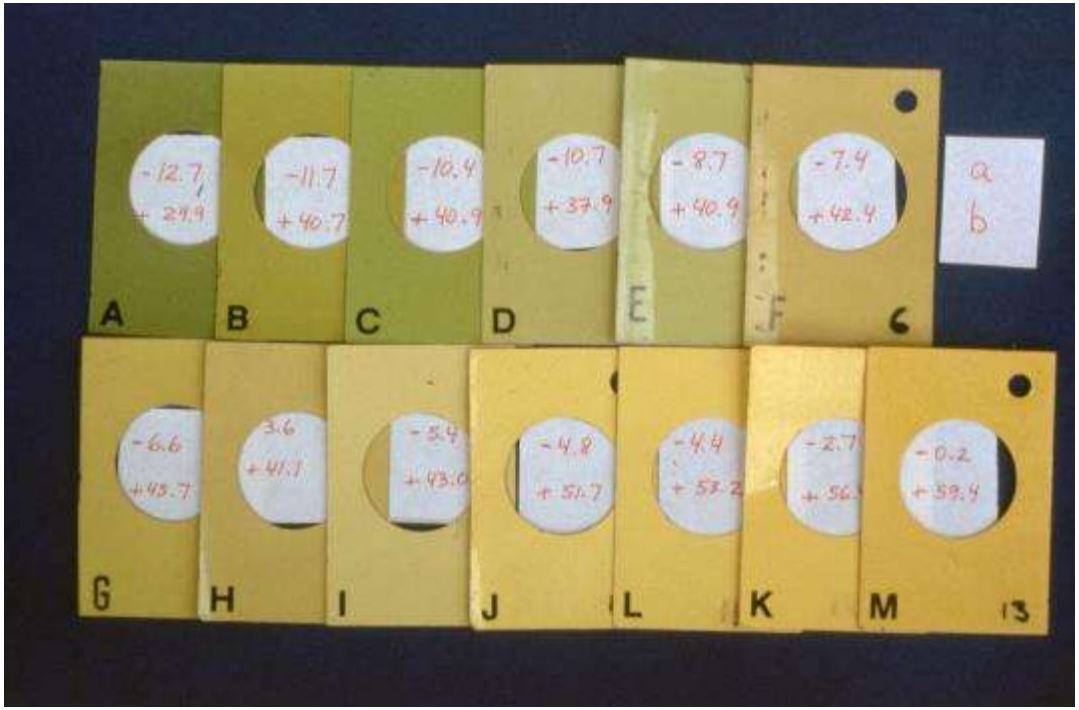
The ‘b’ value ranges from blue (-b) to yellow (+b).

Color Difference Meter



Color Difference Meter also measures lightness (‘L’ value) which is viewed as a third dimension in color space.

Quantifying Ground Color



From Chip A to M, the primary change was found in the ‘a’ value. The ‘a’ value increased about one unit with each successive chip. While ‘b’ values varied, there was no clear trend.

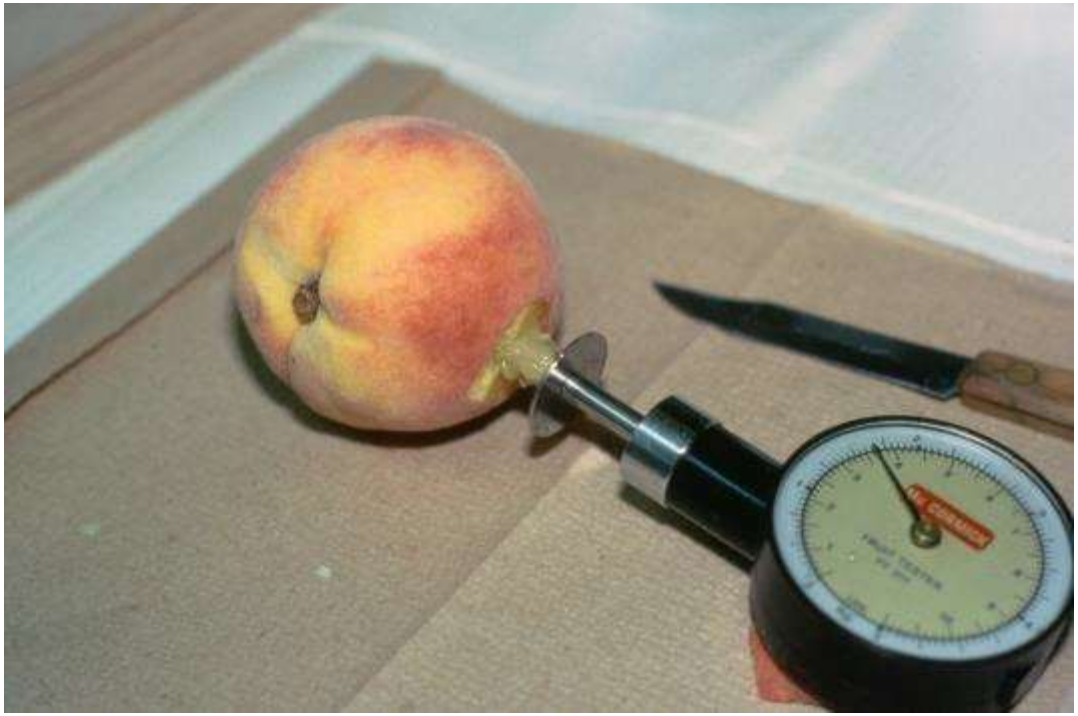
Ground Color Sorting

Peach fruits were hand-harvested, brought to the laboratory and then sorted by ground color.

