Optimizing Secondary Fermentation in South African Cap Classique: A Comparative Study of 2B Fermentation Solutions

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Abstract:

In the production of Cap Classique, particularly during secondary fermentation, there lies an exciting opportunity for differentiation through yeast and nutritional options that empower winemakers to showcase the unique expression of their terroir. Traditionally, the focus has been on ensuring the reliability of secondary fermentation, sometimes at the expense of enhancing the true character of the cultivar. However, with the right approach, winemakers can achieve both consistency and vibrant terroir expression, elevating the quality and individuality of their Cap Classique wines.

Introduction:

In addition to its applications in still wine production, 2B Fermcontrol products have proven effective in both the primary and secondary fermentations of South African Cap Classique. This report specifically examines the application of these products, with a focus on the performance of Vitiferm BIO Sauvage yeast during the "prise de mousse" stage, particularly under challenging conditions involving low-temperature fermentation. Furthermore, the study evaluates collar stability by comparing wines vinified using a control yeast to those produced with Vitiferm BIO Sauvage. The trial spanned a period of three years to simulate the typical maximum maturation time for Cap Classique wines, providing insights into longer bottle maturation effects. This extensive trial also facilitated the development of a novel "pied de cuvée" protocol, tailored exclusively to the requirements of South African Cap Classique production.

Materials and Methods:

Although numerous trials were conducted over three vintage seasons, the results published here are specific to the intended outcomes of the experiments, namely: (1) Successful "prise de mousse" under low-temperature fermentation conditions. (2) the assessment of collar stability during extended bottle maturation

In each trial, only Chardonnay base wine intended for Blanc de Blancs production was used. For the collar stability trials (objective 2), the wine followed standard Cap Classique grape and wine production practices, utilizing 2B's minimalistic winemaking approach from the 2022 vintage. This approach did not involve any additional additives apart from the prescribed yeast, yeast nutrients, and yeast cell wall derivatives. No mannoproteins, wine-specific enzymes, or any products influencing colloidal stability were used throughout the wine production process, ensuring that no external factors contributed to collar stability.

With respect to trial (1), the samples were prepared in the same manner as in trial (2), with the key difference being that they originated from the 2024 vintage. The objective was to stress-test the viability and efficacy of Vitiferm BIO Sauvage yeast during August, the coldest month in the Western Cape of South Africa. At lower fermentation temperatures, yeast cells typically exhibit a slower rate of sugar conversion to alcohol, reduced nutrient uptake leading to potential nutrient deficiencies, and increased rigidity of cell membranes, which impairs nutrient transport and overall cellular function, as well as heightened osmotic stress.

All trials conducted over the three-year period contributed to the objective that Vitiferm BIO yeasts facilitate successful secondary fermentation in South African Cap Classique sparkling wines.

All the wines were stored at a constant store temperature of 15°C, except during the Autumn to Winter months from May to August, whereby cooling is turned off and the ambient temperature allowed to prevail. Typically, these are the months where store temperatures lower below 10°C.

No malo - lactic fermentation was encouraged in any of the trial wines over the 3 years, and this remains true in the final disgorged samples.

Data Collection and Analysis:

Data collection was carried out through a series of in-house tastings and comprehensive evaluations of the wines over the three-year period. Each wine was assessed at regular intervals to monitor its sensory development and maturation, with a specific focus on tracking key parameters such as sugar metabolization and pressure evolution.

In terms of analytical methodology, duplicate samples were tested weekly on the same day to ensure consistency and reliability of the data. This consistent schedule allowed for precise tracking of the fermentation process and assessment of key performance indicators. Sugar metabolization was monitored closely over an 8 to 10-week period to capture the rate of sugar conversion to alcohol ® by the yeast. Concurrently, the resulting pressure (measured in bars) was analyzed as an indicator of dissolved carbon dioxide (CO_2) formation, providing insight into the progression and efficiency of the secondary fermentation (prise de mousse).

Measurements were taken under controlled laboratory conditions to ensure accuracy, with the pressure assessed using a manometer, and sugar levels analyzed through enzymatic assays or refractometric techniques to confirm the residual sugar content. These analyses were cross-validated between duplicate samples to minimize any variations or errors. This methodical approach allowed for a detailed understanding of the kinetics of fermentation and the influence of Vitiferm BIO Sauvage yeast on the secondary fermentation dynamics of Cap Classique wines under different conditions.

