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PRISE DE MOUSSE WITH A SHORTENED 1-STEP YEAST STARTER PREPARATION

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INTRODUCTION

The Prise de mousse (PDM) is the final step that allows a base wine to become sparkling or effervescent. It requires the preparation of a yeast starter called Pied De Cuve (PDC) able to ferment sugars into ethanol and carbon dioxide, source of the effervescence. The quality of the PDC is therefore essential to a successful PDM. Traditionally the PDC preparation takes 3 to 5 days but our work shows that it can be reduced to 36hrs and done in a single step process. This study was performed with a specific yeast strain selected by Fermentis for sparkling application and aims to optimize the existing protocols of PDC preparation by adjusting the dosage of yeast, sugar and assimilable nitrogen.

MATERIALS & METHODS

This study was performed with the yeast strain SafŒno™ SPK 05 selected and launched in 2023 by Fermentis for both primary and secondary fermentation of sparkling wines. This strain's main characteristics were identified as the following:

- Ability to ferment sparkling must: low pH (>2.8), high acidity;
- Ability to perform PDM even at low temperature: 12-20°C / 53-68°F (ex in figure 1);
- Produces white wines with clean and fresh profiles;
- Resistant to difficult conditions and low nitrogen requirement.

Alcohol (%Vol)	10.79
Total acidity (g/L H_2SO_4)	5.7
Titrable acidity (g/L tartaric acid)	8.7
pH	3.03
Volatile acidity (g/L H_2SO_4)	0.15
Volatile acidity (g/L acetic acid)	0.18
Glucose + fructose (g/L)	0.3
Total SO_2 (mg/L)	34
Free SO_2 (mg/L)	6
Malic acid (g/L)	4.3
Tartaric acid (g/L)	3.8
Ammoniacal nitrogen (mg/L)	3
Alpha amino nitrogen (mg/L)	31

Table 1: Wine analysis after ALF
yeast inoculation rate: 20 g/hL (1.7 lb/1000 gal)
ALF temperature: 18°C (64.4°F)

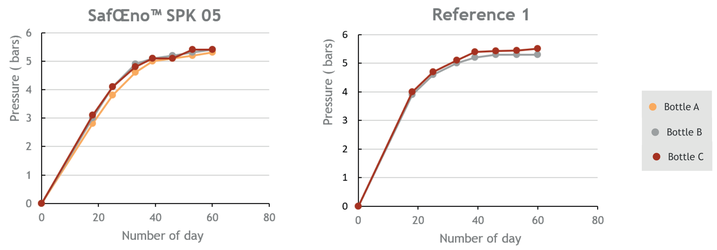
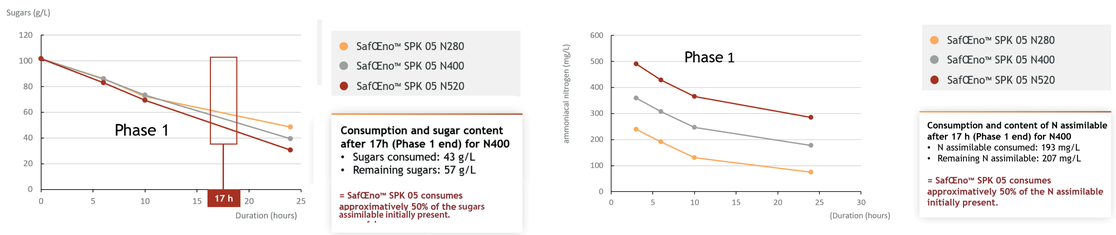


Figure 1: Example of PDM performance at 18°C with SafŒno™ SPK 05 vs a Champagne reference analysis of the base wine Pinot Meunier, Champagne, 2021 with provided analysis.

RESULTS

Consumption of sugar and nitrogen in the phase 1

In order to establish the dosage of sugar and nitrogen needed in the single step protocol, we first looked into the consumption of sugar and nitrogen in the first step of the traditional protocol. The academic 2-step process is providing 400 ppm of YAN in the phase 1. We studied 400 ppm of YAN and +/- 30% to assess the effect on the performance of the first phase (figure 3)



The results show that whatever the dosage of nitrogen in phase 1 (280ppm, 400pm or 520ppm) there is enough nitrogen and sugar for the yeast to grow and reach the density 1015-1025 at 17hrs. However, the more nitrogen, the more sugar consumed, the fastest the first phase. For the classic 400 ppm of YAN protocol the yeast SafŒno™ SPK 05 only consumes 50% of the YAN initially present and less than 50% of the sugar initially present. We therefore decided to assess different lower dosages of nitrogen to find the appropriate amount of DAP for this strain in a 1-step protocol.

