HOW TO AVOID STUCK FERMENTATIONS

Anchor WINE YEAST

THE LEADING NEW WORLD WINE YEAST BRAND

HOW TO AVOID STUCK FERMENTATIONS

Karien O'Kennedy

Quick guide

- *Do not propagate ("mother tank") a yeast.*
- *Base choice of yeast on fermentation performance first and then on suitability for a specific grape variety or style of wine.*
- *Rehydrate correctly.*
- *The first 5°Brix (3°Baumé) of a red wine fermentation should not exceed 25°C / 77°F.*
- *The last 5°Brix (3°Baumé) of a red wine fermentation should not exceed 25°C / 77°F.*
- *The maximum temperature of a red wine ferment should never exceed 30°C / 86°F.*
- *Avoid a heat peak by not adding DAP at the start of fermentation unless the YAN is below 100 mg/L.*
- *Use cold tolerant yeast strains to cold ferment (12 – 15°C, 54 - 59°F).*
- *Avoid abrupt temperature shifts of more than 5°C / 9°F.*
- *Measure the YAN of the juice – add complex yeast nutrients in stages during the fermentation.*
- *Use lysozyme in red musts with the initial sugar exceeding 25°Brix (14°Baumé).*

Complete explanation

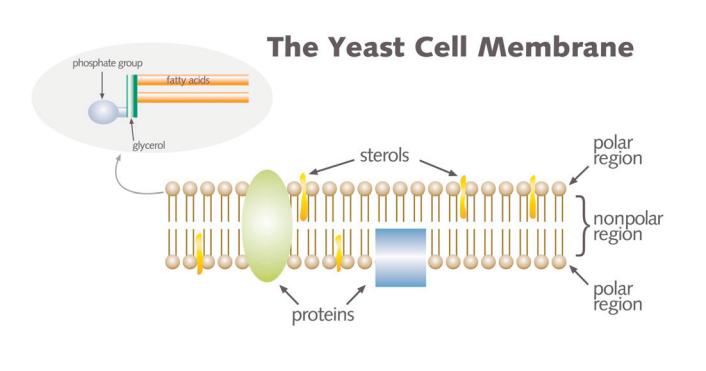
Do not propagate yeast

The practice of "mother tanking" is still widespread around the world – some countries more than others. People who propagate believe that it saves production costs. However, there is quite a simple explanation as to why this practice very often leads to sluggish or stuck fermentations, thereby making it less cost effective. The production processes used by yeast companies allow for the yeast to increase in biomass by respiration. The propagation practices at wineries allow for the yeast to increase in biomass by fermentation. Propagation via respiration takes place in the presence of oxygen and the absence of alcohol. Propagation by fermentation is in the absence of (or in limiting amounts of) oxygen and in the presence of alcohol.

Oxygen is needed for the production of lipids and sterols, the most important components of yeast cell membranes. These lipids and sterols protect the yeast cell from alcohol toxicity, especially towards the end of fermentation. The amount of

aeration wineries use in their propagation tanks is not remotely close to the amount of purified compressed air that yeast companies use. In the absence of oxygen, each new yeast cell formed by budding has half the amount of lipids (and most likely sterols) of the cell from which it originates. As lipid/sterol content is directly related to alcohol tolerance some generations of the yeast grown via propagation in wineries will not be alcohol tolerant enough to finish fermentation.

Alcohol increases cell membrane permeability. That means that it becomes increasingly difficult for the yeast to maintain its internal pH (important for enzymes to function properly) as well as to maintain



The yeast cell membrane comprise mainly of lipids (long chain fatty acids) and sterols

the osmotic balance between the inside and the outside of the yeast cell. It is therefore extremely unfavorable to grow yeast in the presence of alcohol.

The result is that yeast propagated in a winery is less alcohol tolerant than yeast grown in a yeast factory and has a greater chance of getting stuck.

Use the correct yeast

Yeasts are living organisms that differ greatly from each other in terms of alcohol tolerance, temperature tolerance and nitrogen demands. Base your choice of yeast on your specific fermentation needs first before looking at suitability for a specific grape variety or style. There are many yeast strains suitable for Cabernet Sauvignon production – only a few of them are suitable to ferment 26°Brix (14.4°Baumé) to dryness.

