

FINAL REPORT

WTFRC Project #CH-04-407

WSU Project #14C-4164-1201

Project title: Postharvest quality of new commercially grown cherry varieties

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Organization: WSU Tree Fruit Research and Extension Center

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Objectives:

1. Develop harvest maturity guidelines and determine quality characteristics at harvest and after storage of early ('Chelan') and late ('Lapins', 'Sweetheart' and 'Skeena') sweet cherry varieties as compare with 'Bing'.
2. Determine the effect of growing season temperatures and postharvest treatments on the quality of 'Lapins' cherries.
3. Test the susceptibility to impact force using induced pitting.

Significant findings:

Harvest maturity study:

- Lapins cherries, whether grown at low, medium or high elevations, were less firm than the other varieties at all sampling dates; Skeena and Sweetheart were the firmest (Figure 1).
- The largest cherries were Lapins while Skeena were the smallest. Skeena size was strongly influenced by harvest maturity.
- Chelan was the least acidic and had the lowest soluble solids of the varieties sampled; Bing had the most acidity and soluble solids.

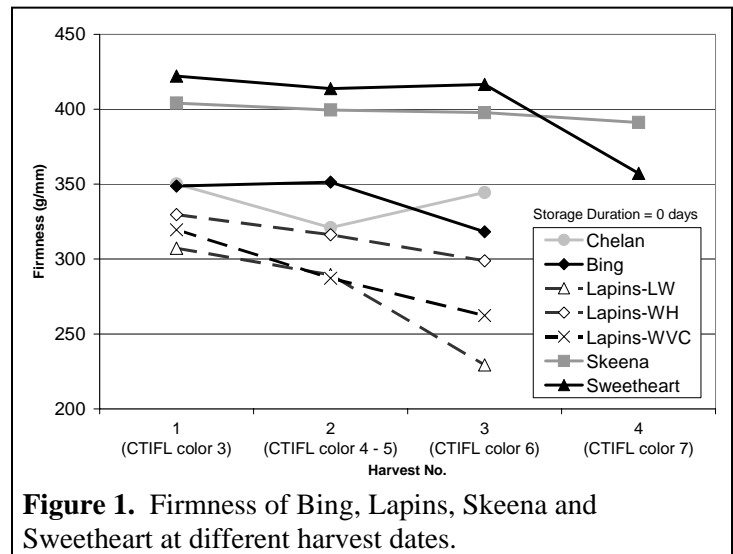


Figure 1. Firmness of Bing, Lapins, Skeena and Sweetheart at different harvest dates.

Storage study:

- All varieties lost acidity gradually, at about the same rate during 28-day storage at 33°F. Bing cherries had the highest acidity at all storage periods; Lapins generally had the lowest acidity.
- Most varieties retained about the same soluble solids levels during storage except for Sweetheart, which gained soluble solids in each of the storage periods (Figure 2).

- Firmness declined after 7 days from harvest in Bing, Sweetheart, and Chelan. Firmness in these varieties rose above harvest firmness after 14 and 28 days in storage. The firmness of Lapins cherries rose gradually during the storage period.
- Skin color did not change appreciably over the 28-day storage period in any variety.
- Percentage of green stem color was equal to that at harvest after 7 days but declined significantly after 14 days of storage and continued to decline after 28 days in storage. Chelan cherry stems remained green throughout the 28-day period. Sweetheart cherry stem color declined rapidly between 14 and 28 days (Figure 3).
- Percentage of fruit with shrivel rose rapidly in Bing and Lapins, while Skeena and Chelan fruit did not shrivel until after 14 days in storage.
- Percentage of pitted fruit rose dramatically within 7 days of harvest in Chelan and Lapins. In Sweetheart, pitting rose gradually over 7 days, then rapidly with longer duration. In Skeena, pitting was about the same as at harvest after 7 days but then rose at 14 days where it stabilized (Figure 4).

Induced pitting:

- When a standard pitting stress using the BC pitting device was applied to fruit from each variety at each harvest, pitting sensitivity from highest to lowest was Sweetheart (82%), Lapins (65%), Bing (62%), Skeena (55%) and Chelan (42%).
- It was unclear whether harvest maturity played a role in the amount of fruit developing pits.

