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LALLEMAND

WINEMAKING UPDATE

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LALVIN uvaferm ENOFERM

NEWS FLASH

- At the London International Wine and Spirits Fair, Lallemand participated in a round table discussion on the impact of oxygen on wine quality, as part of an event organized by O2inWines™ and moderated by Dr. Jamie Goode, journalist and author in the United Kingdom. Dr. Andrew Markides from Lallemand Australia PTY addressed the issue of the O_2 requirements of yeast for proper fermentation management, not only to avoid stuck or sluggish fermentation, but to avoid the formation of off-odour compounds as well. The panel discussion can be heard at www.02inwines.org/IMG/mp3/O2W1805.mp3
- Trials carried out over the past five years show that, under variable must conditions, yeasts prepared through the YSEO® process produce more regular fermentation and lower levels of hydrogen sulphide and volatile acidity. For example, before being prepared with the YSEO® process, the Uvaferm GHM® yeast would sometimes have difficulty completing fermentation. Once Uvaferm GHM® yeast was produced under YSEO® conditions, the results show that the process improves the yeast's performance for fermentation, while maintaining its sensory characteristics.

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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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Balanced Nutrition for Healthy Alcoholic Fermentation

Nitrogen is an essential nutrient for smooth alcoholic fermentation (AF). Numerous studies have shown that nitrogen has a positive impact on the growth and fermentation activity of yeast (Bell et al. 1979, Ough and Lee 1981, Bezenger and Navarro 1987). Deficiencies in yeast-available nitrogen (YAN) in the must significantly increase the risk of sluggish or stuck fermentations because they can arrest protein synthesis in the yeast cells. We consider a must with an initial sugar level of about 200 g/L to be deficient when its YAN concentration is about 150 mg/L (Henschke and Jiranek 1993). A YAN deficiency in the must can also cause the yeast to increase the production of H_2S (Henschke and Jiranek 1991). This edition of *Winemaking Update* focuses on the impact of balanced nutrition on alcoholic fermentation.

1. Nitrogen Sources and Their Impact

The variability of the nitrogen requirements of yeasts has been studied in our laboratories. More than 150 selected yeasts have been categorized into six groups (Figure 1), and it is important to understand the nitrogen requirements of the yeast used for fermentation in order to adopt the best nutrition strategy.

Group 1: very low nitrogen requirements

Group 2: low nitrogen requirements

Group 3: low to medium nitrogen requirements

Group 4: medium to high nitrogen requirements

Group 5: high nitrogen requirements

Group 6: extreme nitrogen requirements

The two types of nitrogen available to yeast are ammonium and α-amino nitrogen. Both types of YAN – the ammonium (inorganic nitrogen that is very quickly assimilated) and the amino acids (organic nitrogen that is gradually assimilated) – naturally cohabit in the must.

The three nitrogen sources regularly used for yeast nutrition are ammonium salts (DAP/DAS – a source of 100% inorganic nitrogen), a complex preparation composed of ammonium salts and inactivated yeast fractions rich in α-amino organic nitrogen that combines the positive effects of inorganic nitrogen with organic nitrogen for the growth and fermentation of yeasts, and, lastly, a completely organic source of nitrogen with specific inactivated yeast fractions rich in α-amino nitrogen (such as Fermaid O®)

Ammonium (inorganic nitrogen) is very rapidly assimilated and has a direct influence on the

