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LALLEMAND

WINEMAKING UPDATE

Number 1 – 2010

LALVIN uvaferm ENOFERM

NEWS FLASH

❖ The Opti-White®, Opti-Red® and Go-Ferm® Protect products have had their Organic Materials Review Institute (OMRI) approval renewed for organic winemaking. Opti-White® and Opti-Red® are specific inactivated yeasts harvested from natural yeasts. They are used, respectively, in white and red wines to facilitate fermentation. Opti-White® has high antioxidant properties, and makes positive contributions to the mouthfeel and aromatic complexity in white wines. Opti-Red® is used at the beginning of fermentation to obtain fuller-bodied, more colour-stable red wines with smooth palates. The NATSTEP® product Go-Ferm® Protect is a stimulant and a protectant added to the wine yeast during rehydration. It facilitates fermentation by providing bioavailable micronutrients during the rehydration phase, resulting in the significantly better health of the yeast cells during fermentation.

The OMRI is a national non-profit organization in the United States that determines which input products are allowed for use in organic production and processing. OMRI-approved and -listed products may be used in operations certified "organic" under the USDA National Organic Program (www.omri.org).

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WINEMAKING UPDATE

WINEMAKING UPDATE is published by Lallemand to inform oenologists and winemaking staff about the latest news and applications arising from research. To request previous issues, or to send your questions or comments, contact us at:

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Sequential Inoculation with *Torulaspora delbrueckii* and *Saccharomyces cerevisiae* Yeasts: The Next Level in Fermentation

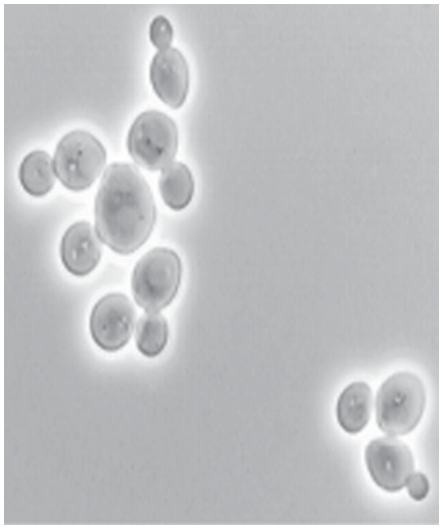
The benefits of using active dry yeast (ADY) to obtain quality wine – reliable fermentation and sensory quality – have been clearly demonstrated, and ADY are also necessary for the traceability and consistency of the winemaking processes. Although the yeast microflora present in the vineyard and cellar offer significant diversity, the *Saccharomyces* genus monopolizes nearly all alcoholic fermentations (AF). In addition, it has been established that the involvement and successive predominance of different (non-*Saccharomyces*) yeast genera during AF offer numerous advantages:

- They encourage the diversity of fermentation products and sub-products;
- They can sometimes correct certain wine faults, such as certain strains of *Torulaspora delbrueckii* does with volatile acidity;
- **They reveal the aromatic potential** of wines. The enzymatic activity of non-*Saccharomyces* yeasts reinforces the terpene-type varietal aromas and thiol notes. Alternating non-*Saccharomyces* and *Saccharomyces* yeast populations leads to an increase in ester levels. In the end, the wines appear **more intense and more complex**;
- Some non-*Saccharomyces* yeasts can biologically prevent the development of *Brettanomyces* contaminant yeasts.

Until now, no active dry non-*Saccharomyces* yeast has had sufficient quality to ensure good multiplication in winemaking conditions. Winemakers who would like to utilize the oenological qualities of non-*Saccharomyces* yeasts had to rely on the spontaneous development of wild yeasts, with the inherent risks of unreliable fermentations and uncontrollable sensory deviations.

Fortunately, this is no longer the case. Through Lallemand's research into yeast production processes, winemakers can now utilize non-*Saccharomyces* yeasts in the must, which have a survival rate throughout the first phase of fermentation comparable to that commonly obtained with *Saccharomyces* yeasts. Then, through the sequential utilization of complementary *Saccharomyces* yeast, the winemaker can now reproduce the natural succession of dominating yeast populations, reliably and effectively.

This special issue of *Winemaking Update* presents the first results of the sequential utilization of a non-*Saccharomyces* yeast – *Torulaspora delbrueckii* – selected by Lallemand and known as a strain present initially in particular grape musts, followed by a *Saccharomyces cerevisiae* yeast that is complementary to the first yeast. The result of this research is the "Level^2 TD®" kit of complementary yeasts.