Ground Color Sorting

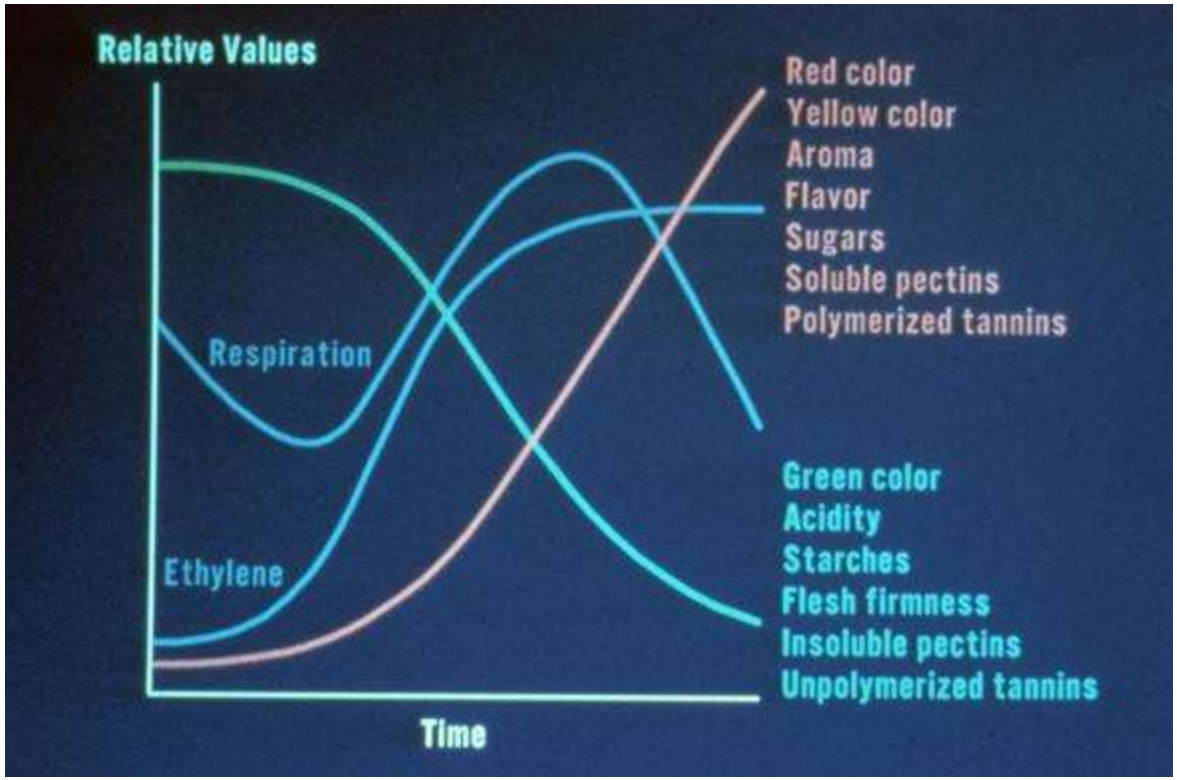
To test the effects of fruit maturity on maturity and quality, we hand-sorted fruit in the laboratory.

Color and Firmness



Peach firmness, measured using a penetrometer.

Postharvest Biology

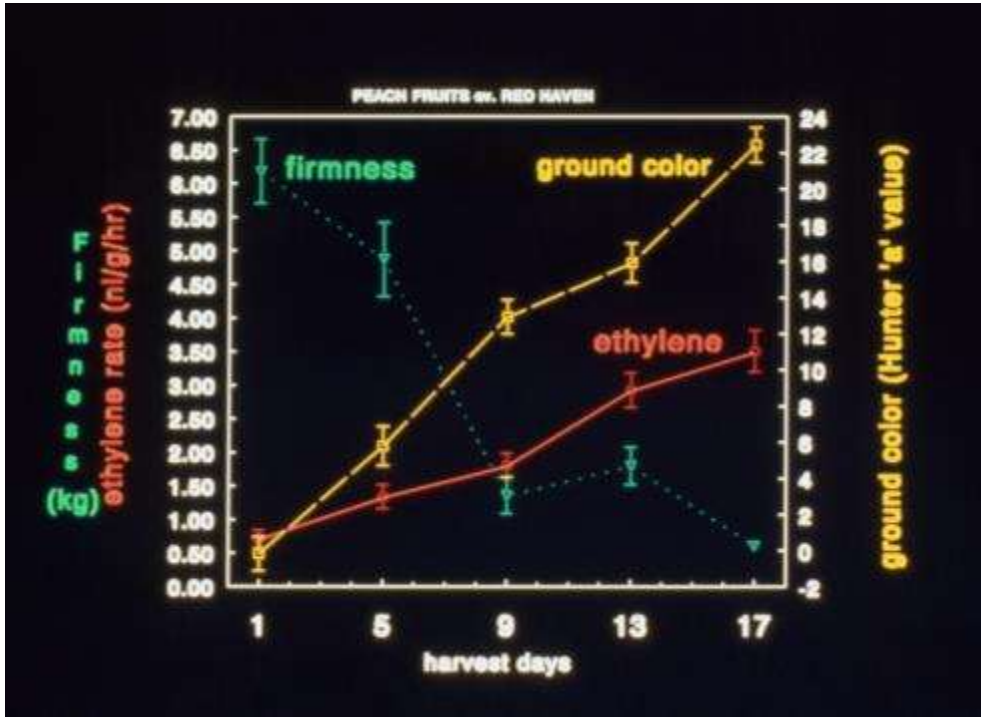


This classical postharvest figure links ethylene and respiration (the climacteric) with changes in fruit quality and chemistry. What about peaches?

Postharvest Biology

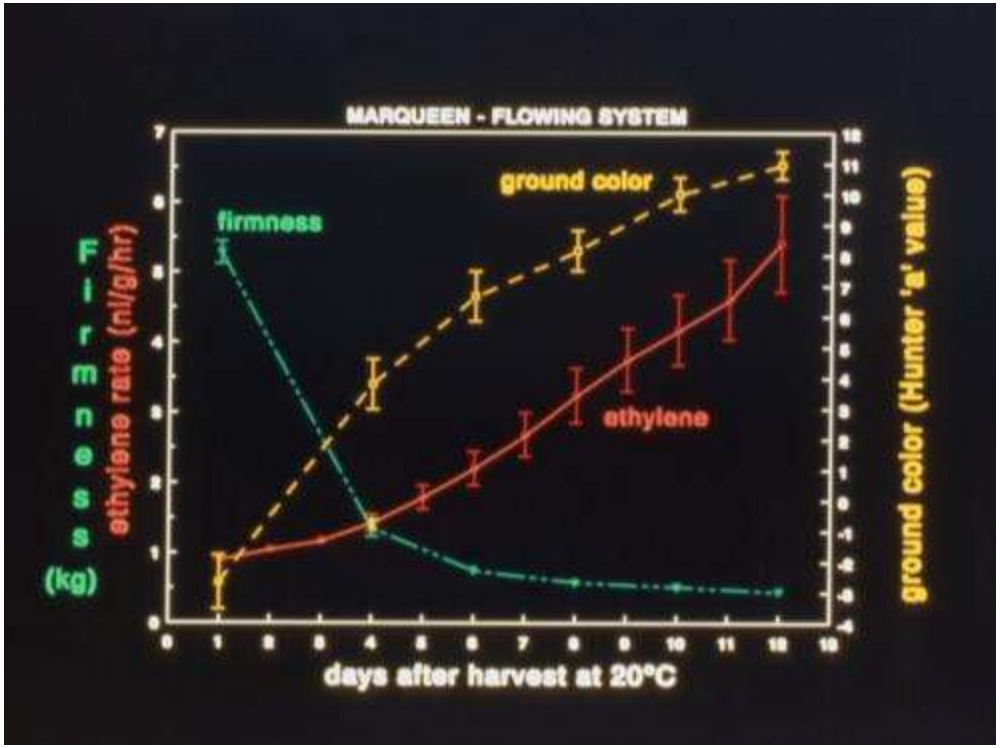
Automated flow-through system provided replicated measurements of ethylene and fruit ripening.

