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Monitoring fruit ripening is a critical step in determining the optimal time to harvest grapes to ensure higher fruit quality for wine production. Unlike some other fruit crops, grapes do not continue to ripen after harvest. Grapes that are picked too early have low sugar content, low flavor and high acidity, resulting in wines with “green” herbaceous tones and too much acidity. However, leaving grapes on the vine too long can result in higher pest or disease damage, berries desiccating and falling off the vine, and unbalanced wines with low acidity levels and undesirable “cooked fruit” flavors.

This fact sheet provides information on how to properly sample berries in the vineyard and how to measure sugar, acidity, and pH to estimate fruit maturity.

Evaluating cold hardy wine grape maturity

Collecting samples from the vineyard

Use the following strategies to collect a representative sample:

- Sampling should begin at the onset of **veraison** (or ripening). Initially, sampling can be done once per week, but as harvest approaches sampling should be done daily.
- To begin, separate berries from each cultivar.
- Collect samples in the morning for accurate and consistent readings. Grape sugar content increases in the heat of the day, so samples taken later in the day will have a higher sugar content reading. Avoid sampling during or right after a rain event, which will dilute the sugar.
- Avoid vines on the edges of any block, where fruit matures faster than in other parts of the vineyard.
- Collect a representative sample from a vineyard block by making sure you sample at least 10% of the vines in a block. If there is high variability among vines of a given cultivar, more vines should be sampled.

- Collect samples from both sides of the vine row, including those located on the inside and outside of the canopy.
- Samples can consist of collecting entire clusters or single berries. If sampling clusters, collect a minimum of 10 representative clusters within a vineyard block. If sampling berries, 100 to 200 berries should be collected, including berries from all parts of the cluster (top, bottom, back, and front).
- Avoid diseased fruit, but do not avoid unripe fruit.
- Store samples in a sealed plastic bag in a refrigerator until processing. Ideally, process fruit within 24 hours of sampling.

Processing samples

Make sure all berries are well crushed to extract juice from all parts of the berries. This can be done using a hand-held juicer and cheesecloth to separate the seeds from the juice (figure 1). Rinse the juicer with water between samples.

FIGURE 1. Hand-held juicer.





FIGURE 2. A refractometer measures the sugar concentration of fruit juice quickly and easily.

Evaluating ripeness by quantitative parameters

Sugar content

Sugar content is the most common parameter used to evaluate fruit ripeness, because it directly translates to the potential alcoholic content of the wine. Sugar content is measured as soluble solids concentration (SSC) in °Brix, which represent the grams of sugar (mainly glucose and fructose) per 100 grams of juice. Total SSC is measured using a refractometer (figure 2), and optimum concentrations will depend on the cultivars and wine style.

Acidity

Titrate acidity (TA) is a measure of how much acid is present in the juice, and is expressed in grams of acid per liter of juice. The predominant organic acids in grapes are malic, tartaric, and citric acids. The TA values are a measure of all acids present in the grape, but are expressed as tartaric acid equivalents in grams per liter. TA is measured through a titration process in which a base solution of sodium hydroxide is added to the juice sample until the acids in the juice are neutralized.

A color indicator dye (phenolphthalein) or a pH meter are commonly used to determine when the acids in the juice have been neutralized. Automated titration systems (figure 3) are available that can save time when a high volume of samples need to be processed.

pH

The pH of juice is a measure of the concentration of hydrogen ions (H^+) in the solution and is expressed on a logarithmic scale (i.e., for each pH unit, the concentration changes tenfold). This is related to acidity because acids can break down in a juice solution, freeing H^+ ions.

The pH can affect wine stability: high pH increases oxidation rates, while low pH can increase the precipitation of unstable proteins, which creates a haze or precipitate. The pH also affects biological stability, since lactic acid and acetic acid bacteria tend to proliferate in high pH juice during fermentation, imparting undesirable flavors and aroma in the wine. The pH also influences sensory traits, especially sourness and to some degree astringency, as well as color and clarity of a wine.

Fruit quality ranges at harvest for cold hardy wine grapes

Recommended ranges of fruit composition parameters for wine production are well established for *V. vinifera* cultivars. However, similar criteria need to be developed for cold hardy cultivars to help growers determine optimal harvest time. Grapes were harvested at the vineyards located at both the West Madison and Peninsular Agricultural Research Stations based on taste, appearance, and fruit composition parameter values established for *Vitis vinifera* and American hybrids.

Table 1 shows the harvest-ready ranges for soluble solids, TA, and pH for several cold-climate grape cultivars grown in Wisconsin. These ranges were established based on data collected over the 2011 through 2017 growing seasons, so they take into consideration some of the high variability in temperature and precipitation during the growing seasons in the United States' Upper Midwest.

In addition to evaluating SSC, TA, and pH to determine harvest dates, observations from the vineyard are as important as the parameters described above. Qualitative parameters include berry color, texture, skin splitting, aroma, and aftertaste, as well as rachis and berry dehydration. These can help indicate the best time to harvest in order to achieve the optimum wine quality. Keeping good records from year to year of harvesting dates, fruit composition, and weather conditions can help inform potential harvest dates in future years.

TABLE 1. Recommended fruit composition ranges at harvest for cold-climate grapes.

Cultivar	Brix (%)	TA (g/L)	pH
RED VARIETIES			
Frontenac	20–25	11–15	3.0–3.6
Marquette	20–27	9–12	2.9–3.3
Maréchal Foch	20–24	6–10	3.1–3.3
Petite Pearl	20–23	7–10	3.0–3.2
WHITE VARIETIES			
Brianna	17–23	7–10	3.1–3.3
La Crescent	17–25	10–15	3.0–3.2
La Crosse	18–22	8–10	3.1–3.4
Frontenac Gris	20–24	11–15	3.0–3.2

FIGURE 3. A commercially available titrator can measure both pH and acidity levels.





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