Torulaspora delbrueckii

Saccharomyces cerevisiae

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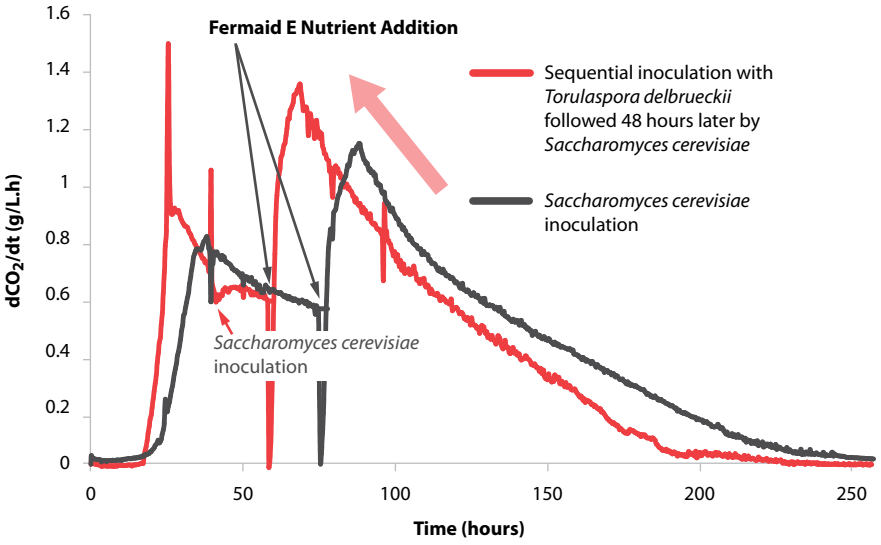
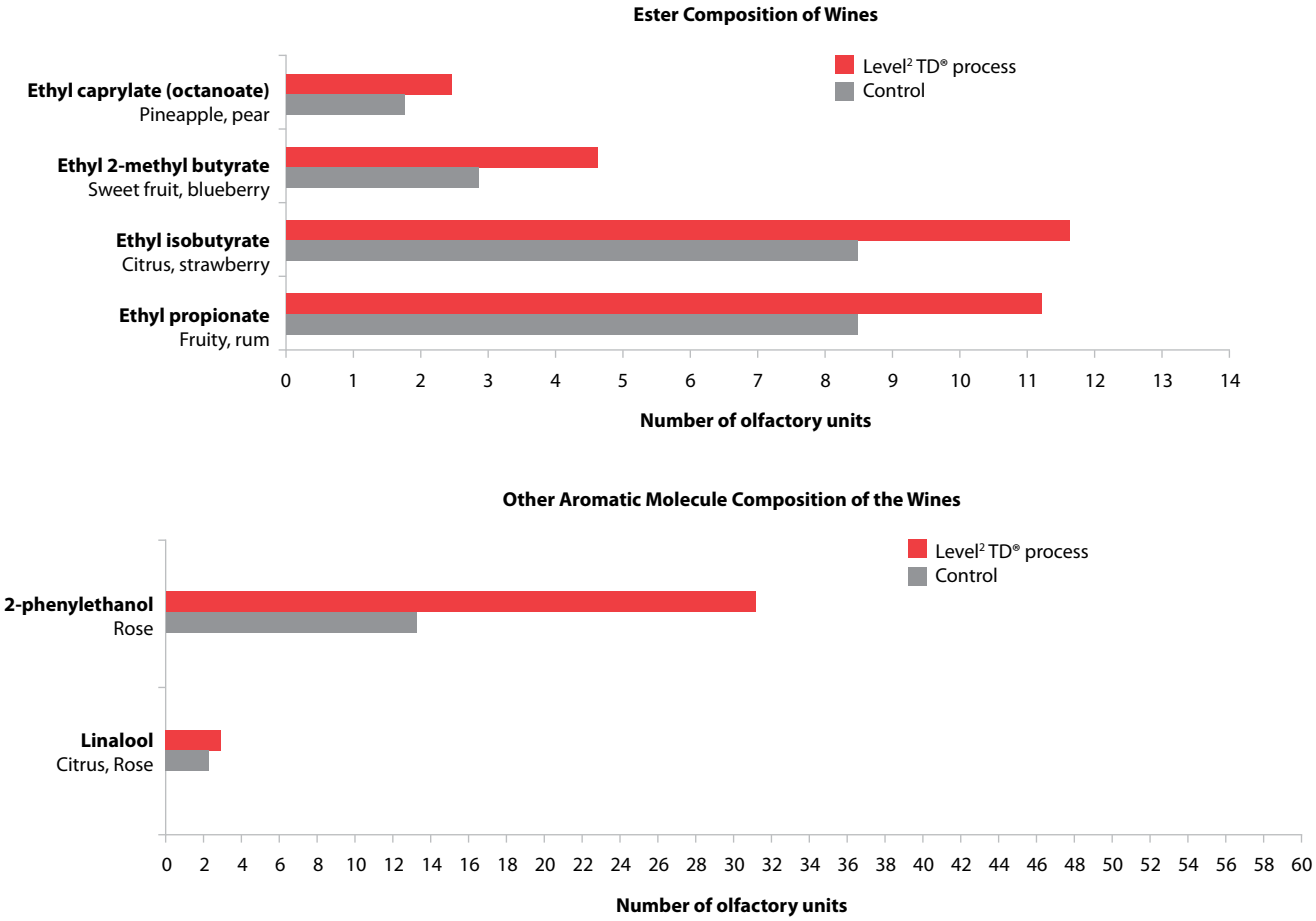


