



TECHNIQUES AND CONTROLS FOR ALCOHOLIC FERMENTATION

When the grape harvest starts, the wine cellars fill with grapes to be processed, and fermentations start. As all winemakers know, there is nothing more important than a complete fermentation during the season. The alcoholic fermentation (AF) process is crucial not only for ethanol production but also for the organoleptic parameters and quality of the final product.

In this factsheet, the main techniques used for AF in winemaking and the main parameters to be analyzed before AF are explained.

Techniques for Alcoholic Fermentation

The main techniques of alcoholic fermentation of must (grape juice) are listed as follows:

- *Inoculation with commercial active dry yeasts (ADY)* – It's possible to choose among different ADYs depending on the variety of the grape and style of the wine. Different strains of *Saccharomyces cerevisiae* are available in the market. They allow winemakers to decrease the risk of having a stuck

fermentation and to achieve the predetermined wine style with desired organoleptic characteristics. On the other hand, some winemakers and researchers believe that commercial ADYs create "uniformity" in wine characteristics.

To overcome this uniformity, recent studies made a possible selection of *non-Saccharomyces* yeast species and strains with various desirable traits for enology that are different from conventional *Saccharomyces cerevisiae*. Currently, *non-Saccharomyces* yeasts are commercially available in the market in ADY form for winemakers to choose from.

- *Spontaneous fermentation* – In this method, the yeasts which are already present on the grape skin as well as in the winery environment carry out fermentation. This allows winemakers to create unique wine characteristics. However, these fermentations continue to be a "risk" to the winemakers since the completion of fermentation and regularity in wine quality are not guaranteed.

As a protection method, some winemakers may choose to start the fermentation with native yeasts and inoculate with an ADY after a certain alcohol level is reached.

- *Pied de cuve* – This is the traditional method of preparing a winery-made fermentation starter from grapes. The method involves collecting some grapes close to harvest date, crushing them, and fermenting

the fresh must. This small volume of preparation, which is rich in different yeast strains coming from the vineyard, is used to inoculate subsequent batches of harvested grapes. It's a good idea to prepare different batches and choose the pied de cuve with the best fermentation activity and aromatic profile. This might be time-consuming during the busy harvest season; however, it decreases the lag time of the fermentation take-off and the risk of spontaneous fermentation.

This method can also be used for malolactic fermentation.

- **Co-inoculation of yeast & bacteria** – If **malolactic fermentation (MLF)** is desired to be performed after alcoholic fermentation, it's possible to have a spontaneous MLF or inoculate with commercial lactic acid bacteria (LAB). Although generally done sequentially after alcoholic fermentation is completed, it can be done as a co-inoculation with yeast during alcoholic fermentation. This decreases the time lost between alcoholic and malolactic fermentation, and the wine is prepared earlier than traditional sequential fermentations. In addition, studies showed organoleptic differences between these two approaches.

If this method is used, it's necessary to choose a LAB strain suitable for co-inoculation with yeast.

Controls Before Alcoholic Fermentation

A complete analysis of the must (grape juice) chemical composition is essential for the fermentation process. Regardless of the method being employed, the following controls are vital before the AF process:

- **Brix and reducing sugars** – These two parameters indicate the potential alcohol. In addition, it indicates the final ethanol concentration of the wine, but it may vary depending on the fermentation conditions.
- **pH** – pH is determined by the sum of acids and cations in the must. It's important to check this parameter before fermentation since the activity of the yeasts and bacteria will depend on the pH. Moderate pH of the must is 3 to 3.5. The lower pH values may hinder the completion of fermentation. In extreme cases, it's recommended to make **acidity adjustments** before fermentation. On the other hand, higher pH values render the microbiological stability of the wine difficult to achieve in further winemaking processes and after bottling.

- **Yeast Assimilable Nitrogen** – The nitrogen which can be used by the yeasts for the fermentation process. Checking this value before the beginning of fermentation allows better fermentation management. Keep in mind that the nitrogen requirement of each yeast strain is different and varies depending on various fermentation parameters, including the amount of sugar that is expected to be consumed by the yeast.
- **Acidity parameters** – The total or titratable acidity of must considers all types of acids present, including organic and inorganic. The main organic acids in must are tartaric and malic acid. Their levels in the must, and consequently in wine, affect the organoleptic characteristics, as well as tartaric and microbiological stability.

These chemical analyses are complemented by organoleptic characteristics and other factors to be considered while deciding the style of the wine to be produced. Other parameters can complement these principal values depending on the type of wine that will be produced: In the case of red winemaking, extractable anthocyanins and tannins, while of the white winemaking, turbidity of the must after the settling process are useful parameters to know before AF. In unhealthy grapes, gluconic acid analysis is useful to be completed to decide the next steps and manage the fermentation process.

More questions?

Contact Neslihan Ivit,
Winemaking & Innovation Specialist
nivit@perennia.ca
902-300-3652