Results:

During the three-year trial, in-house tastings were conducted at three-month intervals. The wines were tasted blind by a panel and evaluated for their flavor profiles and development. A Chardonnay aroma and palate wheel was used as a reference to identify flavor characteristics, which were then recorded on tasting sheets. Dominant flavors were assigned a score, and these scores were compiled at the conclusion of each tasting session. The resulting data was used to construct respective spider graphs for Vitiferm BIO Esprit and Vitiferm BIO Sauvage, reflecting the evolution of each wine's flavor profile over time.

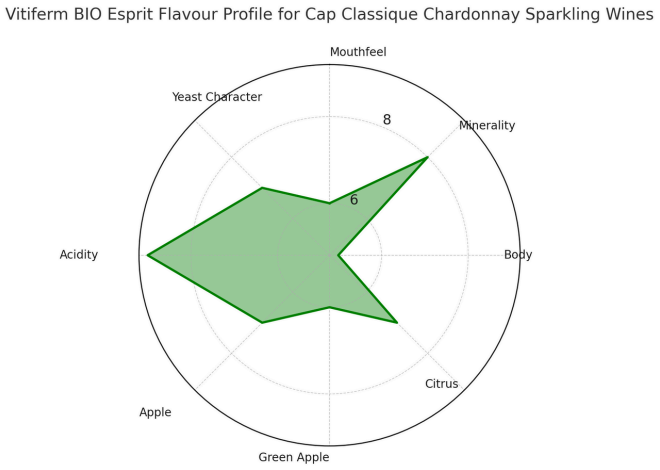

Figure 1: Vitiferm BIO Esprit spider graph of flavour profile development in Chardonnay Cap Classique

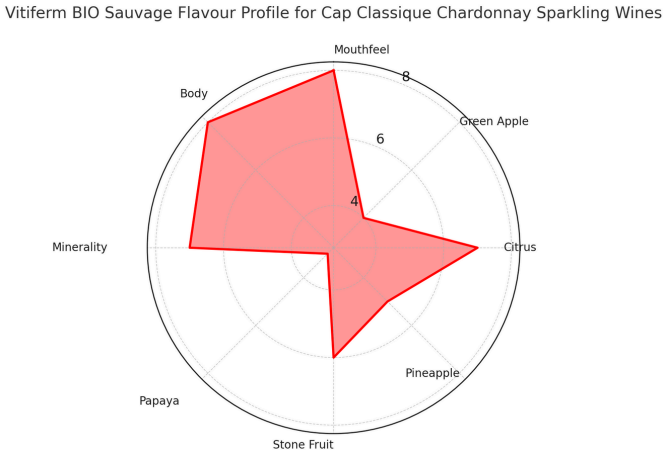

Figure 2: Vitiferm BIO Sauvage spider graph of flavour profile development in Chardonnay Cap Classique

Trial 1 -

<u>Successful "prise de mousse" under low-temperature fermentation conditions.</u>

As stated, secondary fermentation trials were established and performed during the month of August in Franschhoek, Western Cape, South Africa to stress test Vitiferm BIO Sauvage to low temperature fermentation conditions as experienced during Winter. The results of these trials can be viewed in Figure 3, a detailed graph that displays the daily low and daily high temperatures for this region over the period 22nd July 2024 up until the 10th October 2024.

It is important to note that the daily low temperatures during this period averaged around 8°C, with nighttime temperatures occasionally dropping to an average low of 6°C. Internal storeroom temperatures fell to 10°C during the evenings, subjecting the yeast and its performance to stress. Although these temperature ranges were not optimal for typical yeast metabolism, the fermentation kinetics displayed a standard linear progression, as shown in the graph. The only deviation occurred between August 11th and 22nd, when both daily low and high temperatures were at their lowest. By October 5th, 2024, the final reading indicated a residual sugar (RS) of 2.34 g/L and a resulting pressure of 7.3 bar, marking a complete and successful fermentation. The graph detailing this data can be found on page 4, Figure 4.

To eliminate potential bias, trials were conducted using a competitor control yeast alongside Vitiferm BIO Sauvage. This comparative approach ensured that any observed differences in fermentation performance, flavor development, or final product quality could be accurately attributed to the yeast strains themselves, rather than external variables or subjective preferences. As per Figure 5 below, the Vitiferm BIO Sauvage yeast is labelled as "original" while the control yeast was labelled as "competitor."

