Not just sugars: analytical parameters that help make quick decisions before and during the harvest

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1. The time of harvest as a technical decision

During harvest, 48 hours can be enough to alter the relationship between sugars, acidity, and pH, changing the winemaking destination of a batch of grapes. Therefore, choosing the right harvest time cannot be based solely on sugar content, but requires a combined analysis of key analytical parameters to interpret the berry's overall development.

The winemaker's experience remains crucial. Grape tasting, assessing pulp consistency, skin thickness, and seed lignification are still essential practices. However, in a context characterized by greater climatic variability, these observations are more effective when complemented with objective analytical data.

Years with heavy rainfall, prolonged drought, or high temperatures can rapidly alter the internal balance of the grape. Pre-harvest analyses therefore allow for precise measurement of key chemical indicators alongside sensory evaluation, reducing uncertainty in selecting the right harvest window.

2. The fundamental parameters of technological maturity

Technological maturity concerns the balance between chemical components that influence the fermentation profile, microbiological stability, and the sensory characteristics of the wine. Among the most important parameters to monitor in the pre-harvest phase are **sugars** , **total acidity**, **pH ,** and **L-malic acid, YAN, and gluconic acid**.

Sugars and potential alcohol content

Fermentable sugars, primarily **glucose** and **fructose** , are the substrate used by yeasts to produce ethanol during alcoholic fermentation. Their determination therefore allows us to estimate the potential alcohol content of the must and precisely monitor the evolution of fermentation.

With **CDR WineLab®,** the analysis of **fermentable sugars** in wine and must is correlated with the **OIV-MA-AS311-02** reference method and has been optimized to offer rapid results directly in the cellar. The system allows us to measure the total **glucose and fructose** content and, if necessary, also **sucrose**, providing useful operational data for managing harvest and winemaking.

In the pre-harvest phase, monitoring sugar levels helps assess the progress of ripening and define the harvest window most consistent with the winemaking objective. However, sugar accumulation must always be interpreted in conjunction with **total acidity**, **pH**, **L-malic acid**, phenolic maturity, and agronomic observations, since a high sugar content does not necessarily correspond to a complete balance of the berry.

Total acidity and pH

Total acidity and pH are two closely related, but not overlapping, parameters.

Total acidity measures the total acids present in the must, including tartaric acid, malic acid, and other organic acids. **pH**, on the other hand, expresses the active acidity and provides essential information on the microbiological stability and chemical reactivity of the must. A properly controlled pH helps limit the growth of unwanted microorganisms and promotes better fermentation management. Conversely, high pH values can increase the must's vulnerability to oxidation and microbiological alterations.

L-malic acid

L-malic acid is a particularly useful indicator for evaluating the evolution of grape ripeness. Its concentration tends to decrease during ripening, especially at high temperatures, as the plant can use it in its respiratory processes. **Monitoring malic acid** is important for two reasons. First, it allows us to assess the progressive loss of acidic freshness. Second, it helps predict the impact of malolactic fermentation, which converts malic acid into lactic acid, altering the wine's perception of smoothness, balance, and structure.

3. The relationship between sugars and acidity in a more variable climate

One of the most delicate aspects of contemporary viticulture is the possible misalignment between technological, phenolic, and aromatic maturity. Under conditions of heat or water stress, sugar accumulation can accelerate, while phenolic and aromatic ripening can take longer. This can create a complex situation for the producer: harvest early to preserve acidity and freshness, or wait for more complete phenolic ripening, with the risk of obtaining musts richer in sugars and less balanced in terms of acidity. Analytical monitoring helps interpret this evolution. The combined assessment of **sugars**, **total acidity**, **pH,** and **malic acid** allows for a more precise identification of the moment when the grapes express the best balance between potential alcohol content, freshness, stability, and

the expected sensory profile. In this context, the experience of the viticulturist or winemaker, but it does provide concrete decision-making support, especially when climatic conditions make vine behavior less predictable.

Scenario	Risk	Useful analysis
Hot and dry year	High sugars, decreasing acidity, low malic acid	Sugars, pH, total acidity, L-malic acid, YAN
Pre- harvest rains	Dilution and sanitary risk	Sugars, pH, gluconic acid
Aromatic grapes	Loss of freshness or aromas if you wait too long	Sugars, acidity, L-malic acid, YAN
Grapes intended for structured reds	Phenolic waiting with high alcohol risk	Sugars, pH, acidity, polyphenols if available

These scenarios demonstrate how the value of pre-harvest analysis depends not on a single isolated parameter, but on the combined reading of multiple indicators. Some examples help illustrate how rapidly available data can guide different decisions in the vineyard and in the winery.

Practical examples of combined parameter reading

Hot year:

A parcel shows rapidly increasing sugar levels, rising pH, and a sharp decline in L-malic acid. In this case, rapid analytical data can help decide whether to harvest early to preserve freshness and balance, or allocate those grapes for a different winemaking process.

Rainfall before harvest:

After a rainy event, checking sugar and acidity alone may not be enough. Measuring gluconic acid helps identify batches with a higher health risk, which should be separated and carefully managed upon arrival at the winery.