Use the correct rehydration procedure

Rehydration is vitally important to replace the water removed by drying, thereby restoring the yeast to its metabolically active form. Rehydration can be done in water only or in a water juice mixture (1/3 juice: 2/3 water). The juice must not contain any SO_2 or pesticide/fungicide residues. Rehydration should be done between 35 – 38°C / †95 - 100°F for 20 minutes. The rehydration mix must be cooled down with juice after 20 min, 5°C / 9°F at a time. Failure to cool down from the rehydration temperature after 30 minutes can result in cell death. Do not use any nitrogen-containing nutrients in the rehydration mixture. The use of inactivated yeast based- rehydration nutrients or protectants can be beneficial for some yeasts and must be used according to the manufacturers' instructions.

Control the temperature

The temperature at the start of a red wine fermentation must not exceed 25°C / 77°F (this may be lower for more robust yeasts.) This is to avoid the exponential growth phase of yeast occurring too quickly, as it can negatively affect yeast viability towards the end of fermentation. To avoid a heat peak, do not add DAP before at least 3 - 5°Brix (2 - 3°Baumé) has fermented, unless the initial YAN is below 100 ppm. Having a longer first third of fermentation will also increase color extraction.

Towards the end of the fermentation (5°Brix, 3°Baumé and below) the temperature has to be lowered to 25°C / 77°F or lower, depending on the alcohol tolerance of the particular strain. The higher the fermentation temperature (in the case of red

musts) the higher the toxic effect of alcohol on yeast cell membranes. Red wine fermentation temperatures should never exceed 30°C / 86°F. This is very toxic for the yeast especially towards the end of fermentation.

In the case of white winemaking only certain yeasts can cold ferment (11 – 15°C, 52 - 59°F). Yeast data sheets indicate temperature ranges of yeasts. Do not try to ferment outside of this temperature range. Use yeasts suitable for cold fermentation.

Some yeast strains are very sensitive to abrupt temperature changes even if the start and end temperatures fall within their specific range. This is called thermal shock. Acclimatize rehydrated yeast slowly to the juice temperature, especially juice that has been cold settled in the case of white winemaking. Do this by adding small amounts of the cold juice to the rehydrated mix to lower the temperature of the mix 5°C / 9°F at a time. Wait 15 minutes between cold juice additions.

Control yeast nutrition

It is very important to measure the YAN of each fermentation. It is generally accepted that musts with YAN values lower than 150 mg/L run the risk of becoming problematic. A low YAN is usually also an indicator of low vitamin and mineral content. Vitamins and minerals are co-factors in enzymatic reactions and, if there is a shortage of these co-factors, it can slow down fermentation as well as prevent certain reactions from taking place at all. It is therefore advisable to use a complex yeast nutrient that is also a source of vitamins and minerals in low YAN musts instead of just adjusting the YAN with DAP. Always use a robust yeast strain that has a low nitrogen requirement in low YAN musts even if the YAN has been adjusted. Always use very alcohol tolerant strains in low YAN musts. Stuck fermentations are more often the cumulative effect of two or more stress factors rather than a singular factor.

Control the bacterial growth

If you have history of a vineyard with grapes with a high bacterial population it is advisable to add 100 mg/L lysozyme to red grapes as a precaution at the start of fermentation. Overripe grapes can have higher bacterial populations because of longer hanging time on the vine. Certain climatic conditions are also more conducive to higher bacterial counts. The danger of a high bacterial population is that when fermentation slows down due to an increasing alcohol concentration, bacteria can compete with yeasts for nutrients. This, together with the production of volatile acidity due to sugar instead of malic acid metabolism, can greatly increase the risk of a stuck fermentation. Lysozyme kills lactic acid bacteria, thereby eliminating this risk. Lysozyme is unstable and will lose activity shortly after fermentation. At this point one has to inoculate with commercial malolactic bacteria.

References:

1. Stuck fermentation Management, Karien Lourens and Graham Reid. The Australian and New Zealand Grapegrower and Winemaker, February 2003.

2. Overcoming stuck and sluggish fermentations, Gordon Specht. Practical Winery and Vineyard, September/October 2003.

3. Nitrogen management is critical for wine flavour and style, Maurizio Ugliano, et al. the Australian and New Zealand Wine Industry Journal, November/December 2007.

4. Enology Notes 139, Bruce Zoecklein, March 2008.