Redhaven Peach



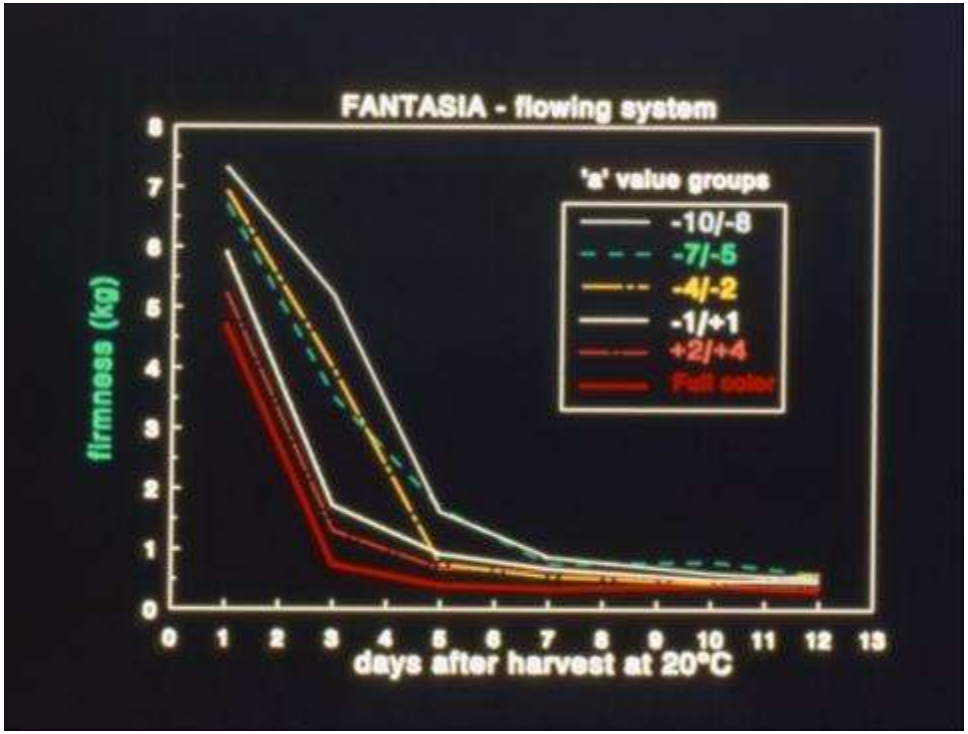
Redhaven fruit firmness changes slowly at first and then drops rapidly after about five days at room temperature. Ground color changes and ethylene evolution change slowly and steadily during ripening.

Marqueen Peach



Ripening at room temperature quickly led to softening in Marqueen, while ethylene and ground color increased slowly over a much longer period.

Fantasia Nectarine



Fantasia nectarine fruits were sorted by ground color. Despite wide variability in initial ground color and firmness, holding at 20°C (68°F) led to rapid softening despite wide differences in maturity.

Mealiness in Peach

Peach fruit on the left is dry and mealy while fruit on the right is not. Both were shipped and stored in the same tray pack.

Mealiness in Peach

Peach mealiness is the greatest problem affecting wholesale peach production. Mealy peaches greatly reduce return sales by consumers.

Mealiness in Peach

What causes mealiness? Is it just water loss?

Peach Juiciness

Peach fruits were hand-harvested, sorted by ground color and stored. Quality and juiciness were evaluated after storage.

