Tracking Tart Cherry Fruit Development

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Introduction

'Montmorency' is the primary cultivar of tart cherry (*Prunus cerasus)* grown in the United States, but there are many other varieties with commercial potential. The USDA Tart Cherry Collection (Geneva NY) contains 149 genetically distinct accessions, each with a unique profile of phenolic compounds and sugar-acid ratios that change over the growing season. Since cherries are non-climacteric fruit, they stop ripening once picked from the tree. Thus, growers must harvest at a time when fruit quality matches consumer preferences for sweetness, appearance, and health benefits derived from phenolic antioxidants. This project characterizes how 'Montmorency' and three lesser-known varieties ripen over three weeks by measuring sugar content, color, and phenolic compounds. Providing more information on lesser-known varieties could help the tart cherry industry diversify into novel cultivars.

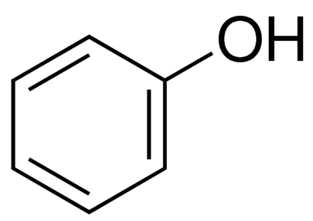

Figure 1: Phenol ring

Figure 2: USDA Tart Cherry Collection. Photo Credit: Zachary Stansell

Materials and Methods

Harvested tart cherries on six dates from June 26 to July 13, 2023 from four varieties:

- **'Montmorency'**
- **'Balaton'**
- **'Fructbare von Michurin'**
- **'Itt 18 (12)'**

Figure 3: Colorimeter used to measure L* a* b* values

Figure 4: Refractometer used to measure Brix (sugar percentage) on juice samples

Prepared frozen cherries samples to perform High Performance Liquid Chromatography (HPLC):

- Ground cherry flesh into powder
- Extracted 0.5 mg cherry with 1.5 mL of solvent (70 % MeOH, 2% CH_2O_2 in water)
- Mixed, centrifuged, filtered.
- Ran samples with the lab's HPLC cherry phenolic protocol (Chang et al., 2010)

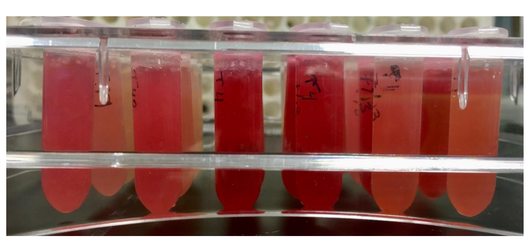

Figure 5: 2 mL tubes of extracted cherry flesh, prior to filtering

Major compounds were identified by matching retention time and wavelength with previous cherry phenolics lab results.

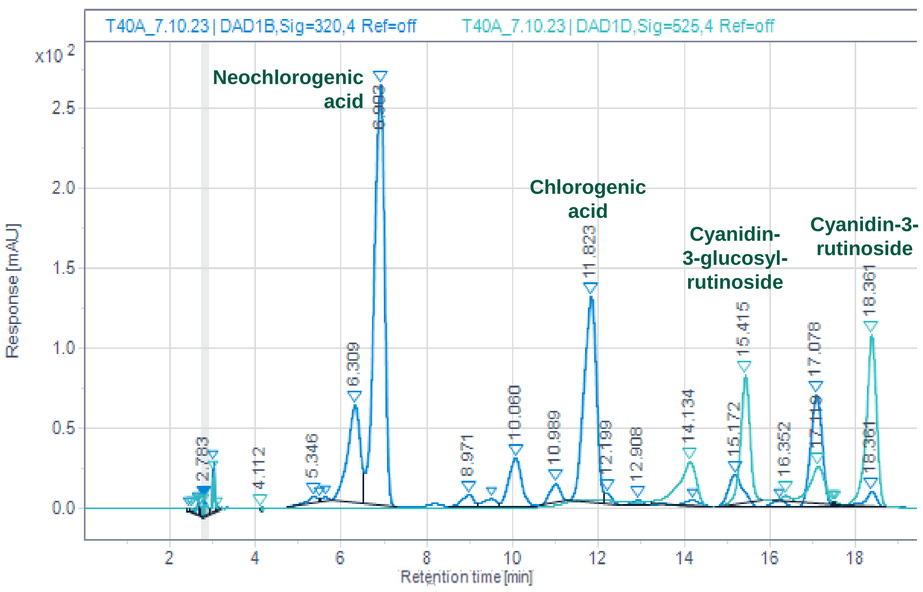

Figure 6: HPLC chromatogram for Itt 18 (12) harvested on June 10.

