# NATIVE *SACCHAROMYCES CEREVISIAE* STRAINS TAILORED FOR ORGANIC VERDICCHIO WINE PRODUCTION

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## Introduction

*Saccharomyces cerevisiae* is recognized as the main yeast responsible to wine fermentation for its biotechnological and physiological properties such as high ethanol tolerance and fermentative power (Pretorius, 2000; Vaughan-Martini and Martini, 2011; Dashko et al., 2014). Actually, winemakers use commercial "domesticated" *S. cerevisiae* as starter strains, selected for their fermentative aptitude. On the other hand, the reduced numbers of widely used *S. cerevisiae* commercial strains led a sensory profile standardization of wines (Vigentini et al., 2014). For these reasons, the researchers focused their attention on the selection of native strains that could be exploited in winemaking to valorize the aromatic notes of wines (Callejon et al., 2010; Orli´c et al., 2010; Capozzi et al., 2015).

In this study, was evaluated the sexual recombination of yeast's spores as strategy to obtain the improvement of a native *S. cerevisiae* strain previously isolated from grapes. Indeed, several studies reported that native *S. cerevisiae* did not show technological characteristics required during in wine fermentation. The goal was to obtain new strains with ability to give a "geographical aromatic imprinting" to wine and low producer of sulphite and sulfur compounds. The level of sulfur compounds represents in wine an important parameter because confer negative aroma while sulfite compounds may inhibit malolactic fermentation, limit the aging of wines and negatively affect human health (Carrete et al., 2002; Komarnisky et al., 2003; Mendes-Ferreira et al., 2009). The new *S. cerevisiae* low $SO_2$ and $H_2S$ producer strains were evaluated under winemaking conditions in two consecutive winemaking years (2016 and 2017) using organic Verdicchio grape juice and compared with *S. cerevisiae* commercial strain low $H_2S$ producer (Lavin ICV OKAY) evaluating the fermentation performance and the analytical profile of the final wines.

## Experimental results

### Main analytical compounds

The results regarding to the main analytical compounds of the wines obtained by the two improved *S. cerevisiae* strains (G4 and I4) are reported in Table 1.

| Trials | Vintage 2016 | | | Vintage 2017 | | |
|---|---|---|---|---|---|---|
| | Ethanol (% *v/v*) | $SO_2$ (mg/L) | Volatile acidity (g/L) | Ethanol (% *v/v*) | $SO_2$ (mg/L) | Volatile acidity (g/L) |
| Lalvin ICV OKAY | 14.2 | 6 | 0.54 | 13.1 | 9.5 | 0.37 |
| *S. cerevisiae* G4 | 14.2 | 13 | 0.53 | 13.3 | 9.0 | 0.40 |
| *S. cerevisiae* I4 | 13.9 | 18 | 0.49 | 13.1 | 11.0 | 0.44 |

*Table 1. Main analytical compounds of resulting wines.*

The results showed that the two improved native *S. cerevisiae* strains exhibited a comparable oenological characters with the commercial starter strain during two consecutive winemaking years.

On the contrary, the $SO_2$ content was higher in vintage 2016 both improved strains than Lalvin ICV OKAY.

This trend was not confirmed during vintage 2017. Indeed, all the strains tested showed the same $SO_2$ production. This difference behavior could be due to a different composition of grape juice used in the trials and a possible minimal contamination with $SO_2$. However, the $SO_2$ content in the final wines were closely to the limit for wines without adding sulfite (10 mg/l).

The low production of sulfide compounds was confirmed also by plate test on Biggy agar to test the $H_2S$ production (Figure 1).