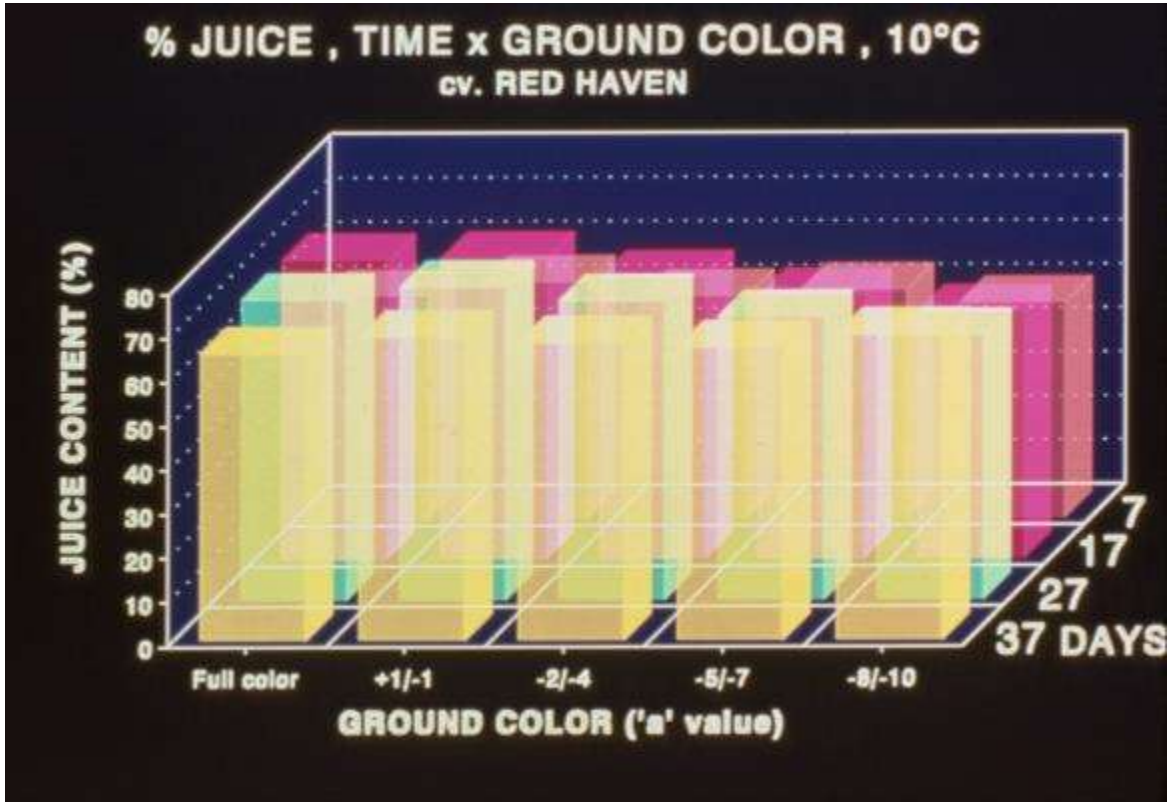
Peach Juiciness

To measure juice, cut a sample of peach flesh and pulverize it by squeezing through a syringe and measure its weight.

Peach Juiciness

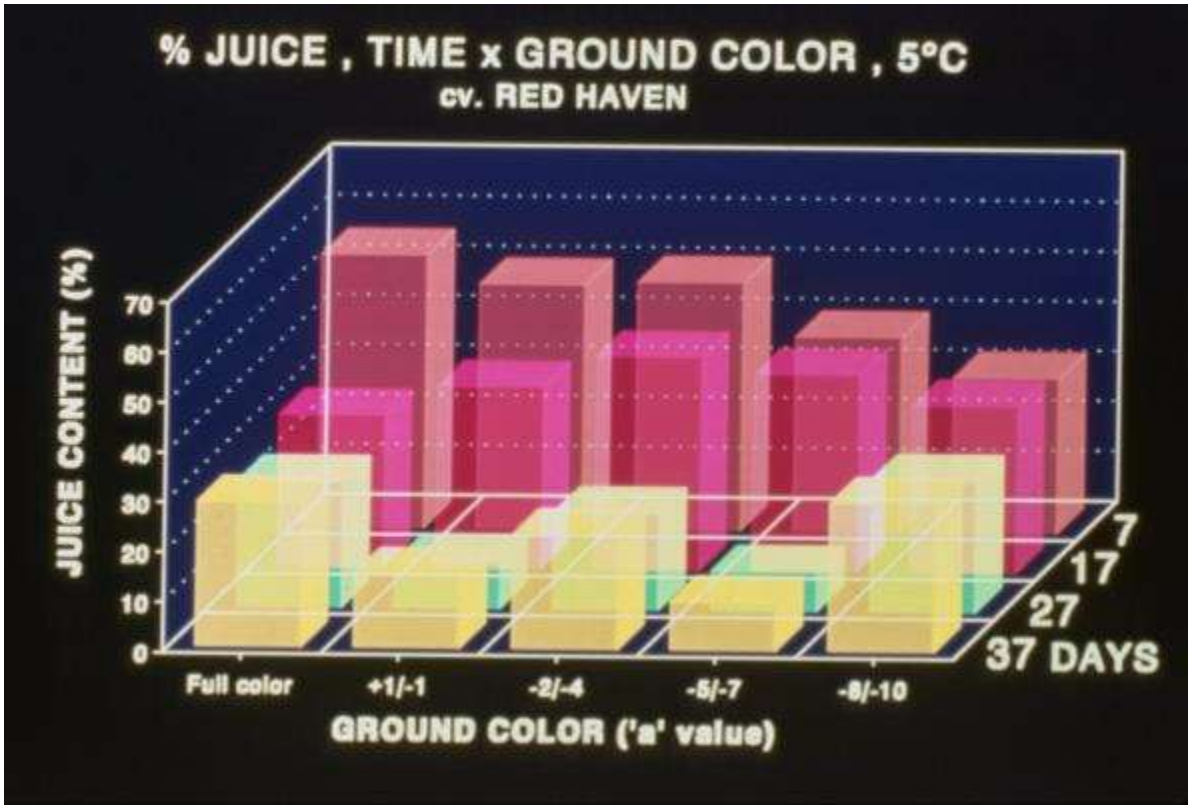
Centrifuge flesh to separate solid material from juice.
Measure the weight of juice and pellet separately.

Redhaven Peach



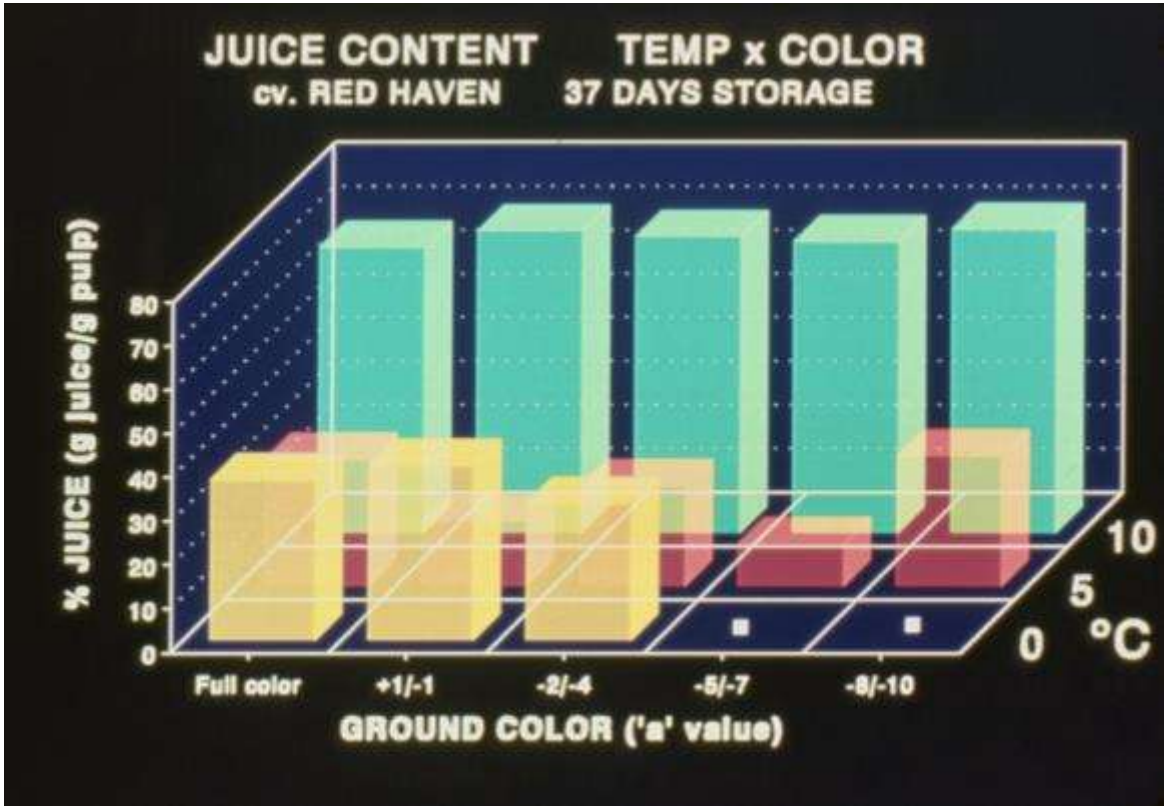
Juice content in peach fruit is maintained during long-term storage at 10°C (50°F).

