

Monitoring Fermentable Sugars in Ripening Grapes

Introduction

Many factors are taken into consideration when concluding whether or not a grape is ready to pick for winemaking purposes; the grape variety, the sugar content, acidity level and even the type of wine that the grape is destined to make. Traditionally, the sweetness and acidity of wine grapes would have been judged simply by taste and appearance, but over the years advances in laboratory testing and analytical equipment have allowed the traditional winemaker to take a more scientific approach to producing excellent wine.

Professor A. F. W. Brix was a German chemist in the 19th Century who first discovered that the density of plant juices can be measured by floating a hydrometer in them and this theory led to the hand-held BRIX refractometer now commonly used to test the fermentable sugar levels in grape juice. The pH of the grape juice can be easily measured using a simple pH meter and of similar interest, the total acidity of grape juice can be determined by titration, often with a base such as sodium hydroxide and an indicator such as phenolphthalein. These parameters and many more including free/total SO₂, yeast assimilable nitrogen (YAN) and L-lactic/L-malic acid can all be measured using well documented laboratory techniques at accredited reference laboratories such as Campden BRI.

The WineLab is a portable and easy to use analyser based on LED technology and dedicated chemistry test kits to provide full analysis of wine and grape juice. It was developed by CDR in Italy and has been widely used in the Italian wine industry for many years. The WineLab is supplied exclusively in the UK and Ireland by QCL, a company specialising in quality control solutions for the food and beverage industry. The parameters available on the WineLab are shown in Table 1.

ABV	Acetic Acid
L-Lactic Acid	L-Malic Acid
pH	Free and Total SO ₂
Glycerol	Acetaldehyde
Fermentable Sugars	Glucose and Fructose
Anthocyanins	Total Polyphenols Index
Polyphenols	Intensity and Tonality
Gluconic Acid	Malolactic Fermentation
Catechins	Copper
Yeast Assimilable Nitrogen (YAN)	

Table 1: WineLab Parameters

Project

Dr Melvyn Walters who is a retired consultant rheumatologist and his wife Brenda have recently undertaken the task of planting a vineyard consisting of 11,600 vines of the champagne varieties (Pinot Noir, Chardonnay and Pinot Meunier) and Bacchus, as well as building an entire winery from scratch.

From the outset, Dr Walters decided that he wanted to look at the efficiency of the winemaking process and find a way to simplify traditional laboratory analytical methods that require a wide range of laboratory apparatus.

Grape Harvesting

The WineLab was used by Dr Walters to measure fermentable sugars and total acidity during the grape ripening process, to ascertain the best time to harvest the grapes.



Figure 1: The Vineyard

The fermentable sugars were measured alongside the BRIX (by digital refractometry) of each varietal, which as can be seen in figures 3, 4, and 5 showed a general correlation with sugars, but not at the lower levels. In the case of the Pinot Noir the BRIX underestimated the sugar levels by around 10 g/L, which is a concern if the wine producer is planning on chaptalization of the grape juice. In particular, following fermentation, the BRIX levels appeared to imply much higher residual sugars than measured more accurately by the WineLab.

The small microliter quantities of juice required for the WineLab tests obviated the use of a hydrometer, reducing juice loss.

Winemaking

In order to produce good quality wine from the grape juice, it is not just the acidity and sugar content that needs to be monitored, but also the nitrogen content to support healthy yeast growth.



Figure 2: The Winery

Yeast assimilable nitrogen (YAN) is measured in two forms; organic nitrogen (primary amino nitrogen) and inorganic nitrogen (ammonium salts). By understanding the quantities of

both the organic and inorganic nitrogen, appropriate quantities of nitrogen supplements can be added to the grape juice prior to fermentation to ensure that a healthy yeast culture is formed.