Figure 1. Fermentation rate of Maccabeu must (sugars 240 g/L; turbidity 44 NTU, TA 2.10 g/L H_2SO_4, pH 3.86) with sequential inoculation of Level² TD® and a control with *Saccharomyces cerevisiae* active dry yeast

1. Sequential inoculation

It is generally accepted that the utilization of non-*Saccharomyces* yeasts in a monoculture does not permit the completion of fermentation (residual sugar < 2 g/L) within a reasonable timeframe compatible with the requirements of current winemaking techniques, while guaranteeing the absence of sensory faults. Under oenological conditions, these species have limited fermentation capacities compared to *Saccharomyces* yeasts, due notably to their weak capacity to multiply and to their particular needs for micronutrients and oxygen. It has been widely described that the succession of yeast populations, with the alternating domination of non-*Saccharomyces* yeasts in the first phase of alcoholic fermentation followed by *Saccharomyces*, is important to the aromatic complexity of wines (Zironi et al. 1993, Ferraro et al. 2000). In previous research (Languet et al. 2005), it was validated that the reproduction of the population dynamics of the yeasts with sequential inoculation, such as obtained with this *T. delbrueckii*, was the key to complexity. Although sequential inoculation is more restrictive than mixed inoculation in terms of oenological practices, two successive inoculations have proven to be indispensable to reproduce that in which nature often excels.

The large-scale production of pure *T. delbrueckii* yeast in an active dry form, which presents sufficient capacity for survival and multiplication to meet the prime reliability criteria that is the implantation of a selected non-*Saccharomyces* yeast during the first phase of fermentation, has been the focus of Lallemand's research and development for the past five years.



Figures 2a and 2b. Chardonnay: Number of olfactory units (concentration / perception threshold ratio) for different aromatic molecules in each wine after malolactic fermentation

After repeatedly optimizing the production processes, high quality active dry *T. delbrueckii* yeast was obtained. Its performance as a complement to a *S. cerevisiae* yeast was measured to ensure that the duo – later named Level^2 TD® – was reliable during fermentation. For example, in Figure 1, the fermentation kinetics are maintained with the sequential inoculation (Level^2 TD® – *T. delbrueckii* and *S. cerevisiae*) compared to a traditional *S. cerevisiae* yeast in active dry form.

2. Aromatic complexity

Several cellar trials were required to validate not only the sequential inoculation process with Level^2 TD® itself, but also to measure the sensory impact of a sequential inoculation on different musts and in different conditions. These trials were conducted over more than five years.

2.1 For example, a must from a vineyard producing Chardonnay in 2008 in the Mâcon Village appellation in France showed little observable difference on the course of AF or the analysis, including the level of volatile acidity. The control yeast seems to have produced more SO_2.

On the other hand, the analyses of the aroma compounds revealed important differences (Figure 2a and 2b)

Esters: As soon as the AF was complete, the trial wine presented significantly higher values than the control wine for ethyl hexanoate and ethyl butyrate, which increase the fruity perception. After the malolactic fermentation (MLF), the levels of these compounds decreased. However, the aroma losses were markedly less in the wine fermented sequentially.

Terpenes: After AF, the linalool levels (lemon, rose) and 2-phenylethanol (floral notes) were higher in the wine fermented with Level^2 TD®. As for the esters, this gap is reinforced after MLF.

After MLF, **a panel of consumers clearly preferred the wine fermented sequentially with Level^2 TD®** (Figure 3). This wine was perceived as having superior aromatic complexity. Some tasters noted the presence of the "pastry" aroma range in this wine, which no one had detected in the control wine.