Redhaven Peach



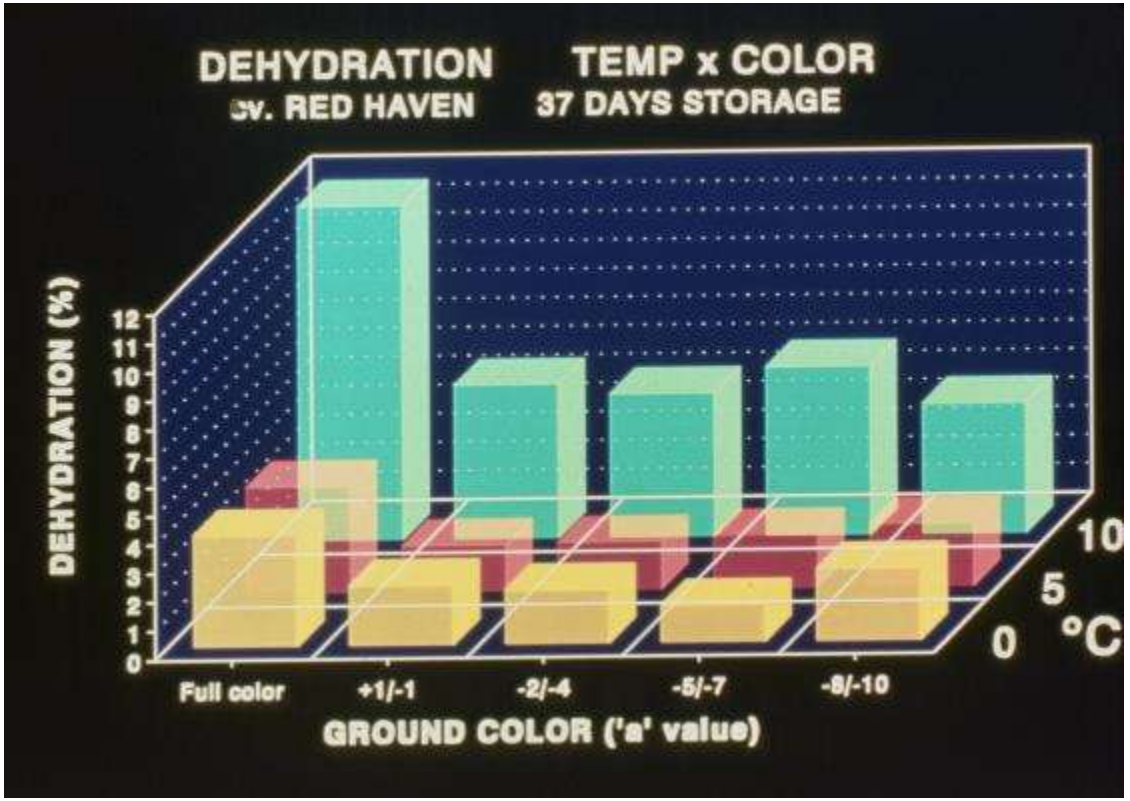
The longer peach fruit are cold-stored at 5°C (41°F) the less juice is measurable.

Redhaven Peach



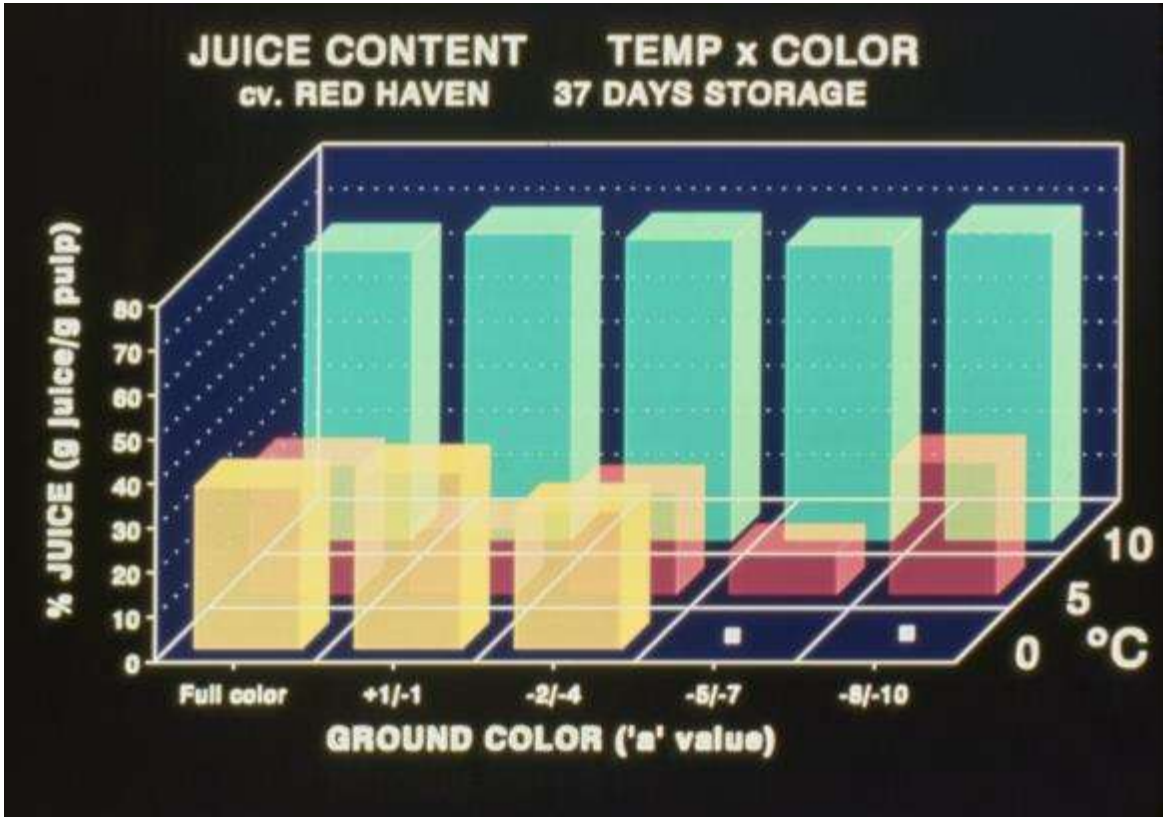
Storage at 10°C (50°F) led to greater percentage of juice extracted after 37 days storage than 0°C (32°F) or 5°C (41°F).