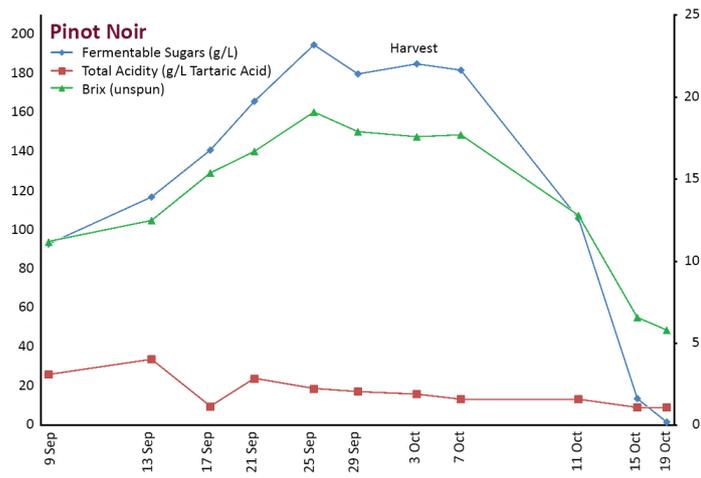


Figure 3: Pinot Noir Fermentable Sugars

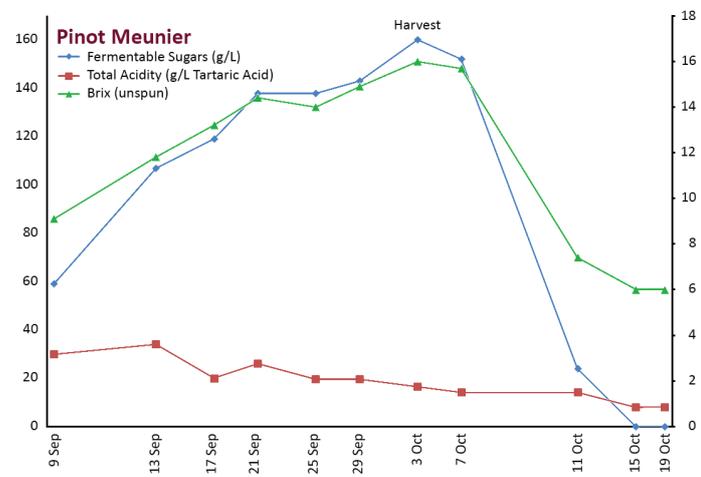


Figure 4: Pinot Meunier Fermentable Sugars

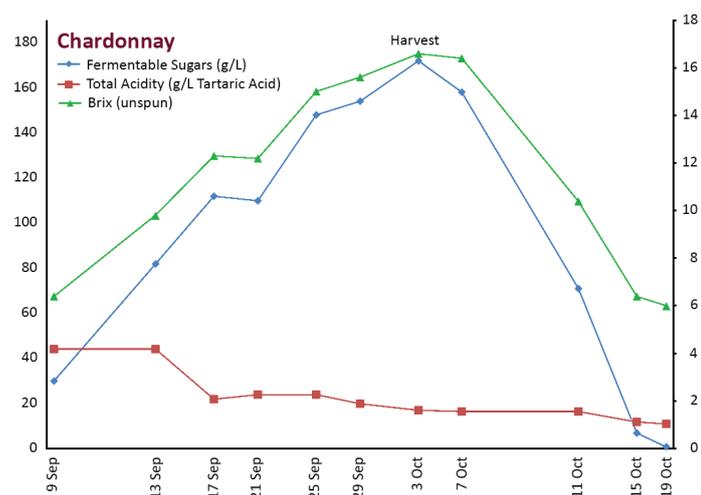


Figure 5: Chardonnay Fermentable Sugars

Yeast Assimable Nitrogen

The YAN of the grape juice was measured using the WineLab and showed that each varietal had a total YAN value between 140 – 250 mg/L, with each test taking roughly 5 to 6 minutes to perform. This enabled the lower nitrogen levels to be rapidly

corrected by the addition of nitrogen supplements to the juice prior to yeast addition, giving a healthy and consistent fermentation.

Interestingly, Dr Walters also had a number of 12 month old Bacchus vines, which were producing small bunches of grapes, however when the YAN of this varietal was measured it came out lower than 40 mg/L, demonstrating the need for vine maturity.

SO₂

In order to prevent wine spoilage, SO₂ was also added to the grape juice in the form of potassium metabisulfite and the resulting free/total SO₂ was measured on the WineLab to ensure that the correct amount was added. This will be easily monitored using the WineLab and maintained throughout the ageing process to ensure the microbial stability of the wine.

ABV

At the end of fermentation, the ABV of each base wine was tested on the WineLab to ensure that chaptalization had been calculated correctly and also to further prove the accuracy of the fermentable sugar measurement of the grape juice before fermentation.



Figure 6: The Winery Lab

Summary

Dr Walters and Brenda have spent the last few years putting a lot of effort into planting, pruning and caring for a vineyard of champagne varietals and Bacchus, alongside building a winery.

Dr Walters said:

“The WineLab was employed initially to monitor the maturing grapes on the young vines to study fermentable sugars and total acidity to ascertain the prime moment for our first harvest. During this time, we found that the WineLab was useful for testing an extensive range of parameters in-house, simplifying the winemaking process.”

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