There were no obvious visible performance deficiencies observed in the fermentation kinetics between the two yeasts, except it was noted that sugar metabolism in the Vitiferm BIO Sauvage yeast was faster than the "competitor" yeast with a mush faster pressure accumulation. It was also recorded that the Vitiferm BIO Sauvage completed fermentation and effectively classified as dry at least 7 days earlier than the "competitor" yeast.

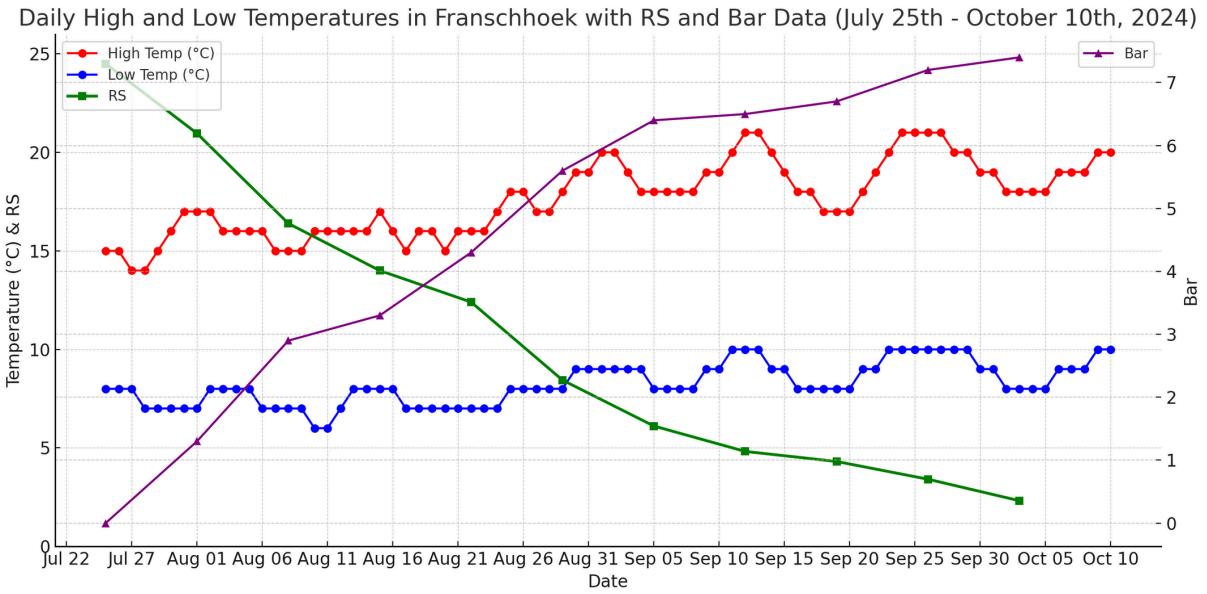

Figure 4: Secondary fermentation in Chardonnay Cap Classique expressed over daily low and high temperatures in Franschhoek, South Africa during July - October

