BERRY QUALITY

RESEARCH & EXTENSION

INVESTIGATOR: L. Calderwood
15. TITLE: Wild Blueberry Organic Acid Quality Analysis

OBJECTIVES

- Identify the range of organic acids in wild blueberry
- Establish a framework for quality analysis
- Pursue funding for further testing

LOCATIONS: Jonesboro and Dedham, Maine
PROJECT TIMEFRAME: July 2019 – August 2019

INTORDUCTION:

While researchers have been measuring acidity, sugar and anthocyanin content in lowbush blueberry for several years (Potter et al. 2006), applied field research has not been conducted to identify when region and plant specific ripening chemistry develops and how measures of quality change in response to farm management practices.

We know that sugar content and acidity are the standard quality measures monitored in berry, wine grape and other fruit production systems. As berries ripen, their taste transitions from bitter to sweet due to the shifting sugar to acid ratio. Talking with local vintners who use Maine wild blueberries in wine, wild blueberry acidity tends to drop while sugar content increases from approximately 7 to 13 Brix over the course of the four-week harvest season. This anecdotal evidence and findings in Ontario (Mallick and Hamilton 2017) indicate that the ratio of sugar:acid in lowbush blueberry follows a similar sugar:acid ratio to grape, highbush blueberry, grapefruit, and apple (Jayasena et al. 2007; Harker et al. 2002; Wolf 2008). Because ripe blueberries typically have lower Brix levels than grape, 7-13 and 18-24, respectively (Dami 2018) and ‘green’ berries have a higher acidity content than ‘blue’ berries, we are interested in understanding the acid:sugar ratio when under-ripe ‘green’ and ‘pink’ berries are mixed in with the ripe ‘blue’ berries. Additionally, we are interested in learning more about the sequence of organic acid development in wild blueberry from July through the end of August.

The major antioxidants in wild blueberries are flavonoid anthocyanins that are responsible for the blue pigmentation and are associated with health benefits. While some large processors measure berry quality in their facilities, quality measurements on the farm are not yet routine practice in the wild blueberry industry. An on-farm understanding of quality measures and their development would improve overall wild blueberry quality and increase opportunities to tailor berry quality to end users.

Unlike highbush blueberry, lowbush wild blueberry fields are comprised of numerous heterogenous plants (Kalt and McDonald 1996). While the diversity in wild blueberry fields provides resistance to pest pressure and environmental conditions, the range of ripening times, flavors, and color provide challenges to some end markets. Establishing a

framework for on-farm quality management would help farmers provide consistent quality that meets the needs of value-added end users. Quality dependent wild blueberry markets include juice, wine, vinegar, gourmet cooking, baked goods, dried berries, and powder.

METHODS

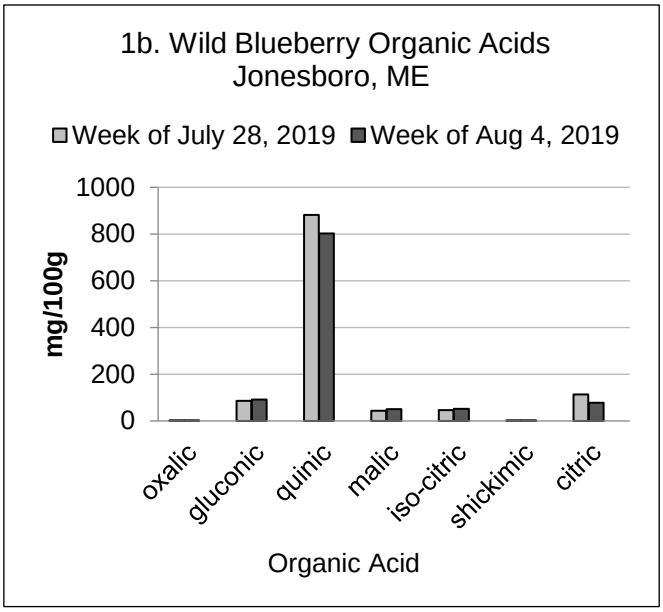
Wild blueberries from one plant in two different wild blueberry fields were collected via hand raking on two dates during the 2019 harvest season. The locations included Blueberry Hill Farm, Jonesboro ME and Peaked Mountain Farm, Dedham ME. Berries were collected once during the weeks of July 28 and August 4. The same plant was sampled on each farm on each date. At each plant, berries were raked into a bin, mixed together, and a 100g subsample was extracted. Each sample was stored in a labeled plastic bag and delivered to Brian Perkin's Food Science Lab for organic acid analysis. Organic acids in fresh berries were evaluated by quantifying residual sugars (fructose, glucose and sucrose), and organic acids (citric, malic, succinic, gluconic, oxalic) in berry juice/puree. High performance liquid chromatography (HPLC) coupled with diode array (DAD) and refractive index (RID) detectors (Lai et al., 2016 and Fu et al., 2015) were employed for all assays. All samples were evaluated in triplicate.