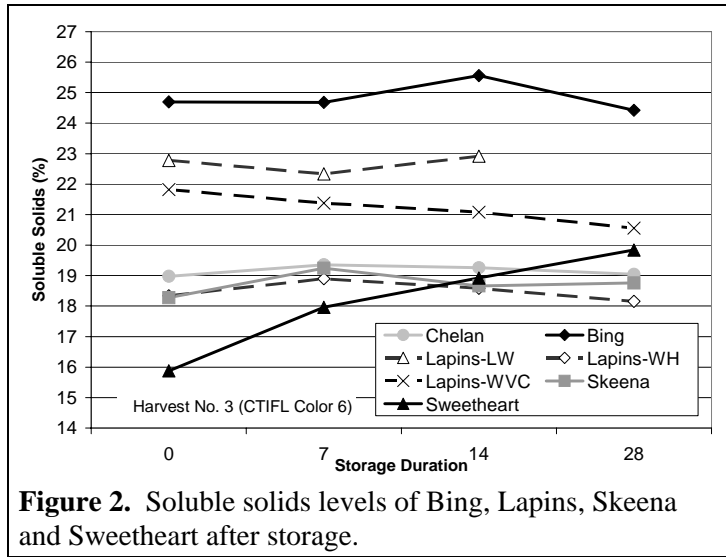


Figure 2. Soluble solids levels of Bing, Lapins, Skeena and Sweetheart after storage.

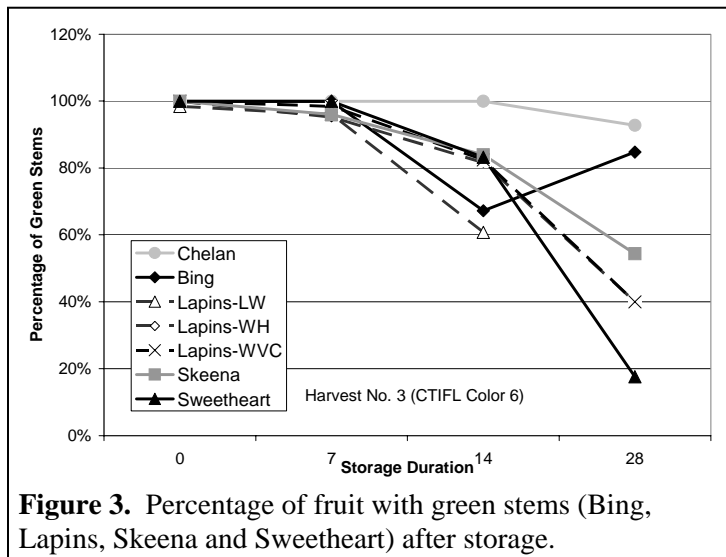


Figure 3. Percentage of fruit with green stems (Bing, Lapins, Skeena and Sweetheart) after storage.

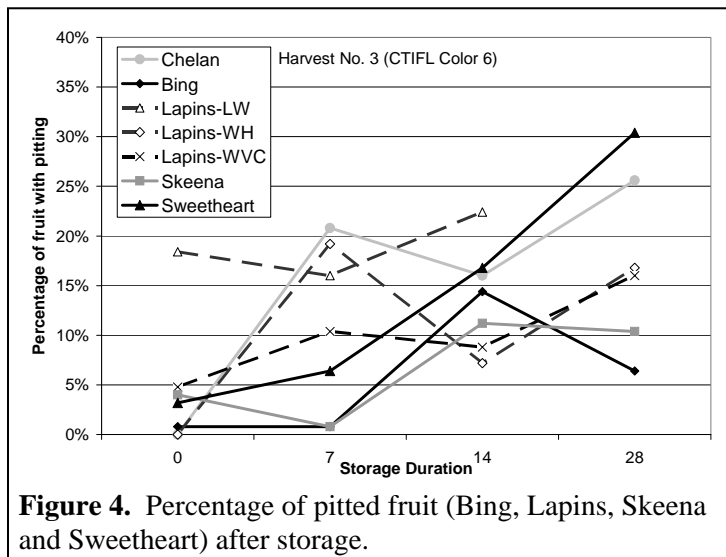


Figure 4. Percentage of pitted fruit (Bing, Lapins, Skeena and Sweetheart) after storage.

Postharvest temperature and firmness:

In a trial in which cherry firmness was evaluated at different postharvest temperatures (33-116°F) preliminary data were obtained on Lapins, Bing, Skeena and Sweetheart varieties. Firmness declined linearly in Lapins ($r^2=0.81$), but there was more variation in Bing ($r^2=0.59$), Skeena ($r^2=0.65$), and Sweetheart ($r^2=0.23$) [see Figure 5]. This work needs to be clarified by additional studies proposed for 2005.