Redhaven Peach



While fruit stored at 10°C (50°F) were juicier, they lost much more water in storage.
Water loss is not the cause of mealiness.

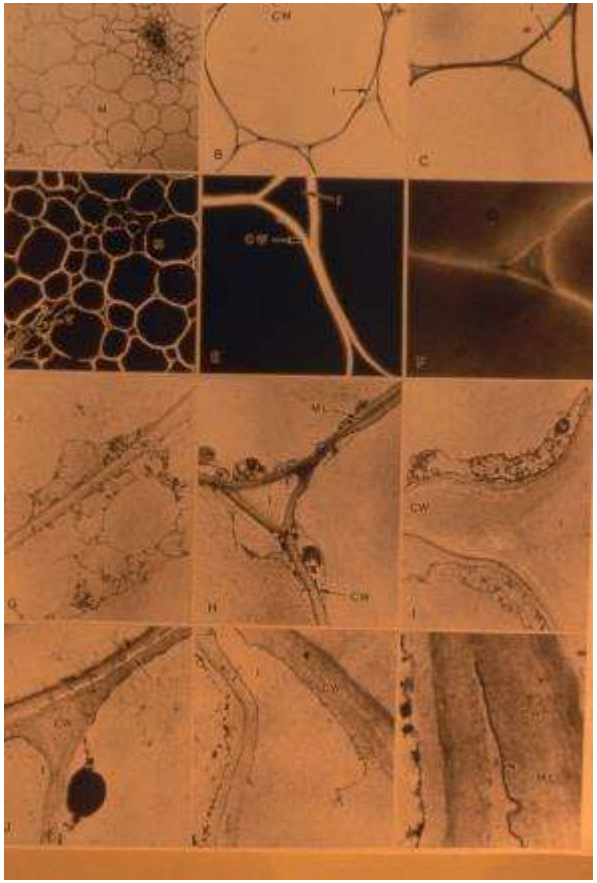
Redhaven Peach



If the water isn't lost at cold temperatures, where is it?

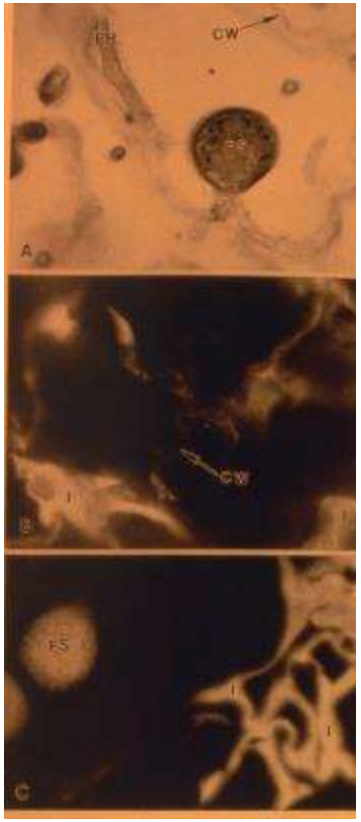
Why do cold-stored peaches taste so dry?

Peach Anatomy



In sound fruit, cells are turgid. Biting cracks the cell walls between your teeth, and you taste the juice.

Peach Anatomy

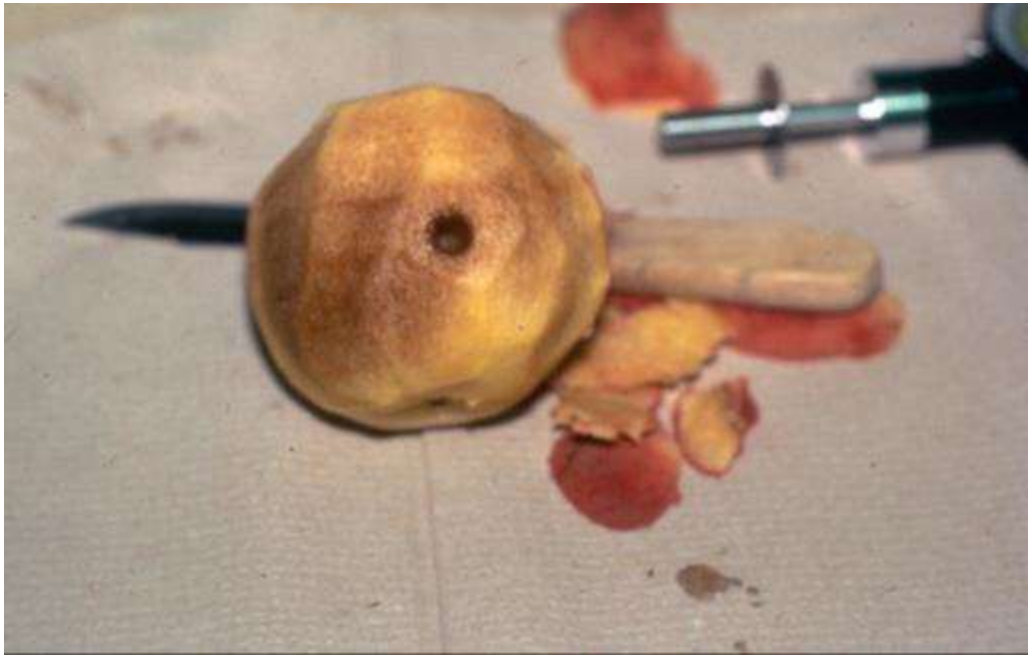


In mealy fruit, cells are not turgid and walls appear crenulated. Water appears to exit the fruit cells and binds to pectic materials in the wall (von Mollendorf, UC Davis).

