TO YEAST OR NOT TO YEAST

By Lisa Van de Water, Director, Pacific Rim Oenology Services, Blenheim

Where do yeasts come from?

Such a romantic notion...The "perfect" yeast for a given field of grapes develops over time, wafting through the vineyard and settling on the grapeskins. Eventually they are carried into the winery on the grapes, where, if only winemakers would let them perform the fermentation, what wonders of complexity would we see!

Romantic, yes, but alas, like many other winemaking myths, far from the truth. Grapeskins are indeed hosts to populations of other yeast species, but research in the past decade has shown that *Saccharomyces*, the yeasts used by winemakers for fermentation, are rare in the vineyard. Grape samples taken directly from the vineyard hardly ever contain any *Saccharomyces* yeasts at all.

Most wineries worldwide now inoculate their grapes with a cultured strain of *Saccharomyces*. But when winemakers do not add yeast, the juice ferments anyway, because wineries harbour large numbers of yeasts derived from previous fermentations. During the harvest season, *Saccharomyces* yeasts populate every winery surface, including crusher and press, even winery workers' hands.

DNA tests corroborate that combinations of these winery-resident *Saccharomyces* strains perform most fermentations when no yeasts are added, and sometimes even when yeast is added, especially when the inoculated yeasts are killed or weakened by improper handling procedures [It is much easier to kill dry yeast than winemakers realise – yeast handling guidelines are available on request]. If your fermentation does not behave like the yeast supplier's description, it is very likely that other yeast strains or species have contributed to, or even dominated, the ferment.

Vineyard yeasts

What grapeskins do carry is a variety of yeast species, some able to ferment, some not. By far the predominant species, and the most important, is *Kloeckera apiculata* (and its close relative, *Hanseniaspora uvarum*). This yeast is found in large numbers on ripe fruit all over the world.

Kloeckera can start to grow as soon as the berry skin is broken, even before the grapes are picked if there is bird damage. Mechanically harvested grapes with a distance to travel are especially likely to harbour a burgeoning population of *Kloeckera* before they reach the winery, and may begin fermenting with *Kloeckera* before arrival. Adding SO2 (PMS) helps slow *Kloeckera* growth but does not necessarily kill this yeast.

A whiff of esters such as ethyl acetate (smells like nail polish remover) or amyl acetate (banana) as fermentation begins means that *Kloeckera* has grown to some extent, but if a strong, clean-smelling fermentation ensues quickly, probably there is no harm done. But if *Kloeckera* grows too extensively it can make a bumpy, slimy scum on the juice surface or floating clumps resembling vomit, which eventually settle out as exasperatingly fluffy lees. Esters may remain in the wine even after fermentation is over, so a classic description of *Kloeckera's* aromas is "A banana wearing nail polish in a field of rotten hay."

Kloeckera quickly strips the must of vitamins, particularly thiamine, and depletes other nutrients as well. *Kloeckera* also produces 25-30 times as much acetic acid as *Saccharomyces*. Acetic acid can help cause stuck ferments late in fermentation, because it becomes more toxic to yeasts as alcohol rises.

In uninoculated fermentations, the longer time needed for a very small *Saccharomyces* yeast population to grow very often allows *Kloeckera* to grow, sometimes extensively. Most uninoculated fermentations start with *Kloeckera*, which can actually complete a fermentation by itself. Typically, though, *Kloeckera* begins to die when the alcohol reaches a few %, leaving *Saccharomyces* to attempt to finish the fermentation.

Kloeckera often contributes to inoculated fermentations, too, especially when must is allowed to warm up slowly before inoculation, or yeasts are added to cold juice without acclimation steps, because *Kloeckera* is more cold-tolerant than *Saccharomyces*. Inoculation with a properly prepared and acclimated yeast culture is usually effective in swamping *Kloeckera* with a large number of cells of the selected strain.

The name game: uninoculated fermentations

What can we call fermentations to which no yeast culture is added? *Please, don't call them "natural;"* all wine fermentations are "natural" (no GMO's)! The term encourages consumers to regard most wines with distrust, because if only uninoculated fermentations are "natural," what are the rest? Unnatural? Artificial?

What about calling them "wild," "native," "indigenous," or "feral"? These colourful terms conjure up pictures of unruly yeasts lurking in the bush, which could apply to *Kloeckera* and its friends, but are misleading in reference to civilised *Saccharomyces* yeasts colonising wine cellars. "Spontaneous" is a good term, neutral in connotation. Our preference is "uninoculated," because its meaning is simple, clear, and appropriate.