Methods employed in 2004:

1. Maturity and storage study:

Chelan fruit were harvested from an orchard in Rock Island. Bing, Skeena and Sweetheart cherries were harvested

three or four times from an orchard on Wenatchee Heights. Lapins cherries were harvested from three orchards located at different elevations (Wenatchee River, airport in Wenatchee and Wenatchee Heights) to explore the relationship of accumulated heat units and fruit quality. Harvested cherries corresponded to colors represented on a color scale produced by CTIFL (France) at color ratings of 4, 6 and 8, respectively. A 25-fruit sample taken from each of five trees was analyzed for quality at harvest and after storage for 7, 14 and 28 days at 32°F. Quality analysis included stem, skin and flesh color, firmness, and size measured on every cherry. Weight, soluble solids (SS) and titratable acidity were measured by pooling all cherries in the sample. Temperature data loggers were placed in each orchard and programmed to monitor temperatures on an hourly basis.

2. Pitting study:

A 25-cherry sample was taken from each of five trees for pitting evaluation. Cherries were held at 38°F for 24 hours after harvest, then pitting was induced using the device designed at the Pacific Agri-Food Research Centre, Summerland B.C. to induce a standard pitting stress. Cherries were held for 14 days at 33°F plus 24 hours at 70°F before evaluating damage. Fruit damage assessed is expressed as the percentage of damaged fruit.

3. Postharvest temperature and firmness study:

Although it is agreed that postharvest temperature affects cherry firmness, the relationship between a specific temperature and cherry firmness is not known. Packers need to know how fruit measured at cold temperature compares with fruit at warm temperature. A preliminary experiment was performed in which Lapins, Bing, Skeena and Sweetheart were removed from cold storage and allowed to warm. Fruit flesh temperature and firmness of 25 cherries were tested at four times between 44 and 69°F. The fruit were then allowed to continue to warm by being placed directly in the sun, and four firmness measurements were taken between 69 and 110°F. Firmness was measured using the FirmTech II.

4. Commercial packing study:

At time of commercial harvest for each variety, a sample of fruit was obtained prior to dumping and at the end of the commercial packingline. The sample was evaluated when it was obtained as well as after storage for 14 days.

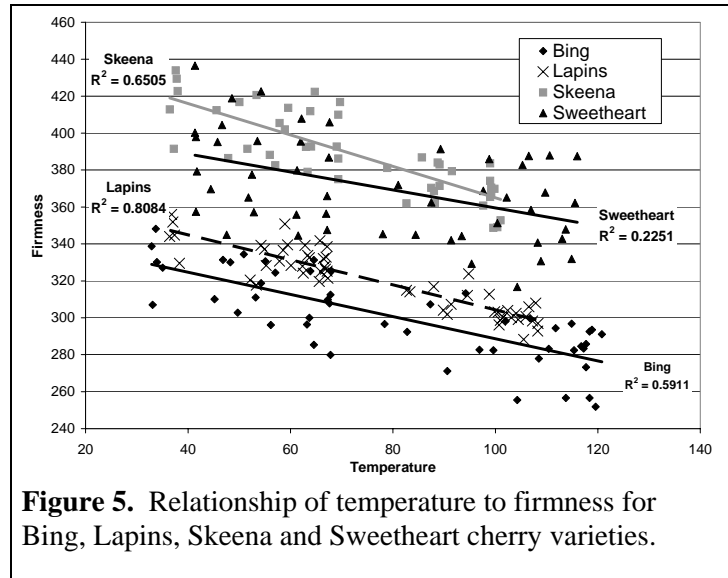


Figure 5. Relationship of temperature to firmness for Bing, Lapins, Skeena and Sweetheart cherry varieties.

5. Water study:

A sample of each Lapins harvest and second-harvest Bing was held for 5, 10 or 15 minutes in 33°F water and evaluated for fruit condition and firmness after 14 days at 33°F.

Results and discussion:

1. Maturity Study:

Bing – Bing cherries at harvest had the highest acidity and soluble solids during the commercial harvest period of any variety evaluated. Soluble solids rose linearly with skin color ($r^2=0.96$) and with internal color ($r^2=0.99$). Bing cherries were not the most firm, but were of high firmness. Bing size was small, peaking on 10 row at commercial harvest. (The orchard was located on Wenatchee Heights and was under the same management as the other varieties.)