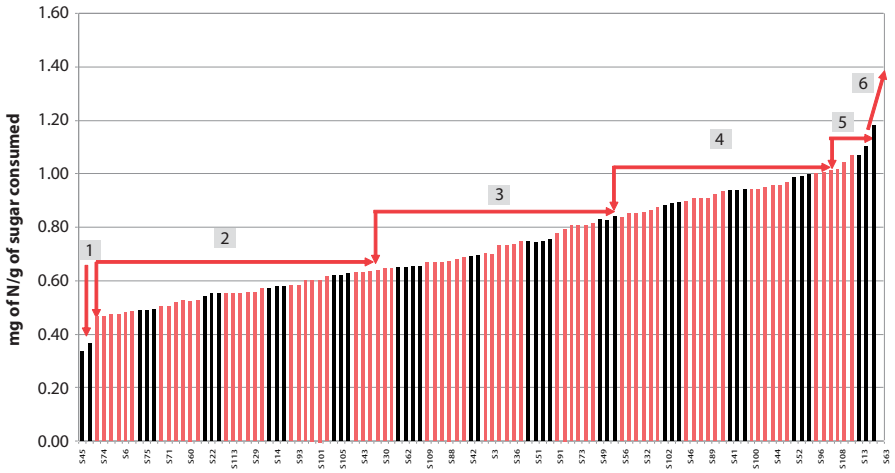

Figure 1. Milligrams of available nitrogen necessary to consume 1 g of sugar in a nitrogen-deficient must (100 mg/L available nitrogen)

Continued

biomass by enhancing growth during the exponential phase (Figure 2), resulting in an overcrowding of yeast cells. These yeast cells will continue to use inorganic nitrogen and then the amino nitrogen. The result is an "induced" nitrogen deficiency.

While using its own amino acids to synthesize the membrane proteins, the yeast will secrete sulphur-containing compounds into the fermenting must. The impact of complex and organic nitrogen preparations on the rate of fermentation and growth is different and more gradual, and such preparations help ensure the steady progress of the AF.

2. The Impact of Different N_2 Sources on Fermentation Kinetics

We compared the efficacy of adding inorganic ammonium and an organic nitrogen preparation to a Viognier must with 215 g/L of sugars and a YAN of 150 mg/L, fermented with the Lalvin EC-1118 yeast. Nitrogen was added to obtain 16 mg/L of added YAN, which meant adding DAP at 8 g/hL in two doses (4 g/hL at the start of fermentation and 4 g/hL at one-third sugar depletion). Organic nitrogen (Fermaid O®) was added at 40 g/hL in two doses (20 g/hL at the start of fermentation and 20 g/hL at the one-third point of fermentation). The control fermentation had no added nitrogen.

The resulting fermentation kinetics are represented in Figure 3.

With the addition of 16 mg/L of YAN in organic form, fermentation was complete in 10 days. No difference was observed between the fermentation rates of the must to which 16 mg/L of YAN in ammonia form was added, nor in the must with no nitrogen addition. The must to which inorganic nitrogen (ammonium) was added had a slow end to fermentation. The level of residual sugars is higher in the wine where only DAP was utilized, compared to that with Fermaid O®.

These trials confirm the importance of the choice of the source of YAN. At identical doses of added YAN, the preparation based on amino acids from yeasts was shown to be more effective than 100% inorganic ammonium nitrogen.

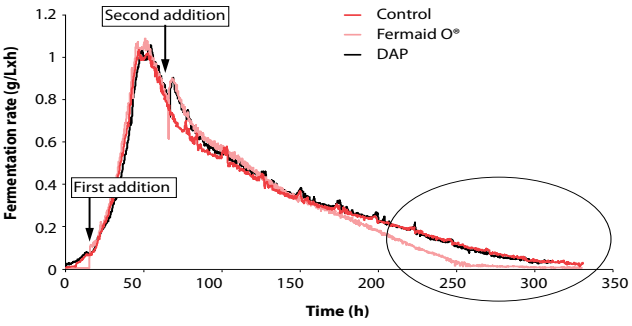

Figure 3. Fermentation kinetics representing the fermentation activity of yeasts according to the three protocols (expressed in g/Lxh^{-1} of CO_2 released)

3. The Impact of Different Nitrogen Sources on the Sensory Profiles of Wines

The sensory impact of nitrogen supplementation on the must varies considerably according to the nitrogen source selected. Complex preparations ensure more complete nutrition. They contain inactivated yeast fractions that are rich in amino acids, which limit the excessive production of undesirable compounds (e.g., ethyl acetate and hexanol) and enhance the expression of positive aromatic compounds (e.g., phenylethanol, phenylacetate, terpenes and esters) while lowering sulphur-like odours in the wine, whatever the variety (D. Granès, ICV, internal communication). Sensory analysis was carried out in a blind tasting three months after bottling, by a jury trained with references, on bottled Syrah wines fermented with ICV GRE® yeast and with different sources of nitrogen added – DAS (diammonium sulphate at 22 g/hL), Fermaid E™ (complex yeast nutrients at 30 g/hL), and Fermaid O® (at 40 g/hL).

