Yeast/bacteria interaction: practical aspects in Mediterranean and Rhone red wines

Dominique Delteil
Institut Coopératif du Vin, 34 970 Lattes, France

Introduction
This paper presents the main slides shown during the 22 April 2002 Lallemand conference in Biarritz (France). The goal of this presentation is to show some experimental results that call attention to the practical impact of yeast/bacteria interaction. These trials were made in the complex wine matrix. They don’t have the ambition of explaining phenomenon. Their only ambition is to show that yeast/bacteria/wine interaction really has an effect on winemaking and that this interaction can also be identified using routine on-line analysis.

Some definitions used:
- Yeast/bacteria interaction:
  - one bacteria with different practical behaviour in wines fermented with different yeast
  - different bacteria with different behaviour according to the yeast used for fermentation
- MLF <enological lag-phase> = duration of stable malic acid level in wine
- LAB = Lactic acid bacteria

1990: first practical information on yeast/bacteria interaction in Mediterranean and Rhone wines

Comments on Figure 1: The main reason for duration differences is the total SO2 in the wine before inoculation. The <ICV K1 Marquée> wine had 40mg/L, the <ICV D47> wine had 20mg/L.

Comments on Figure 2: The main reason for duration differences is not the total SO2. The two wines had 10mg/L before inoculation. Both wines had very similar total acidity and pH.

With these first results it appears that the yeast/bacteria/wine interaction really has an impact on winemaking and that this interaction can also be identified using routine on-line analysis.

Could a late MLF have an impact on wine style?
Comments on Figure 3: In this trial, no spoilage yeast (Brettanomyces sp.) or spoilage

Fig. 1. MLF duration in days according to the yeast used for juice fermentation. Rosé 1990. Source: Classeur Biotechnologies. ICV in house document.

Fig. 2. MLF duration in days according to the yeast used for juice fermentation. White 1990. Source: Delteil, 2001. The Australian Grapegrower & Winemaker.

bacteria (*Pediococcus* sp. or *Lactobacillus* sp.) grew during the longer lag-phase. Chemical phenomena explain the important change in the wine-style during the longer lag-phase. These preliminary works showed that yeast may have an impact on MLF duration and that MLF oenological lag-phase has an impact on wine-style. Since then, we characterise each new oenological yeast on its MLF duration impact.

**Impact of different yeast on MLF duration, with the same selected LAB**

![Graph showing MLF duration](image)

**Fig. 4.** A and B. Merlot 2000, short maceration, 13.5% vol. A: MLF duration after LAB inoculation. B: Total acidity in the wines before LAB inoculation. Source: ICV R&D Department 2001 Report. ICV in-house document.

Comments on Figure 4: In this trial, there were no SO₂ differences in the wines before LAB inoculation. With a broader range of yeast, practical differences can still be measured on the MLF duration. In this case, the total acidity in the wine before inoculation can explain a part of the differences due to ICV K1 Marquée and ICV D21. But on the other hand, <ICV D47> wine undergoes MLF as rapidly as wines with lower total acidity. Another trial that shows that classical parameters interact with LAB. It also shows that in some cases one has to look for less obvious explanation.

To try to understand these reactions we started a special experimental program with an incomplete factorial plan:
- three different grapes
- two different yeasts
- two maceration durations
- two SO₂ addition levels on the grapes before alcoholic fermentation

**Interaction between two oenological yeasts and two LAB populations. Two different grapes: Merlot and Syrah**

Comments on Figure 5A and 5B: At the end of alcoholic fermentation, the wine fermented with ICV K1 Marquée has a higher concentration in malic acid (indicated as “Note the MH₂ difference” in Figure 5A). This difference is quite common between wines fermented with ICV K1 Marquée and ICV D254. With both LAB populations, the kinetics are slower in the wines fermented with ICV K1 Marquée. The yeast ICV K1 Marquée amplifies the differences between the selected LAB population and the non-inoculated population. On the contrary, the malic consumption kinetics are more similar in the wines fermented with yeast ICV D254, whatever the LAB population.

