Summary 79

VITICULTURE & ENOLOGY
UNIVERSITY OF CALIFORNIA DAVIS

"Native yeasts for low input winemaking: Searching for wine diversity and increased complexity"

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In: Proceedings of the International Wine Microbiological Symposium. pp. 33-39. Fresno, California. 2006.

This Uruguayan author isolates different native yeasts and evaluates their merit in replacing nutrient-dependent strains, as well as their ability in developing interesting and unique wine aromas.

• The author starts out by pointing out a paradox. Despite the great degree of biodiversity existing in yeast strains today, only a very limited number of commercial strains are available for use in the winery.

• This paradox leads to a perplexing question: Why do most commercial strains have a high nitrogen demand that makes it necessary to supplement the musts with N? Today, winemakers are trying to work with minimum manipulation of grapes and avoid the use of additives. However, the lack of quality yeasts with low nitrogen demands is not helping them.

• Additionally, nitrogen supplementation of commercial yeast strains poses other problems to the winemaker. These problems include: 1) formation of health risk components like ethyl carbamate, 2) increase of residual amino acids like histidine, precursor of histamine (which causes headaches and other negative health effects), 3) an excess of residual nitrogen facilitates contamination during aging by yeasts like *Brettanomyces*, 4) excess nitrogen makes fermentations more rapid, increasing energy demands for cooling, as well as causing a loss of volatile aromas, and 5) increased addition of ammonium can change a varietal's amino acid profile, altering its typicity.

• But at the end of the introduction, the author finds an explanation to his own apparent perplexity. The majority of the commercial strains available require the addition of ammonium phosphate because they are not adapted to the naturally harsh conditions of the musts of many high-quality vineyards (whose nitrogen barely reaches 100 to 250 mg per liter).

• In the author's opinion, once we have obtained grapes with the maximum concentration of the key quality ingredients (high polyphenols and sugars, and low pH), the next key step to increase a wine's quality is the *natural microflora and/or the type of yeast inoculated.* So he devotes this paper to review the applications to winemaking of: 1) low nitrogen demand yeasts, 2) yeasts naturally antagonistic to grape pathogens, 3) yeasts other than *Saccharomyces* (like apiculate yeasts), and 4) *Saccharomyces* strains with the ability to improve either aroma or color (like monoterpenes and anthocyanin derivatives).

• 1) **Low nitrogen demand yeasts**. The author developed a chemically-defined must medium with low nitrogen. This medium proved incredibly useful in isolating a new generation of yeast strains adapted to low nitrogen. After this step, the low-nitrogen-requiring strains could be tested in true grape musts and subjected to sensory evaluation, among other tests.

• 2) **Disease-antagonistic yeasts**. In a recent article (*See Summary 57*), the same author screened several Uruguayan vineyard soils for the presence of microorganisms antagonistic to the fungus *Botrytis cinerea*. His research team was able to isolate a species of *Bacillus subtilis* and a strain of *Hanseniaspora uvarum* which were very effective in controlling rot development on grape clusters. The author calls this strategy of increasing the natural antagonistic microbial populations present in vineyards "Low Input Viticulture". Additionally, some of these yeast strains are likely to contribute to wine complexity in the winery after harvest.

• 3) **Apiculate yeasts**. There is considerable controversy regarding the role of apiculate yeasts (non-Saccharomyces "pear"-shaped yeasts) on the organoleptic quality of wines. Two previous studies excluded the possibility of using apilculate yeasts in winemaking due to their heavy production of ethyl acetate and acetic acid. But the current author screened apiculate yeasts from Tannat grapes and found 10% of the strains had good sensory characteristics. In a later experiment, some of these strains were tested in a mixed culture with *Saccharomyces*, and the resulting Tannat wines had more intense fruit aromas and increased varietal character.

• 4) **Yeasts than synthesize monoterpenes**. Monoterpenes (linalool, geraniol, nerol, citronellol, terpineol) are compounds that confer floral notes to certain varieties, such as Muscat, Gewursztraminer, Riesling or Chardonnay. During fermentation, only a small number of non-Saccharomyces yeasts are able to cleave the neutral monoterpene glucosides and liberate the aromatic monoterpenes into the wine. However, the current author recently reported the formation *de novo* (that is, "from scratch", rather than due to cleavage) of monoterpenes by natural strains of *S. cerevisiae.* When the author fermented an aromatic variety (Moscato Giallo) with a mix of non-Saccharomyces and *Saccharomyces* strains, he detected approximately 30% increase in terpene concentration.

• 5) **Yeasts that modify anthocyanin derivatives**. Because of the amount of pigment loss caused by yeast during fermentation, the author evaluated different strains of *Saccharomyces cerevisiae* for their ability to adsorb anthocyanins and remove color from wines. To avoid differences in the juices used in the experiment, he developed a model grape juice using a sterile-filtered Chardonnay must (to avoid solids) and an anthocyanin extract from Tannat. Because no skins were used, this protocol reduced anthocyanin losses due to adsorption to grape skins after crushing. Results showed no correlation between color intensity and anthocyanin concentration after fermentation. However, they did find a correlation between color intensity and the *"sum of anthocyanin derivatives"*. For example, the native strain CP882 showed the most increase of anthocyanin derivatives when compared to other commercial strains.

So, as we have seen, there is a whole world of new yeasts out there that have potential for moving us towards a lower-input winemaking, a lower-input viticulture, an increase in aromas, and a higher retention of color in the wines. The author believes that application of a limited number of commercial strains across the various regions of the world results in uniform and "boring" wines. He believes that, among the native grape flora, there exist strains with potential to improve the complexity and microbial stability of wines. And some of the strains he already isolated from Tannat grapes are demonstrating just that.

Author: Bibiana Guerra, Editor: Kay Bogart. This summary series funded by J. Lohr Vineyards & Wines.