What emerges from this tasting is that the addition of organic (Fermaid O®) or complex nitrogen (Fermaid E™) intensifies the aroma sensations generally judged positive: red berries, jammy and spicy perfume. In the wine treated with ammonium salts, sulphur notes dominate.

On the palate (Figure 4), the differences are even clearer. The volume of the wine of the organic nitrogen nutrient sample (Fermaid O®) is correlated to the softening of the final aggressive sensations. The ammonium salts score non-conformity points for a "Premium"-type red wine: sulphur odours, drying and bitter aftertaste.

Overall, the main trends that emerge from the results of the tastings are as follows: organic nitrogen (Fermaid O®) enhances the intensity of the berry notes and increases "softness" in the mouth, while inorganic nitrogen (ammonium salts) often emphasizes the sulphur notes and the aggressive aftertaste.

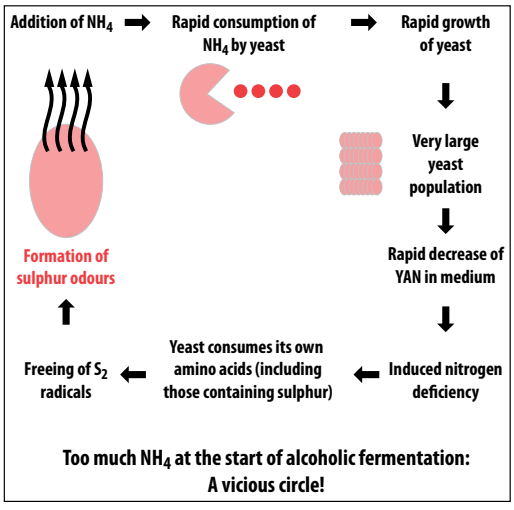

Figure 2. The impact of excessive inorganic nitrogen at the beginning of fermentation

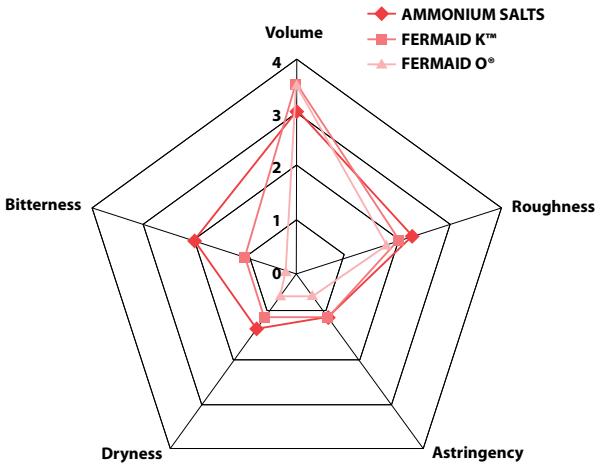

Figure 4. Gustatory profiles of Syrah wine

TO SUMMARIZE...

The results of these trials show not only the importance of nitrogen supplementation during alcoholic fermentation, but also the importance of the type of nitrogen added. For musts threatened by nitrogen deficiency, it is better to aim for a complete nutritional supplement (i.e., nutrients based on α-amino acids, such as the Fermaid® range of products) to effectively carry out fermentation. Fermaid O® is an OMRI-approved product and is different from other Fermaid® products as it contains only the highest quality of α-amino nitrogen. Fermaid O® should be used when the YAN deficiency is not higher than 50 mg/L. Organic nitrogen, which is assimilated gradually, encourages aromatic expression while reducing aggressive notes, and ensure a complete and regular fermentation. For more information on how to properly use Fermaid® nutrition products, please contact your Lallemand representative.