Postharvest Problems

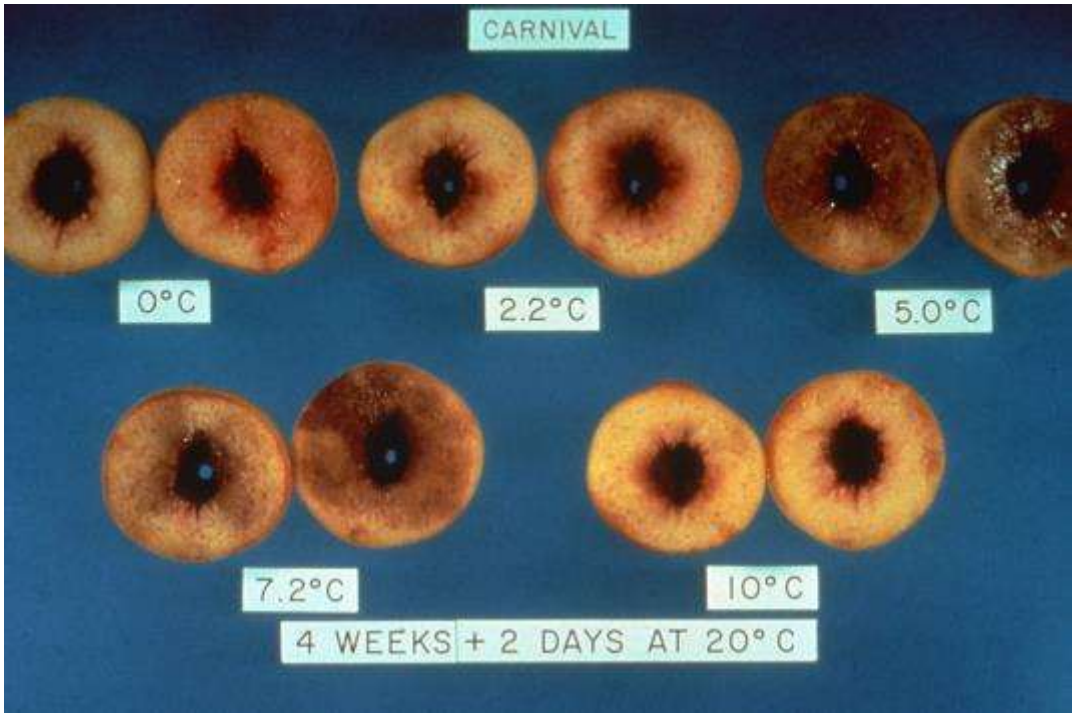
- Think about making fruit preserves. When you cook the fruit mixture on the stove, you are cooking fruit (mostly water) and added sugar. Adding gelatin or pectin causes the mix to harden on cooling into jam or jelly.
- Jam or jelly is mostly water by weight but is not perceived as a liquid when you eat it. The water is absorbed by the gelling agent.
- Mealiness in peach occurs in a similar manner. As water leaves the cell, it binds to gelatin-like cell wall polymers. This makes the fruit taste dry.

Internal Browning



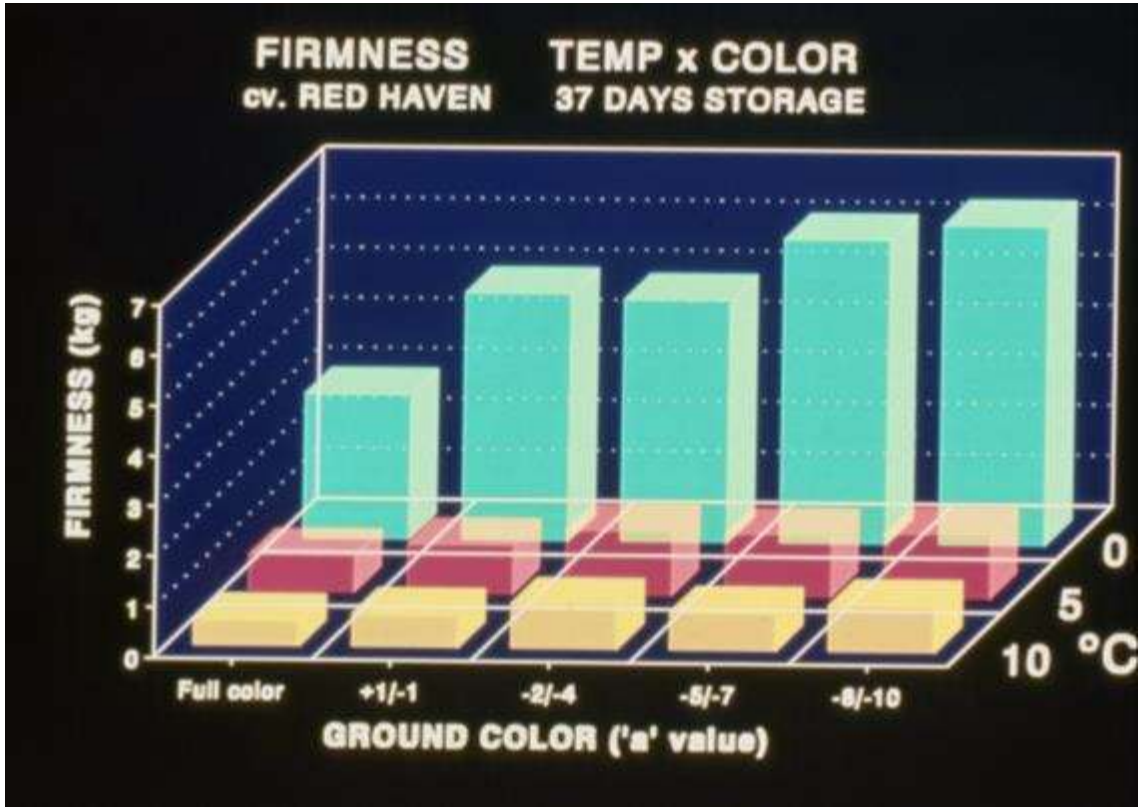
Mealy fruit can also have red or brown flesh.