Evaluation of the dosages in the 1-step protocol

For the 1-step protocol we keep the same yeast dosage in the starter of 300g/hl and we lower the total amount of sugar provided from 91g/hl to 83g/hl in total (as shown large extra dosage in phase 1). We then test three concentrations on YAN in the 1-step protocol:

- 140 ppm of YAN representing approximately what is provided in total in the 2-step protocol
- 100 ppm YAN
- 60 ppm YAN

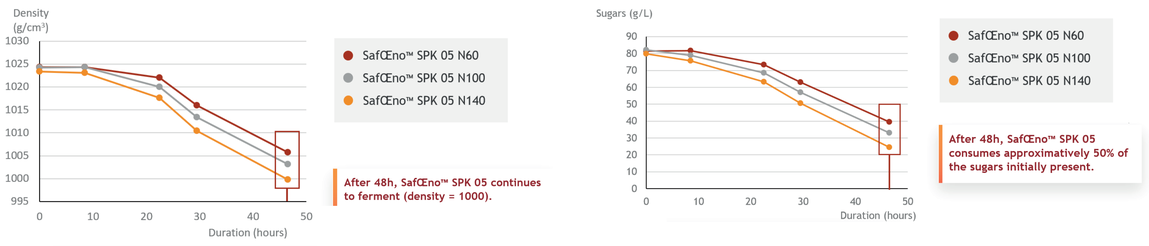


Figure 4a: Effect of 3 YAN concentrations on sugar depletion in the one-step protocol with SafŒno™ SPK 05.

CONCLUSION

This new innovative protocol with SafŒno™ SPK 05 allows to increase the turnover of the Pied de Cuve tanks and reduce the energetic/electric costs associated to the propagation while allowing to maintain the performance of the yeast starter in quality and prise de mousse. It also allows to lower the consumption of DAP and sugar when compared to the typical 2-step protocol.

Experimental design:

The traditional academic PDC preparation protocol and the common average industrial protocol are illustrated in figure 2. This process can take from 3 to 5 days and usually is prepared in 2 steps. The amount of yeast varies from 1.5 (academic) to 10kg (max of range used industrially) of dry yeast to produce a starter of 3-5% vol of a 1000 hl base wine. The first step is the acclimatization phase in which the yeast is slowly growing and getting used to the challenging conditions (acclimatization).

The second phase builds the yeast starter to reach 60 to 80 million cells/mL to be inoculated at 3% of the volume of the base wine (up to 5% in some industrial cases). Based on the high performance of SafOeno SPK 05 in the PDC 2-steps preparation, its performance in PDM, its low nitrogen need and the market interest in reducing operation time and cost, Fermentis decided to test a 1-step PDC protocol (figure 2) by by-passing the acclimatization phase while keeping the same performance indicators of PDC and average quantities of active dry yeast used in wineries.

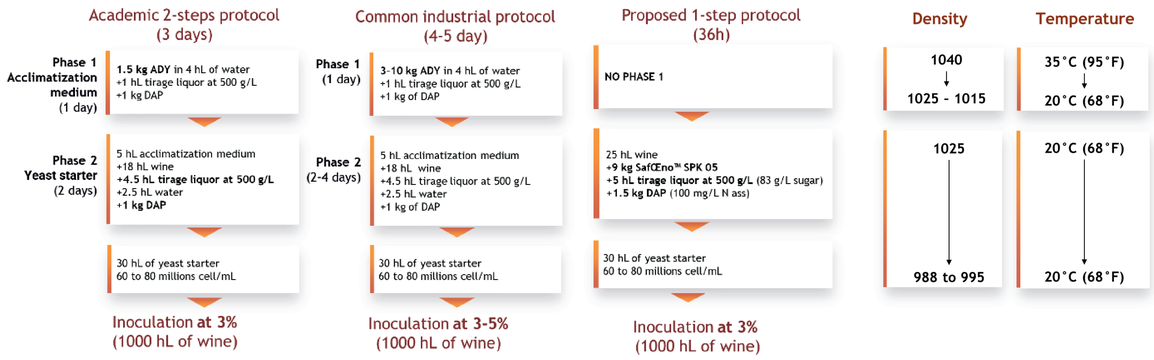


Figure 2: Academic, Common industrial and 1-step proposed protocol for PDC preparation to inoculate 1000hL at 3%. yeast is rehydrated first in all cases.

