BC FoodWeb

Peer-reviewed research

Determining sweet cherry flavour retention for export markets

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KEY TAKEAWAYS

- Of the fruit quality traits we evaluated, **fruit dry matter at harvest was the best predictor of post-storage sweet cherry flavour** (after simulated overseas shipping conditions).
- We found that **colour was not a reliable indicator of maturity and/or flavour quality** as cherries with the same colour didn't always have the same amount of dry matter, soluble solids, or acidity (due to cultivar and growing condition differences).
- We found that **cherries had the best post-storage flavour when they were harvested at the following dry matter levels (= the "optimal dry matter range"): 22.5% - 25% dry matter for Sweetheart and 19.5% - 22.5% dry matter for Staccato**. More research is needed to determine the optimal range for **Sentennial** but our initial data indicates **20.5% - 22.6%** may be optimal. It is important to note that these numbers are based on 2-3 years of research at the Summerland Research and Development Centre and that the optimal range may differ for other regions and growing conditions.

Production Type
- Tree fruit

Practice Benefit(s)
- Better prediction of fruit flavour post-storage

Research Location
- Summerland, BC

Key Terms
- *Dry matter:* the solids in a fruit including sugars, acids, carbohydrates, and starch.
- *Soluble solids:* primarily an indicator of sugar content but also reflects overall fruit maturity and flavour quality.

How can this research be used?

- For the best flavour after overseas shipping, growers can try using **dry matter, instead of colour, as an indicator of when to harvest cherries.**
- Dry matter can be measured using near-infrared (NIR) spectroscopy handheld instruments, such as the Felix F-750 Produce Quality Meter, which takes non-destructive readings of fruit quality. At the time of publishing, the cost per unit is ~$10,000. Visit https://felixinstruments.com/ or https://hoskin.ca/ (Canadian distributor) for more info.

Why was this research done?

This research was conducted to address a key challenge faced by British Columbian (BC) cherry growers in maintaining fruit quality for export markets. Since sweet cherries can sometimes spend up to 28 days in container shipment, preserving their quality during long-distance transport is essential to meet international market demands and maintain Canada's reputation for premium fruit.

Traditionally, colour is used as the main indicator of fruit maturity. However, some growers have found that even when cherries arrive with good colour, firmness, and stem pull, their flavour sometimes falls flat.

To address this issue, we investigated whether other indicators of fruit maturity (such as dry matter, soluble solids, and acidity) could better predict flavour retention after 28 days of cold storage at 0.5°C and 3 °C, simulating ideal and non-ideal overseas shipping conditions, respectively. The results from this study can help growers determine the best time to harvest for optimal flavour in cherries going to export markets.

What was the outcome?

Our results show that dry matter is a better indicator of sweet cherry flavour than colour. While colour was linked to sweetness, dry matter was related to both sweetness and acidity, two key factors that make cherries taste good. We also found that even though cherries may be the same colour, they can differ in acidity, dry matter, and soluble solids as these are affected by growing conditions and cultivar. For example, higher relative humidity during the growing season was related to lower acidity while higher growing season temperatures was associated with higher acidity.

Figure 2. Sweetheart cherries at the 3-4 CTIFL (Centre technique interprofessionnel des fruits et légumes) colour level **(left)**, 4-5 colour level **(middle)**, and 5-6 colour level **(right)**. Photos by N. DeLury.

At maturity, cherries reach a specific dry matter amount where sweetness and acidity are at optimal levels, and respiration rate is at its lowest. This is considered the optimal dry matter range for harvest. Because sweet cherries do not continue to ripen after being picked, **they should be picked at their optimal dry matter range to achieve the best flavour in export markets.** Respiration essentially means that the cherry is "breathing". Like us, cherries breathe and break down nutrients. After a cherry is picked, it breaks down carbohydrates and organic acids. We found that soluble solids (the sugars) did not significantly decrease / break down during storage, but organic acids did, indicating the key role that organic acids play in flavour.

We found the following dry matter ranges led to the best flavour post-storage:

- **Sweetheart: 22.5% - 25%**
- **Staccato: 19.5% - 22.5%**
- **Sentennial:** Sentennial was not originally part of this research project but was added after year 1 due to grower interest. Since we don't have the full 3 years of data, we cannot give concrete recommendations (more research needs to be done), but our initial data indicates **20.5% - 22.6%** may be optimal.

It is important to note that these values are based on 3 years of trials at the Summerland Research and Development Centre. **Optimal dry matter may be different in other growing conditions and regions.**

Table 1. This table shows the average temperature and relative humidity in the 28 days before cherry harvest (during ripening) for each cultivar in 2018, 2019, and 2021. **If your orchard experiences similar conditions, you can expect the dry matter range for best post-storage flavour to be similar to what was found in our study.**

Cultivar and Growing Year	Harvest Date Range	Average Temperature (°C)	Average Low Temperature (°C)	Average High Temperature (°C)	Average Relative Humidity (%)
Sweetheart					
2018	July 16-30	19.4	7.2	32.1	59.4
2019	July 18-24	18.2	7.2	28.8	66.1
2021	July 5-20	24.1	8.5	50.7	40.7
Staccato					
2018	July 30 - Aug 9	20.7	7.4	32.8	56
2019	July 22-31	18.8	7.2	29.4	64
2021	July 13-27	24.1	8.5	50.7	40.7
Sentennial					
2019	July 22 - Aug 6	18.9	7.2	29.4	63.3
2021	July 12-26	24.1	8.5	50.7	40.7

What's next?