2.2 In another trial carried out on a Maccabeu, and following the same procedures (control yeast compared to sequential inoculation with Level^2 TD®), the AF proceeded correctly, with a slightly shorter lag phase in the must inoculated with *T. delbrueckii*. Analysis revealed a volatile acidity level clearly lower in the lot inoculated sequentially. Descriptive sensory analysis carried out with a panel of 14 tasters one month after bottling revealed important differences between the two wines (Figure 4). The trial wine presents aromatic intensities that are significantly higher than those of the control wine.

3. Promising results for lowering volatile acidity

The utilization of certain strains of *T. delbrueckii* in sequential inoculation in the fermentation of late-harvest grape must seems to give particularly interesting results, not only in aromatic terms, but in terms of lowering volatile acidity as well, which is often a problem in this type of fermentation. Trials in Sauternes (France) on a Sémillon grape must with an alcohol potential of 21.4% showed that the sequentially inoculated lot was twice as low in volatile acidity as the classically fermented lot (0.35 g/L to 0.7 g/L).

4. Testimony of cellar trial results

The oenologists Tomaz Vieira da Cruz and Bernardo Magalhães, from the Alentejo region of Portugal, carried out winemaking in 2008 at the Encostas de Estremoz vineyard with *T. delbrueckii*, utilizing it sequentially with *S. cerevisiae*. They commented that:

"The Portuguese varietals are not aromatic by nature, even less so when they are grown in hot regions like Alentejo. Their strong point is the structure and the mouthfeel which, when combined with good winemaking practices, can lead to fine, elegant wines. With good practices in the vineyard and some help from nature, these wines can present balanced acidity, in a natural way.

"The aromatic component is the most problematic point. The radical use of such techniques as fermenting at very low temperatures, over-clarifying the must and utilizing yeasts characterized as freeing certain types of aromas can result in wines with little structure, little body and incoherent 'artificial' aromas that are too unstable over time.

"The aim of introducing *Torulaspora* to the fermentation process was to develop more overall sensory complexity. From a sensory point of view, a major difference was noted in the finesse and elegance of the aroma of the trial wine obtained by sequential inoculation, compared to the control made with *Saccharomyces* alone. What stand out in the trial wine are the pineapple aromas, which improve with time. Two months after the initial tasting, this note was not clear, one month later it was subtle, and now it is outstanding. On the palate, this aroma helps improve the freshness of the wine, by giving the mouthfeel a note of liveliness."

References available on request.

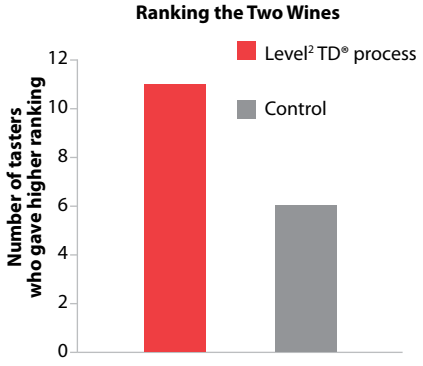


Figure 3. Preferences for the trial wines after MLF, judged by a consumer panel

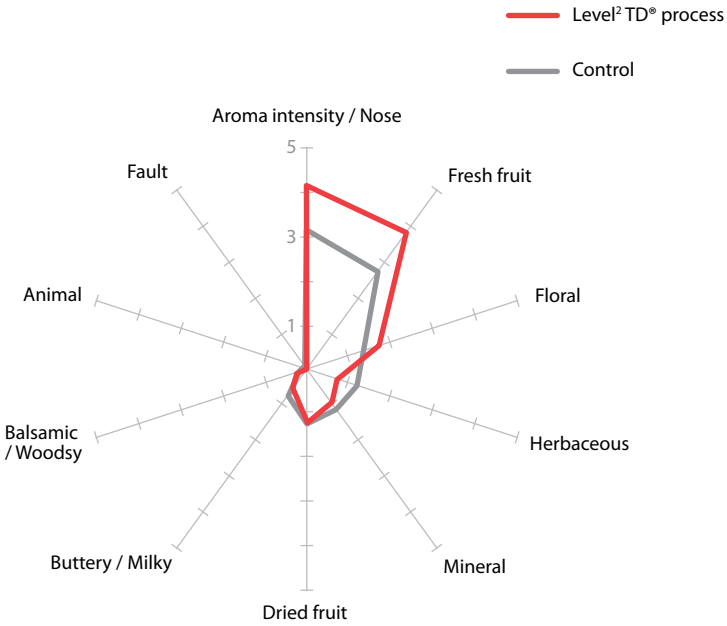


Figure 4. Sensory analysis of two Maccabeu wines one month after bottling, by a panel of 14 professional tasters.