Internal Browning



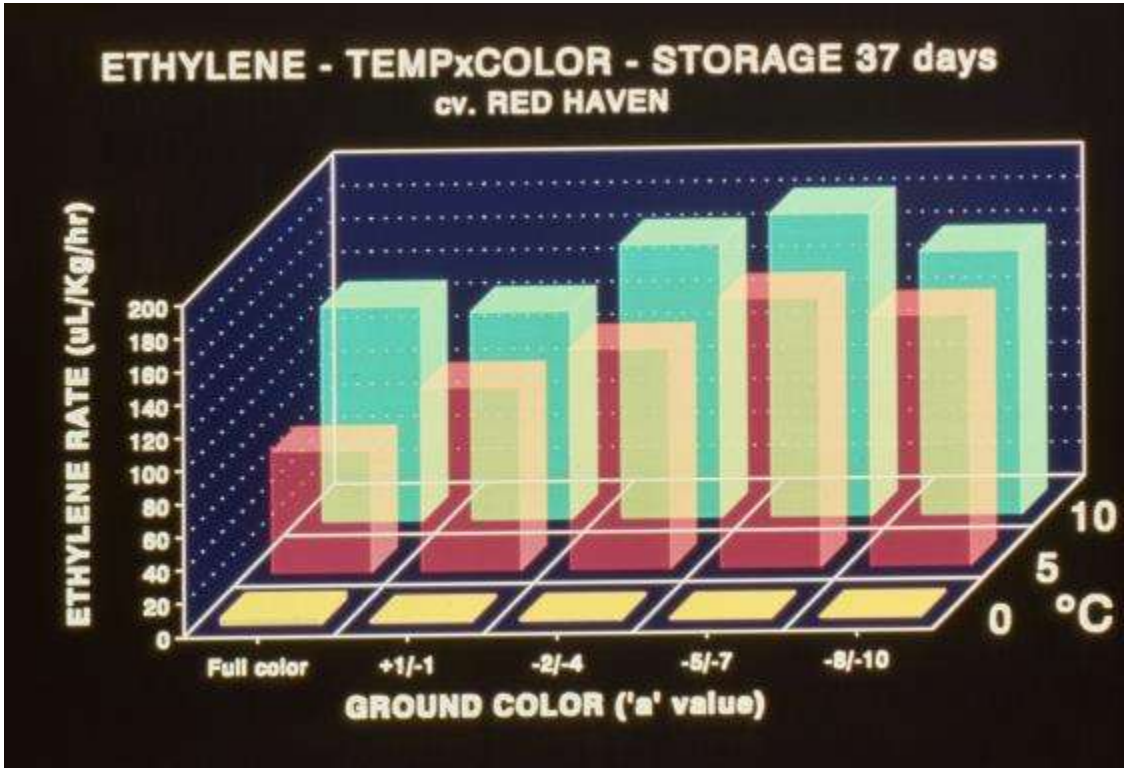
Internal browning appears to be worse at 5°C (41°F) than either 0°C (32°F) or 10°C (50°F). Both mealiness and internal browning may be caused by long-term storage at ‘chilling’ temperatures.

Redhaven Peach



Fruit stored at 0°C (32°F back row) remain firm while those stored at 5°C or 10°C soften.

Redhaven Peach



Storage of peaches at 0°C dramatically suppresses ethylene production, while storage at 5°C does not. Storage at 5°C appears to cause partial softening as ethylene is present.

Fruit Anatomy

Peach flesh after 5°C (41°F) storage. Note differences in browning among maturity treatments.

Fruit Anatomy

Greater amounts of cell wall materials at a greater purity isolated from fruit stored at 0°C (32°F) as shown in the lower row.

Classical Postharvest Biology

Are peaches chilling sensitive?
Do temperatures below 10°C (50°F) damage the fruit?
But is it a classic chilling injury?

An Alternate Hypothesis…..

Susan Lurie discovered that cell wall degradation did not occur properly in the cold. A larger wall fragment was not metabolized during storage at cold temperatures, leading her to describe this as “uncoordinated ripening.”

An Alternate Hypothesis…..

Uncoordinated ripening can occur even in the absence of chilling. We have tasted mealy peaches when harvest is delayed. Varieties that are not likely to drop would be more susceptible. Why?

Potential Solutions?

- Are There Any Solutions?
  - Management
  - Genetics

Storage Conditions

- Stored peaches should be held at either 10°C (50°F) or 0°C (32°F).
- Damage usually is noticeable after 14 to 17 days of cold storage.
- Delayed storage and intermittent warming have shown value on occasion, but the results are erratic.
- Pre-storage treatment with ethylene?

‘Reversion’

After storage, warming sometimes reduces mealiness. This has been called ‘reversion.’
Anecdotal observations of reversion are one reason intermittent warming has been suggested.
Unfortunately this is not a reliable solution.

Prunus Species Differences

- Plums have a longer storage life than nectarines.
- Nectarines have a longer storage life than peaches.
- This difference is not trivial…..
- Nectarines can tolerate the time needed to travel from Chile to Europe by boat but peaches cannot.

Varietal Differences

In the Arkansas program the only cultivars somewhat resistant to mealiness are non-melting flesh. Bowden, Amoore Sweet, and White Rock are unique in that they have a crisp texture rather than the rubbery texture usually associated with non-melting flesh peaches. Of the melting-flesh cultivars, White County is the least susceptible although it still develops mealiness when stored for more than two weeks.

I've also experienced mealy peaches directly off the tree. This was especially apparent after very hot and dry summer weather.

Paul Sandefur, MS – Arkansas.

Long-term Solutions

- Peach/nectarine hybrids?
- Crunchy peaches?
- Genetic resistance to mealiness?

Peach Storageability (Crisosto, et al.)

Variety	Breeder	Storage at 0°C (weeks)	Storage at 5°C (weeks)
Yellow-Flesh Peaches			
June Lady	Merrill	4	1
Flavorcrest	Weinberger	4	2
Fay Elberta	N.A.	4	3
O'Henry	Merrill	3	2
Autumn Lady	Merrill	2	1
White-Flesh Peaches			
White Lady	Zaiger	4	2
Sugar Giant	Zaiger	5	2.5
Nectarine			
Summer Grand	Anderson	5+	3
Ruby Diamond	Bradford	5	3

And thanks to my friends…

Acknowledgements:

– Miklos Faust, USDA Beltsville
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