Because of the complex relationship between growing conditions and different cultivars, we could **not** determine the optimal dry matter range that can be used as a standard for all cherries grown across BC. The peak dry matter that a cherry can reach depends on the growing conditions that year (i.e. a drier vs. wetter year or warmer vs. cooler year). **We recommend future research to develop dry matter standards for each cultivar under a range of environmental conditions.** The research must be done over many years and a diversity of orchard conditions to be comprehensive.

How was the research done?

This study was conducted over 3 growing seasons (2018, 2019, and 2021) at the Summerland Research and Development Centre in Summerland, BC.

Each year, we harvested Sweetheart, Staccato, and Sentennial cherries at colour levels 3-4, 4-5, and 5-6, based on the CTIFL colour standard series. After harvest, we transported the cherries back to our lab where they were placed in a walk-in cooler at 0.5°C to mimic rapid hydro-cooling capabilities that the industry uses. In the afternoon of harvest days, we removed the cherries from the cooler and sorted them according to colour and the British Columbia Tree Fruits Company protocol: larger than 25.4 mm (< 10.5 row size), stems on, and no defects (blemishes, splits, pitting, disease, hail or insect damage).

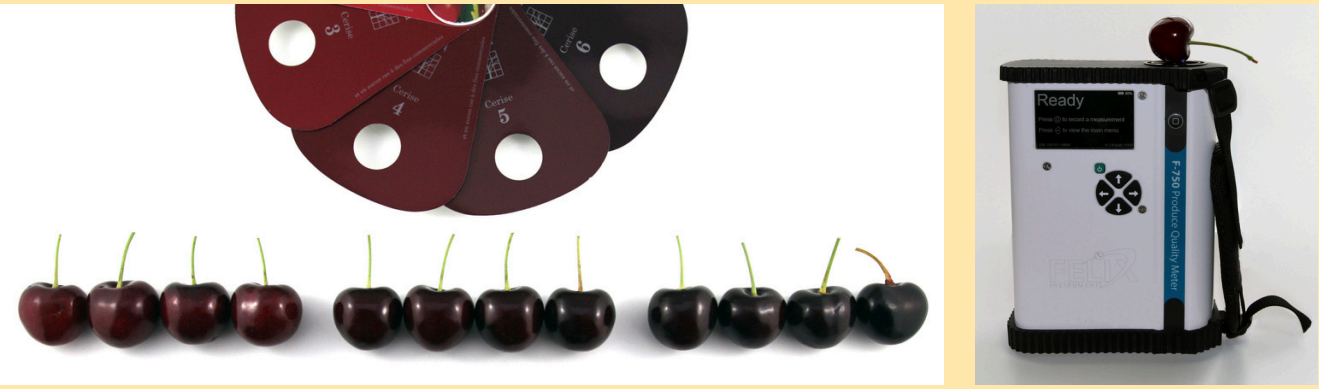

Figure 3. Left: Staccato cherries at the three colour levels assessed in this study, from left to right: 3-4; 4-5; 5-6 CTIFL, with the reference colour chips corresponding to the cherry colour positioned above. **Right:** Measuring dry matter in a cherry using a Felix F-750 Produce Quality Meter. Photos by N. DeLury.

For each colour level, we collected data on fruit dry matter, soluble solids, acidity, firmness, size, stem pull force, stem shrivel, pitting, and pebbling before and after 28 days of storage at 0.5°C (ideal storage temperature) and 3 °C (non-ideal temperature). To mimic overseas shipping conditions, we packed 10 kg of cherries at each colour level into cardboard boxes with a polyethylene liner and an absorbent pad.

About this brief

This brief was prepared by Juliana Cao from the BC Food Web team, with the help of Kelly Ross and Naomi DeLury, and is based on the following scientific journal article:

- Ross, K. A., DeLury, N. C., Fukumoto, L., & Forsyth, J. A. (2024). An assessment of the flavour quality attributes of Staccato, Sweetheart, and Sentennial sweet cherry cultivars in relation to maturity level at harvest. Fruit Research 4: e037. https://www.maxapress.com/article/doi/10.48130/frures-0024-0031

Want to learn more?

- For any questions regarding this research, contact Kelly Ross at kelly.ross2@AGR.GC.CA
- Read a blog post about the research highlights: The sweet spot: timing cherry harvest for peak flavour that lasts (https://profils-profiles.science.gc.ca/en/blog/sweet-spot-timing-cherry-harvest-peak-flavour-lasts)

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BC CHERRY ASSOCIATION

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