Comments on Figure 5C and 5D: Again, the malic acid concentration is higher in the wine fermented with ICV K1 Marquée but with a far smaller difference. With the inoculated LAB population, the kinetics are very similar to the Merlot trial.
Avoid the bite of Agrochemical Residues

Last year Australian wineries exported more than one billion dollars worth of the world’s cleanest wine. We deserve our squeaky clean reputation when it comes to agrochemical residues and we all want to keep it that way. Just one sniff of a problem with agrochemicals could ruin our reputation overnight.

There is only one sure way to play it safe and that is to have your wines tested for agrochemical residues by the Institute’s Analytical Service. Our comprehensive NATA registered laboratory is world class, as recent international proficiency tests show, and our confidentiality policy lets you rest easy. Call Peter Eichinger or Sandra Lloyd-Davies on (08) 8303 6600 or visit our website www.awri.com.au

(Figure 5A). With the non-inoculated LAB population, the wine fermented with ICV K1 Marquée has the same kinetics as the Merlot. The wine fermented with ICV D254 has a different behaviour compared to the Merlot (Figure 5B).

With the inoculated selected LAB population there is little yeast and grape interaction in these trials.

With the non-inoculated LAB there is an important bacteria/yeast/grape interaction.

**The effect of the SO₂ addition to crushed grapes on the MLF completion duration: 5g/hl and 10g/hl SO₂. Two LAB populations**

Comments on Figure 6: At the end of alcoholic fermentation, the wine made with 10g/hl SO₂ in the must had only 10mg/L more total SO₂ than the wine made with 5g/hl. This slight difference may explain the differences in the malic consumption kinetics. As already shown (Delteil, 2001) different SO₂ additions to crushed grapes have an impact on the MLF duration, even when the residual total SO₂ before LAB inoculation is low. With the non-inoculated LAB population, the oenological lag-phase is longer, but the differences between the two SO₂ additions are similar to the difference between the two inoculated variants.
Effect of two different maceration durations: 5 versus 14 days (J). Two LAB populations

We also illustrate the influence of some important winemaking parameters:
- SO2 addition in the crushed grapes (Figure 6A and 6B), even when no total SO2 concentration difference can be measured in the wines (Delteil, 2001).
- Maceration length (Figure 7A and 7B) with complex impact: pH increase with longer maceration, more grape polysaccharides, and higher acetaldehyde concentration.

The effects of those winemaking parameters are amplified with the non-inoculated LAB population.

Summary and conclusion
In this presentation we illustrated classical known yeast/bacteria interaction effects:
- the SO2 produced by yeast (Figure 1)
- wine acidity variation due to the yeast (Figure 3 and 4). These differences could come from a lower malic acid degradation (Figure 5A and 5B). Succinic acid could also be one of the acids involved. ICV K1 Marquée yeast is producing more succinic acid than the other ICV yeast (ICV, personal communication from in-house document) on one hand and the ICV K1 Marquee yeast is always giving slower MLF kinetics (Figures 1, 2, 4 and 5).

Other elements could interfere: polysaccharides. For example, the yeast most-favourable for LAB (ICV D47, ICV D254 and ICV GRE) are also high parietal polysaccharides producers (Delteil and Jarry, 1992; Rosi et al. 1998).

Longer maceration leads to quicker MLF kinetic (Figure 7A and 7B). It also gives wines with higher concentration in grape polysaccharides. In all trials, differences are amplified with the non-inoculated LAB population.

We now invite articles from Australian and overseas grape and wine industry personnel, research and extension officers, and qualified personnel of supplier companies for inclusion in the 2004 Annual Technical Issue. Your early advice regarding the articles you are submitting for this, the industry’s most prestigious and important publication, would be appreciated.

For deadline information please contact Anita Donaldson, giving details of the articles you intend to submit.

Email: editor@grapeandwine.com.au

Call for Technical Papers & Articles for The 32nd Annual Technical Issue

We invite articles on all aspects of grape and wine production, including viticulture, winemaking, and wine management, as well as research papers, case studies, and technical notes. Contributions should be no more than 2500 words, and all authors must provide a brief biography (maximum 100 words).

Deadline for submission: 30 June 2004

For further information or to submit an article, please contact:

Anita Donaldson
The Australian & New Zealand Grapegrower & Winemaker
297 The Parade
Beulah Park SA 5067
Phone (08) 8333 3633
Fax (08) 8333 3644
Email: editor@grapeandwine.com.au