Following storage, acidity and soluble solids for Bing cherries harvested at CTIFL color 6 remained high, and firmness did not change in comparison with other varieties. Bing fruit had less pitting than the other varieties during the 28-day storage period (except for the 14-day pullout, at which time it was intermediate).

Chelan – At harvest, Chelan cherries had the lowest acidity and soluble solids of any variety evaluated. Soluble solids rose linearly with skin color ($r^2=0.92$) and with internal color ($r^2=0.99$). Chelan cherries were firmer than Lapins but less firm than the other varieties. They were smaller than Lapins but larger than the other varieties.

Following storage of Chelan cherries harvested at CTIFL color 6, the acidity was equal to that of Lapins and Skeena but lower than the other varieties, while soluble solids and firmness were intermediate. Pitting was a serious problem with Chelan at all storage durations, and they had the highest percentage of pitted fruit.

Skeena – Skeena cherries at harvest were intermediate in acidity and soluble solids as compared with other varieties. However, Skeena was almost as firm as the firmest variety at each sampling date. There was not a good linear relationship between the rise in soluble solids and skin color ($r^2=0.38$) or internal color ($r^2=0.45$). Skeena cherries were very small at early harvests but intermediate by the third harvest. This variety showed the largest effect of maturity on fruit size.

Following storage of Skeena cherries harvested at CTIFL color 6, the acidity and soluble solids remained intermediate. Firmness remained quite high at all pullout dates. The amount of pitting that developed in storage up to 28 days was low.

Sweetheart – Sweetheart cherries at harvest were high in acidity but intermediate in soluble solids at all dates. Sweetheart cherries were the most firm fruit evaluated at harvest. There was a moderately good linear relationship between soluble solids and skin color ($r^2=0.79$) but a stronger relationship with internal color ($r^2=0.84$). Sweetheart cherry size was not influenced by maturity. Fruit were as large, or larger than, all other varieties, except for Lapins, which were larger.

Following storage of Sweetheart cherries harvested at CTIFL color 6, the acidity was high but soluble solids low compared with the other varieties. The cherries were the most firm at all pullout dates. The percentage of pitting of Sweethearts was low after 7 days, but by 28 days it was the highest of all varieties.

Lapins – At harvest, Lapins cherries from the three orchards sampled had low acidity (higher than Chelan) and medium-high levels of soluble solids. There was a linear relationship between soluble solids and both skin and internal color. At harvest and after storage, they were the least firm of all

varieties at all harvest dates; Lapins were the largest fruit sampled. At harvest and after 7 days in storage, Lapins had the highest percentage of pitted fruit. Only after 14 days in storage was fruit from other varieties more pitted.

2. Lapins comparison:

The exploration of the effect of growing season temperature on Lapins quality is currently being explored through the use of temperature models and is not yet complete.

3. Pitting study:

When a standard pitting stressor using the BC pitting device was applied to fruit from each variety at each harvest, the percentage of fruit with severe pitting from highest to lowest was Sweetheart (82%), Lapins (65%), Bing (62%), Skeena (55%) and Chelan (42%). It was unclear whether harvest maturity played a role in the amount of fruit developing pits.

4. Postharvest temperature and firmness study:

This year for the first time, preliminary data was obtained on the relationship of the fruit temperature and firmness on Lapins, Bing, Skeena and Sweetheart varieties. Firmness declined linearly as temperature increased in Lapins ($r^2=0.81$), but there was more variation in Bing ($r^2=0.59$), Skeena ($r^2=0.65$), and Sweetheart ($r^2=0.23$). This work needs to be clarified by additional studies that are proposed in a new project for 2005.

Budget:

Project title: Postharvest quality of new commercially grown cherry varieties

PI: Eugene Kupferman, Chris Sater (Associate in Research)

Project duration: 2004 (one year)

Current year: 2004

Project total (1 year): \$22,380

Current year breakdown

Item	Year 1 (2004)
Salaries ¹	9,700
Benefits (46%)	2,910
Wages	5,100
Benefits (16%)	816
Equipment	0
Supplies ²	2,854
Travel ³	1,000
Miscellaneous	0
Total	22,380

¹ Chris Sater, Associate in Research, for 4.5 months.

² Supplies include fruit purchase, cherry packing material and lab supplies. Cell phone charges are authorized under this grant.

³ Travel to obtain fruit samples.