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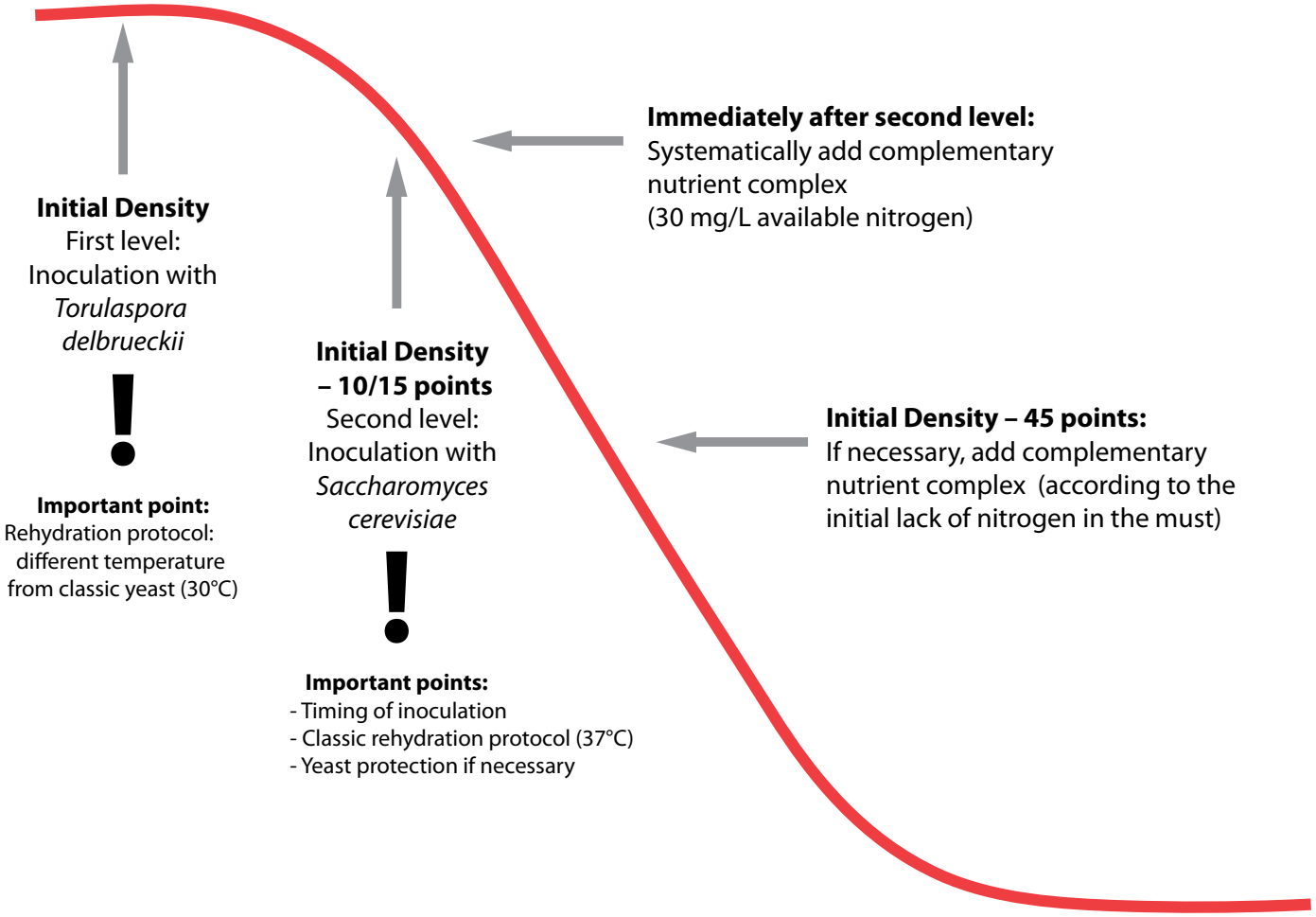
Figure 5.

Level² TD® process on white must

Limitation: Free SO_2 < 20 mg/L



TO SUMMARIZE...

The Level² TD® kit includes the qualitative selection of *Torulaspora delbrueckii* yeast and complementary *Saccharomyces cerevisiae* yeast. The first yeast is inoculated into the must (the first level) then, after a loss of density of about 15 points, the second yeast is inoculated into the must (the second level).

The qualitative impact on wines – **an increase in quality, aromatic intensity and complexity, and mouthfeel** – is optimized and preserved through a proactive set of actions in the cellar.

The Level² TD® kit reveals particular ranges of aromas that enhance the wines, differentiating them from those obtained through conventional yeasts. Winemakers now have a new option to master the quality of their wines.

For further information, contact your Lallemand advisor.