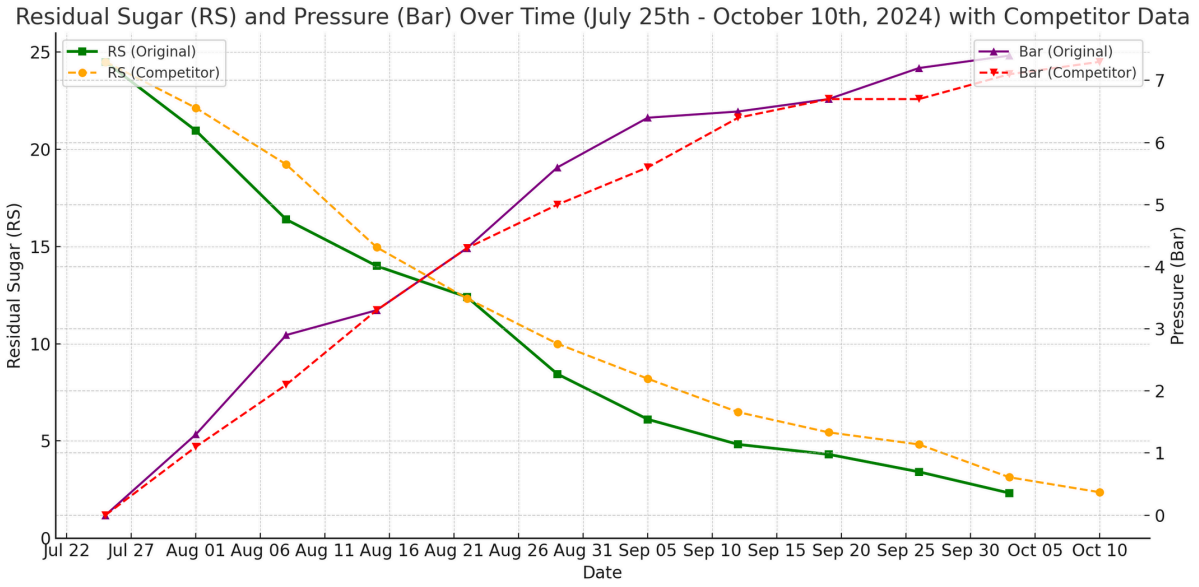

Figure 5: Secondary fermentation performance between Vitiferm BIO Sauvage (original) and a control yeast (competitor)

Trial 2 -

The assessment of collar stability during extended bottle maturation

Vitiferm BIO yeasts are characterized by their high sterol content, which plays a crucial role in supporting yeast viability and fermentation performance. Sterols are essential components of yeast cell membranes, contributing to membrane fluidity, stability, and the efficient transport of nutrients and metabolites. Unlike conventionally produced yeasts, which may have lower sterol availability due to standard production methods, Vitiferm BIO yeasts are produced organically which encourage the natural accumulation of sterols within the cell membrane. This enhanced sterol content allows the yeast to better withstand stressful conditions such as high alcohol levels, temperature fluctuations, and nutrient limitations, which are often encountered during the fermentation process of sparkling wines. Consequently, Vitiferm BIO yeasts maintain superior cellular integrity, metabolic activity, and fermentation kinetics, promoting a more consistent and successful fermentation compared to traditional yeast strains.

While sterols do not directly form the foam or collar, they are crucial for maintaining yeast health, membrane integrity, and cell wall strength, which indirectly influences the formation and stability of the collar. By supporting yeast viability during fermentation, sterols contribute to efficient CO_2 production, controlled bubble formation, and the development of a stable and lasting mousse in sparkling wines.

Surface-Active Compounds: Sterols are surface-active compounds that interact with proteins and polysaccharides from the yeast cell wall to stabilize the foam. They help lower the surface tension of the liquid and enhance the formation of a fine and persistent mousse.

Proteins and Polysaccharides Synergy: During autolysis, the proteins and polysaccharides released from the yeast help form stable foam and bubbles. Sterols enhance the action of these molecules by contributing to the flexibility and integrity of the bubble membrane, leading to a better-structured collar.

Controlled CO_2 Release: When yeast cells are healthy and resistant due to adequate sterol content, the CO_2 release is more uniform and gradual, contributing to the formation of finer bubbles and a more persistent collar.

Figure 6: Collar stability 7 minutes post pour

Figure 6 presents the results of a standard Cap Classique production protocol using conventional yeast (left-hand sample) compared to secondary fermentation with the 2B Fermcontrol protocol (right-hand sample) in a Blanc de Blancs 2022. The wine was matured for 24 months in the bottle and on cork, followed by 3 months post-disgorgement.

The samples were poured after being chilled in a freezer for 1 hour, then opened and left to stand to test the persistence and stability of the collar. Figure 6 shows an image taken 7 minutes after pouring, clearly indicating that the wine fermented with the 2B Fermcontrol protocol demonstrates significantly better performance.

Figure 7: Collar stability 14 minutes post pour

Figure 7 above shows the same wine samples in the same order, but the image was taken 14 minutes after pouring. Once again, the sample on the right, which was fermented using the 2B Fermcontrol products and protocol, demonstrates improved collar performance and stability.

Figure 8 displays the same wine sample 21 minutes after pouring. While the collar has visibly diminished, it remains more prominent than the control sample, where any sign of collar formation has completely disappeared.

Figure 8: Collar stability 21 minutes post pour

Conclusion:

This study demonstrates the significant advantages of using Vitiferm BIO Sauvage yeast in South African Cap Classique production. Over three years, the yeast outperformed the control in fermentation kinetics, completing secondary fermentation faster while enhancing flavor complexity and collar stability.

The 2B Fermcontrol protocol improved mousse persistence, reinforcing its value in producing high-quality sparkling wines. By leveraging this approach, winemakers can achieve both consistency and terroir-driven expression with minimal intervention. These results highlight a more innovative and reliable method for secondary fermentation, ensuring Cap Classique wines with enhanced aging potential and superior sensory attributes. Continued research will further refine best practices, empowering producers to craft exceptional wines that stand out in the global market.