We assess the effect of the YAN dosage on the performance of the 1-step protocol as shown in figure 4. Whatever the dosage of nitrogen through DAP there is enough sugar to reach the targeted population in 36hrs. However, the 60PPM of YAN shows depletion of nitrogen before the target population is met and the population is lower.

Therefore, we decided to use a dosage of 100 ppm of YAN through DAP for the 1-step protocol corresponding to 1.5kg of DAP for the 30hL of yeast starter. With these results we establish the dosage for yeast, DAP and liqueur de tirage for the 1-step protocol as stated in figure 2.

Consumption of assimilable nitrogen (provided by DAP)

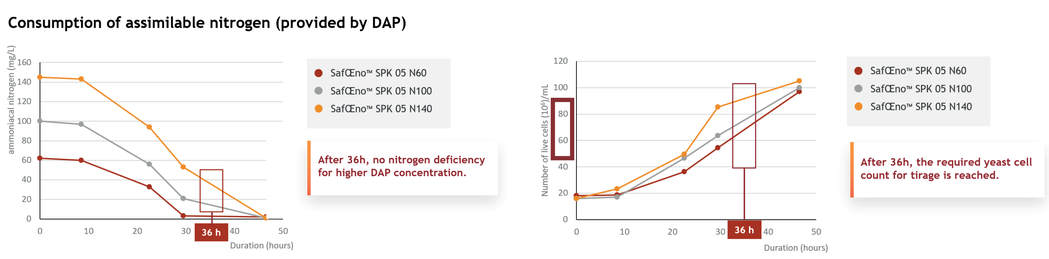


Figure 4b: Effect of 3 YAN concentrations on nitrogen depletion in the one-step protocol with SafŒno™ SPK 05.

Evaluation of the yeast starter and the PDM performance with the 1-step protocol

Eventually the performance of the PDC preparation and of the PDM was assessed and compared on different musts between the 1-step protocol and the academic 2-step protocol. We show in figure 5 and 6 the results for a base wine made from Pinot Meunier from Champagne, France with the University of Reims, France from 2021 (analysis in figure 1).

Figure 5 shows that the 1-step protocol indeed allows to gain time in comparison to the traditional protocols as the yeast population targeted is reached sooner (at 36hrs) and with the correct amount of nitrogen needed for this strain.

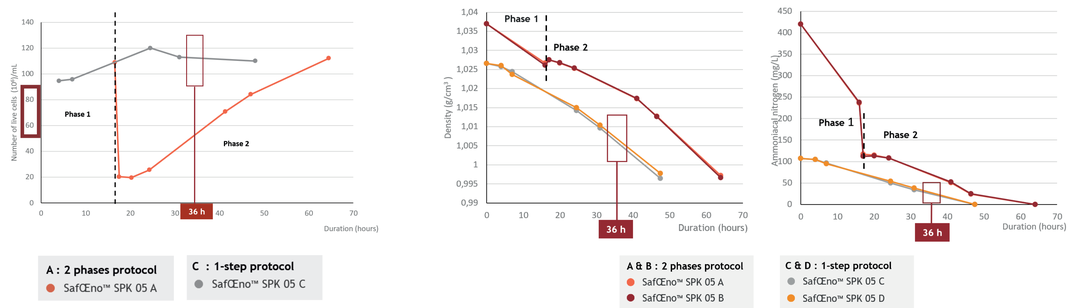


Figure 5: Comparison of the two yeast starter PDC protocols for yeast population, density and nitrogen.

Figure 6 shows that the 1-step protocol yeast starter performed as efficiently on the PDM as the traditional 2-step protocols: ~45 days at 18°C to ~6 bars of pressure. After 12 months the bottles were riddled and disgorged. The tasting of the different sparkling wines made from different PDC preparations protocols showed no impact on the sensorial characteristics of the wines

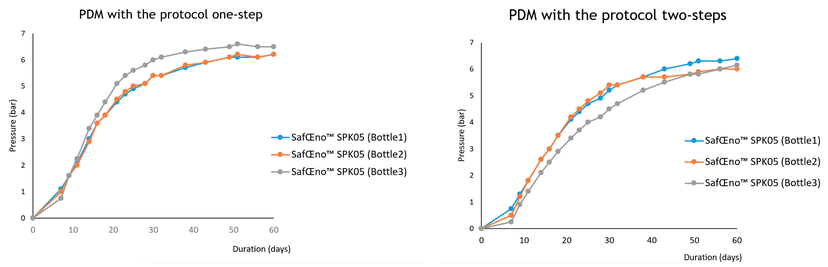


Figure 6: Comparison of the PDM kinetics for both yeast starters PDC protocols by measure of the pressure with amphometers in 3 different bottles over time.

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