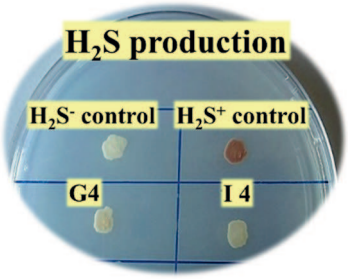


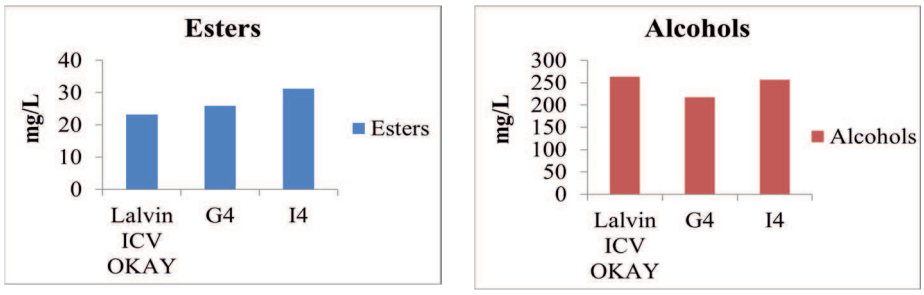

*Figure 1. Screening of Hydrogen sulphide ($H_2S$) production of improved native strains using Biggy agar test plate.*

**The aromatic profile of wine**

Quality perception of wines is a combination of sensory and chemical approaches. The aroma of wine is a combination of volatile compounds originating from grapes (varietal aromas) and products formed during the wine fermentation (Padilla et al., 2016).

Regarding to aromatic profile of wines, during two vintage, esters and higher alcohols were evaluated (Figure 2a). In vintage 2016, I4 produced a higher content of esters compounds while G4 exhibited a comparable amount of esters if compared with *S. cerevisiae* starter strain Lalvin ICV OKAY. Concerning to higher alcohols content, a different trend between the improved strains was observed. While I4 strain exhibited a comparable value, G4 strain showed lower higher alcohols if compared with *S. cerevisiae* starter strain. In the in the following winemaking year (2017), no substantial differences were observed regarding esters content between the strains tested (Figure 2b). Instead, both improved native strains (G4 and I4) exhibited a lower alcohols content than *S. cerevisiae* starter strain. Another positive feature, highlighted by the use of improved native strains, was a different aroma complexity without sensorial defects. Indeed, the sensorial analysis carried out with trained testers (data not shown), highlighted a different aromatic imprinting of the two improved yeast strains (characterized by fruit and floral aroma) in comparison Lalvin ICV OKAY.

Vintage 2016 (a)




Vintage 2017 (b)

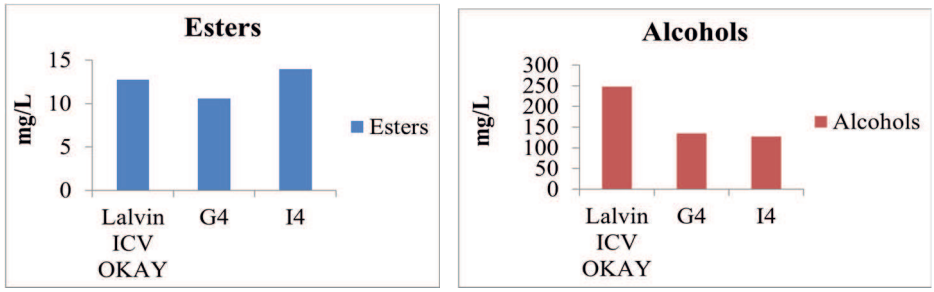



*Figure 2. Esters and higher alcohols in wine during two consecutive vintage 2016 (a) and 2017 (b).*

## Conclusion

The improved native *S. cerevisiae* strains exhibited interesting oenological properties, such as low or absence production of $H_2S$ and $SO_2$ in combination with a comparable production of alcohols and esters but with a peculiar aroma complexity. For these reasons, they could be proposed as new fermentation starter strains with the aim to obtain wines with recognizable aromatic imprinting and low $H_2S$ and $SO_2$ content, characteristics especially required in organic wines or wines without adding sulfite.

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