Results

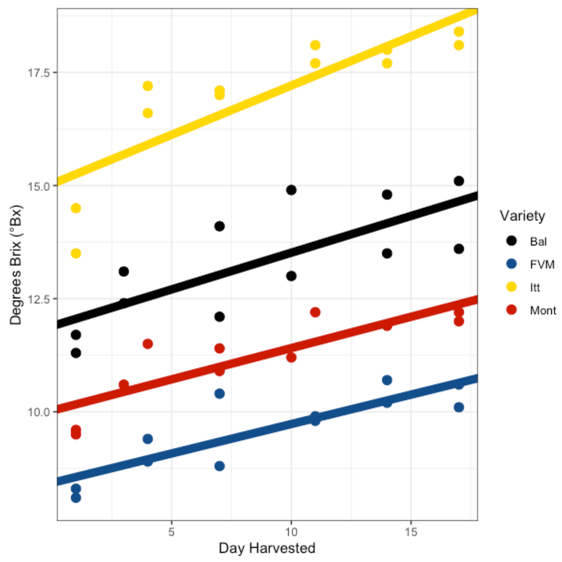

Figure 7: Brix (Sugar Percentage) Over Time

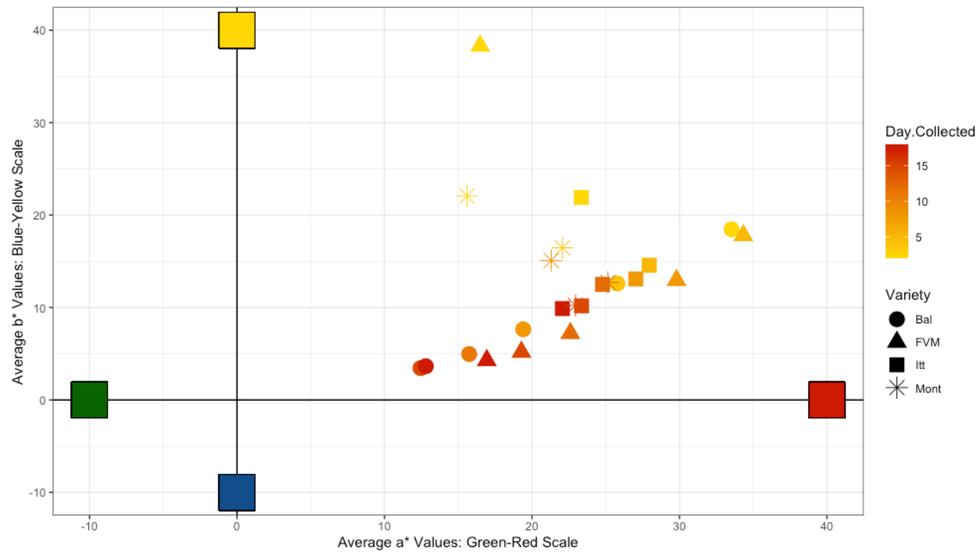

Figure 8: Colorimeter Hue Over Time

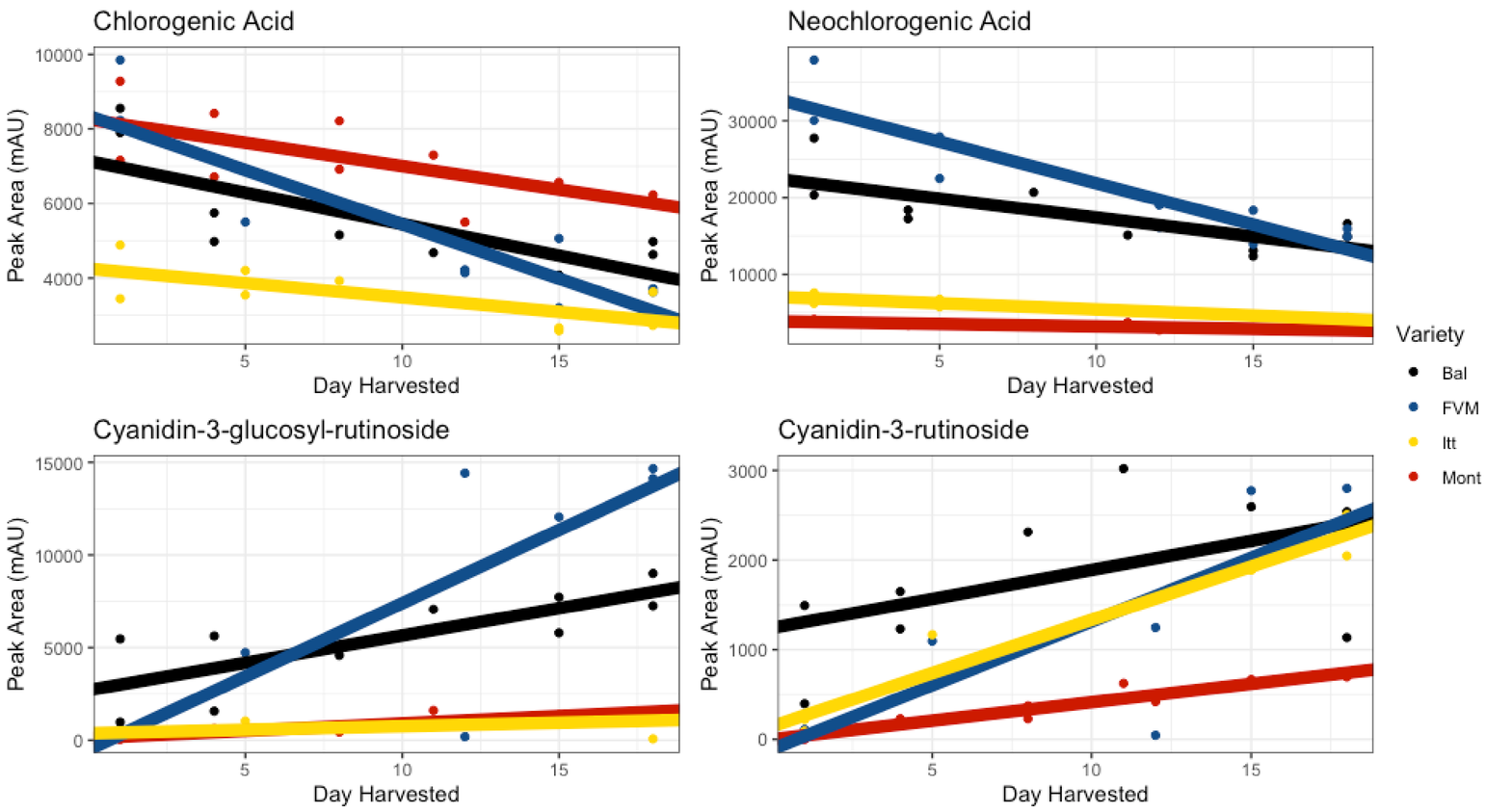

Figure 9: Phenolic Compounds Over Time in 'Balaton' (Bal), 'Fructbare von Michurin' (FVM), 'Itt 18 (12)' (Itt), 'Montmorency' (Mont)

Brix values for all varieties increased over time ($p < 0.001$), and all varieties differed significantly from each other, (all $p < 0.001$) (Fig. 7).

The cherries become more red and the color becomes less brilliant over time (Fig. 8). The lightness value (L* value) decreases over time, demonstrating the cherries becomes darker (not pictured).

In all four phenolic compounds, the day harvested, variety, and their interaction were significant predictors of peak area (all $p < 0.03$). This indicates that depending on cherry variety, the day harvested predicts peak area differently (see slopes in Fig. 9). Neochlorogenic acid and chlorogenic acid decreased over time for all varieties ($p < 0.001$). Cyanidin-3-glucosyl-rutinoside and cyanidin-3-rutinoside increased over time for all varieties ($p < 0.02$) (Fig. 9).

Discussion and Future Work

Previous studies on tart cherry maturation investigated different varieties in different field locations. However, many trends remained consistent. Reports showed increases in Brix (Kack, 2017) and decreases in L* values and brilliance (Sandra et al., 2009). Additionally, increases in cyanidin-3-glucosyl-rutinoside and cyanidin-3-rutinoside were published (Karaaslan et al., 2015).

Several HPLC peaks on the chromatograms remain unspecified (Fig. 6), so identifying these compounds would be the first step to a better understanding of the tart cherry profile.

Different tart cherry sweetness, color, and phenolic profiles may be matched to different markets (fresh, juicing, or canning). Developing full profiles for each variety may translate to better products. We recommend a broader study over a longer period of time, incorporating data from multiple field locations and seasons.

Developing a proxy indicator for phenolic compounds (e.g. Brix values that are easy to measure) would help growers identify when to harvest their fruit. With more data regarding ripening, it would become more feasible for growers to expand into tart cherry varieties beyond 'Montmorency.'

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