Predictability

"I love 'wild' yeasts! They got me my last two jobs!" – Winemaker (who asked to remain anonymous)

The biggest problem with uninoculated fermentations is their lack of predictability, not only from winery to winery and vintage to vintage, but often from one container to another. Fermentations may be performed by one or more than a dozen *Saccharomyces* strains and derivatives, some retaining most characteristics of their parent cultured strains, but some not. Uninoculated fermentations are also much more likely to become sluggish or to stick than musts inoculated with a vigourous strain of yeast.

Why would winemakers risk unpredictability and real trouble? The answer lies in the wine itself. When several strains of yeast participate in fermentation, as is common in uninoculated ferments whether at the same time or in succession, the wine often has a greater complexity of aromas, and may have a fuller mouth-feel as well.

We remmend adding a cultured strain of yeast, achieving complexity by fermenting different batches of grapes with different strains and then blending. Using selected yeast strains greatly increases the chance of a predictable fermentation pattern that matches the expected characteristics of the strain(s).

That said, here are some suggestions if you do not choose to add yeast:

1. Use sound, ripe grapes

Rotten, mouldy, or damaged grapes are unsuitable for healthy uninoculated fermentations. Such musts should be inoculated with appropriate cultured strains instead.

2. Add SO2 as soon as grapes are crushed

We urge winemakers to add 30-50 ppm SO_2 to any fermentation, but it is especially important to add it to those that will not be inoculated with cultured yeast, to help discourage excessive contribution by non-*Saccharomyces* species and to prevent growth of ML spoilage bacteria. If grapes are field-crushed, or harvested and trucked a considerable distance, SO2 should be added in the field.

3. Add lysozyme to reds

Adding100-125 ppm lysozyme help prevent bacterial spoilage, which is encouraged by slow yeast starts. Inoculating after dryness with the CH-35 strain of Viniflora should not be a problem because it is relatively lysozyme-resistant.

4. Warm must after cold-soaking

Because cold temperatures favour *Kloeckera*, it is risky to allow musts to warm up slowly. It may be difficult to warm chilled must to at least 15 C while waiting for fermentation to begin, but it is worthwhile to do so to make *Kloeckera* growth less likely. Fermenters can be warmed by running hot water over them, or wineries may be able to heat-exchange a portion of the juice.

5. Watch out for *Kloeckera*

Smell the juice or must at least twice a day to check for ethyl acetate developing, and look for floating yeast clumps once fermentation begins. If signs of *Kloeckera* appear, and the fermentation does not quickly begin fermenting strongly, with a healthy, yeasty smell, add some fresh, vigourous yeast.

If a microscope is available, look for apiculate yeasts (smaller and 'pointy;' some cells resemble bowling pins, often with small bumps on one or both ends, like a lemon). Do a methylene blue stain to check for viability of the various species.

6. Time nutrient supplementation carefully

Especially for uninoculated fermentations, it is beneficial to add both a complex yeast nutrient (such as Superfood) and DAP (diammonium phosphate). If possible, test ammonia and NOPA, and add DAP to bring usable nitrogen to 200-350 pm (> Brix, > nitrogen is needed). DAP at 100 ppm adds 22 ppm as nitrogen.

If you cannot test nitrogen status, add 500 ppm of a complex blend such as Superfood (or Fermaid plus yeast extract, because it does not contain yeast extract). Depending on factors such as variety, vineyard location, and past performance, also add 250-500+ ppm extra DAP.

But to avoid feeding unwanted vineyard yeast species add at most only a portion (less than half) of the nutrients you will use before fermentation begins. Then, when a vigourous, clean-smelling fermentation starts to develop, add the rest of the complex nutrient and a portion of the extra DAP. At the same time, add a tiny bit (0.5-1 ppm) of a complex yeast vitamin supplement such as Vitamix or Cerevit, to replenish thiamine depleted by *Kloeckera*. Add the rest of the DAP in portions over the first half of the ferment.

7. Do not inoculate with ML bacteria until wine is dry

To avoid any competition with yeasts, which may not be as vigorous or as well-adapted to alcohol as cultured strains, it is best to wait until the wine has completely finished yeast fermentation before inoculating for MLF.

8. Inoculate with yeast if anything goes wrong!

If a serious problem develops - large populations of *Kloeckera*, off odours/flavours, or the ferment is sluggish - be prepared to add a vigourous strain of cultured yeast, if need be, rather than allow the must to stick or spoil!

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