4. Beyond sugars and acidity: why YAN and gluconic acid change harvest decisions

In addition to traditional parameters of technological maturity, some analyses allow us to evaluate more specific aspects related to fermentation and the health of the grapes. Among these, monitoring **yeast assimilable nitrogen** and **gluconic acid** can provide important information before the grapes enter the cellar.

Yeast Assimilable Nitrogen, YAN

YAN, or readily assimilable nitrogen, represents the fraction of nitrogen available for yeast metabolism during alcoholic fermentation. An insufficient concentration can increase the risk of slow, difficult, or incomplete fermentations. Nitrogen availability is influenced by several factors, including variety, soil, agronomic practices, and climate. In years characterized by water stress or nutrient imbalances in the vine, **YAN assessment** can become particularly important.

Specific analytical data on assimilable nitrogen allows for more targeted planning of nutritional supplements, avoiding generic interventions and improving the management of fermentation kinetics.

Gluconic acid

Gluconic acid is commonly used as an indicator of grape health and may be associated with the presence or activity of *Botrytis cinerea*.

Its determination is useful because it allows us to evaluate the potential impact of the harvested material on subsequent winemaking. Grapes with high levels of gluconic acid may present greater oxidative and microbiological problems, requiring more careful management in the cellar.

Furthermore, the presence of **gluconic acid** can affect sulfur dioxide management, as some compounds derived from spoiled grapes can increase the amount of combined SO_2, reducing the free fraction available for wine protection.

5. CDR WineLab® for analytical control in the pre-harvest phase

During the harvest, the challenge isn't just knowing the data, but obtaining it when it can still influence a decision: separating two batches, harvesting a plot early, correcting yeast nutrition, or managing grapes with health risks.

In situations like these, the advantage is not only to perform the analysis internally, but to obtain the data at a time when it can still guide an operational decision.

CDR WineLab® system allows chemical analyses to be performed directly in the winery or in a company laboratory, reducing dependence on external laboratory response times and allowing producers to quickly obtain analytical results useful for managing harvesting and winemaking. The system uses ready-to-use reagents and methods that can be applied to appropriately prepared wine or must samples, for example by filtration or centrifugation when necessary.

The rapidity of the analyses allows for comparing samples from different plots, varieties, or harvest times, selecting batches, monitoring musts, and promptly intervening in the event of fermentation problems. This way, the analytical data isn't added after decisions have already been made, but is incorporated into the daily flow of the harvest.

The following table summarizes the main parameters and the decisions they can support:

Parameter	What does it indicate?	Decision that can support
Sugars	Potential alcohol	Bring harvest forward or delay it
Acidity total	Freshness and structure acidic	Evaluate balance and corrections
pH	Stability microbiological and chemical	SO_2 management and microbiological risk
L- malic acid	Evolution of maturation and freshness	Foresee impact from the malolactic
YAN	Nutrition of the yeasts	Plan targeted nutrient additions
Acid gluconic	Health status of the grapes	Separate batches, manage oxidative risk

No single parameter fully describes the condition of the grapes. The value of analytical control arises from a combined reading: elevated sugars with high pH may indicate a narrower harvest window; declining acidity and low malic acid suggest a loss of freshness; significant gluconic acid requires greater attention in batch separation and management during the early stages of the cellar.

6. Comparison of analytical approaches

Rapid analyses in the winery and external laboratories meet different needs. Reference methods remain essential for official verifications, disputes, and certifications; a rapid system like CDR WineLab® is particularly useful when frequent checks and early decisions are needed during the harvest. It allows analytical data to be integrated into the winery's daily decision-making process, especially on days when harvesting progresses rapidly and grape conditions can vary from vineyard to vineyard.

Criterion	Traditional methods/ External laboratories	CDR WineLab®
Data availability	Times related to sending samples and reporting	Results directly in the cellar
Management operational	Requires planning or specialized personnel	Simplified procedures with ready-to-use reagents
Use during the harvest	Less immediate for close decisions	Suitable for frequent checks on multiple samples
Productivity	Often sequential or external analyses	Possibility of multiple tests in parallel
Decisions supported	Official check, certifications, insights	Harvesting, batch separation, yeast nutrition, must monitoring

7. The value of analytical autonomy

Analytical autonomy represents an important technical advantage for wineries wishing to manage the harvest with greater precision.
Having rapid data on **sugars**, **acidity**, **pH**, **malic acid**, **YAN** and **gluconic acid** allows you to make more informed decisions on harvest timing, grape destination and management of the early stages of winemaking.
In an increasingly variable climate, analytical control does not replace the winemaker's sensitivity or the experience gained in the vineyard. On the contrary, it strengthens them, providing objective information that helps preserve varietal identity, wine balance, and the quality of the final product. Integrating pre-harvest analyses into the decision-making process means transforming chemical data into a practical management tool, capable of supporting timely decisions consistent with the company's winemaking objectives.

8. Conclusions

During the harvest, the speed of data can make the difference between a decision based on a partial indication and a choice based on a more complete overview of the grape's condition. **Sugars**, **acidity**, **pH**, **L-malic acid**, **YAN**, and **gluconic acid** should not be considered as isolated values, but as complementary indicators to be read together. In this context, rapid analysis tools like **CDR WineLab®** allow analytical control to be brought closer to the moment of decision-making, supporting more timely, informed, and targeted management of the harvest.