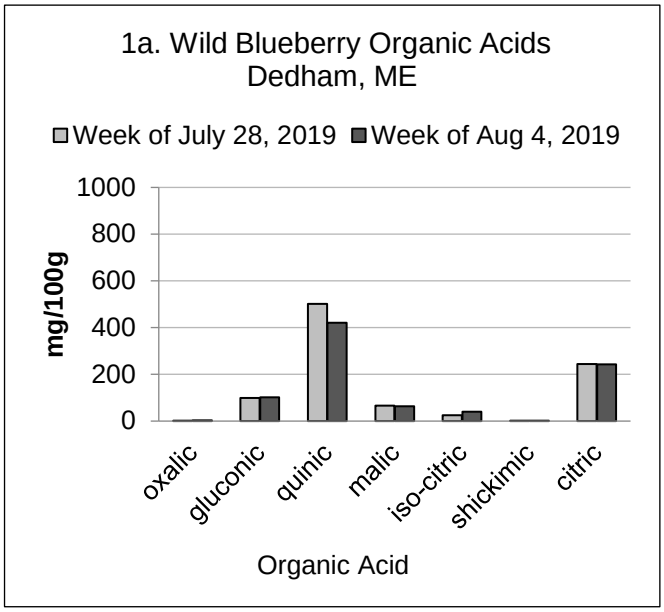
Table 1. Organic acids tested and the general human perceived flavor associated with each acid.

Organic Acid	Perceived Acidity
Oxalic	Sour
Gluconic	Mild sour
Quinic	Coffee
Malic	Green apple
Shickimic	N/A
Citric	Citrus
Iso-citrc	N/A

RESULTS

Preliminary organic acid data indicated that there are plant-specific and/or site-specific differences in organic acids as expected. Quinic, gluconic, and citric acid were most prevalent in both locations. Quinic acid decreased over time in both plants (Figures 1a & 1b).





Figures 1a & 1b. Organic acid content in wild blueberries collected in Dedham (1a) and Jonesboro (1b), Maine on two dates during the 2019 harvest season. These results are preliminary and have not been statistically compared.

DISCUSSION

Preliminarily, the organic acid compositions and concentrations were different between Dedham and Jonesboro. Dedham and Jonesboro Maine are approximately 65 miles apart with Jonesboro closer to the coast than Dedham. Jonesboro sits at 105 feet above sea level while Dedham has an elevation of 344 feet. The Jonesboro site soil type is Colton gravely sandy loam and the Dedham site soil type is Peru fine sandy loam. With such geographic differences, these sites would reach peak ripeness at different times. However, by sampling across two consecutive weeks, any relative differences in ripeness were controlled for. Since both weeks presented the same level of deviation (trend) it suggests these differences are a function of location.

The reasons for variation in flavor between two plants from the same location would be primarily genetic. By sampling more than one location, many variables were added. Given the small scale and preliminary nature of this data, no conclusions can be made. However, these data do make us wonder why differences are observed and if farmers could control for them.

In additional to plant-to-plant differences, year-to-year variation has also been observed in the organic acid concentration of lowbush blueberries (Kalt and McDonald 1996). From this preliminary data, it is clear that a more in-depth study of wild blueberry quality across locations and time is warranted. Long-term testing will be necessary in order to map organic acid, sugar and anthocyanin concentrations across space and time.

CURRENT RECOMMENDATIONS

None at this time.

REFERENCES

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