

STUCK FERMENTATIONS

by
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Occasionally fermentation will stop before all of the sugar is gone, and these stuck fermentations are always a big concern to the winemaker. Residual sugar in wine represents a major biological instability because fermentation can restart anytime. Winemakers are always frustrated when fermentation restarts late in the winemaking cycle because much of the work done to clarify and stabilize the wine will need to be repeated. More handling is required, and the additional manipulation will not have a positive effect wine quality.

An even worse scenario is when fermentation restarts after the wine is bottled. Then the yeast produces unsightly sediment in the bottle and the wine becomes effervescent. Sometimes the bottles explode.

Causes

Fermentation can stop for a variety of reasons including accidental contamination. However, most stuck fermentations are caused by the following conditions: (1) excessively low or high fermentation temperatures, (2) a lack of available nitrogen, (3) a lack of an essential yeast micro nutrient, (4) the use of damaged dry yeast, (5) excessive quantities of acetic acid. Each of these problems is discussed below.

Fermentation Temperature

Undoubtedly, the most common fermentation problem occurs when red fermentations overheat. The conversion of sugar into alcohol and carbon dioxide produces heat (exothermic), and fermentations can become fast and very hot in warm weather. Then problems occur because wine yeasts die when fermentation temperatures exceed 94 degrees for just a few hours. This is why most winemakers check fermentation temperatures at once or twice a day.

Another kind of temperature problem sometimes occurs when Epernay yeast is used for very low temperature, white wine fermentations. Epernay does not tolerate low temperatures well, and it is very sensitive to thermal shock. In fact, Epernay yeast usually stops fermenting if the juice is quickly cooled below about 45 degrees.

Nitrogen Deficiency

Yeasts require nitrogen to produce the large number of cells needed for healthy fermentations. Most large wineries measure the nitrogen content of each batch of grapes and added nitrogen when needed. Most small producers simply add diammonium phosphate (DAP) to juice and must to provide extra nitrogen and encourage rapid yeast growth. DAP is usually added to juice or must before fermentation is started. DAP is often added with other ingredients (see below), and it is a major ingredient in most proprietary yeast foods.

Practically all wine yeasts produce excessive amounts of hydrogen sulfide when juice lacks sufficient available nitrogen. Here, winemakers use an addition of DAP to provide extra nitrogen to help reduce the quantity of hydrogen sulfide produced.

Micro Nutrients

Besides nitrogen, yeasts require vitamins, minerals and amino acids to reproduce new cells, and grapes deficient in these materials can be difficult to ferment to dryness unless extra micro nutrients are added to help the yeast. Super Food, Startup, Yeast Extract and Yeast Hulls

are commercial preparations that winemakers often use to supply micro nutrients and extra nitrogen to their fermentations.

Damaged Dry Yeast

Dry yeast looks like it is almost indestructible. However, dry yeast consists of living cells, and it must be handled with care. Yeast can be damaged easily, and yeast weakened by mishandling often has trouble fermenting juice to dryness. Dry yeast can be damaged several ways: (1) by prolonged storage at temperatures above 95 degrees, (2) by prolonged air exposure after the package has been opened, (3) by rehydrating yeast in water that is either too hot or too cold and (4) by thermal shock. (Thermal shock can be avoided by making sure the temperature of the rehydrated yeast solution is within 15 degrees of the juice temperature). Unopened packages of dry yeast will remain viable for at least two years when stored in a cool, dry place. However, once the package has been opened, the yeast should be used within a few months.

Excessive Acetic Acid

Acetic acid is toxic to all strains of *Saccharomyces* (wine) yeast. Yeast activity is curtailed when the acetic acid content of fermenting juice exceeds about 0.1 percent, and fermentation begins to slow. When the acetic acid content exceeds 0.2 percent or so, few viable yeast cells can be found, and fermentation stops.

A subtle fermentation problem can develop in the following way. Controlling bacteria with sulfur dioxide becomes difficult when the pH of the juice is high (above 3.8). Under these conditions, a large population of *Lactobacillus* bacteria can develop early in the primary sugar fermentation. The bacteria convert the grape sugars into acetic acid, and the acetic acid content begins to rise. *Lactobacillus* bacteria produce little ethyl acetate.

Acetic acid does not have a strong odor, and without ethyl acetate, the winemaker may not be aware of the problem. Undetected, the lactic bacteria can quickly raise the acetic acid content of the juice into the range of 0.1 to 0.4 percent. The yeast cannot tolerate such high concentrations of acetic acid. The yeast cells begin to die, and the fermentation soon stops. The unhappy winemaker is then left with a fermentation that is high in volatile acid and high in residual sugar. The high acid content and the high sugar level produce a sweet-sour taste that is characteristic of stuck fermentations containing too much acetic acid.

Prompt Action is Required

The winemaker should try to restart stuck fermentations quickly to prevent bacterial problems. First the winemaker should use a thermometer and make sure the temperature of the stuck fermentation is reasonable. If a nitrogen deficiency is expected, diammonium phosphate should be added to the stuck wine. When fermentation stops early and a large quantity of sugar remains, the additional nitrogen may restart fermentation. Next, the stuck fermentation should be racked with some splashing and bubbling. Sometimes just racking the wine and introducing a little oxygen will be enough to rejuvenate the yeast. When fermentation stops late and little sugar remains, the stuck fermentation should be re-inoculated with a fresh batch of alcohol tolerant yeast such as Pasteur Champagne or Prise de Mousse.

When All Else Fails

Some stuck fermentations are very difficult to restart and considerable effort may be required. The following method is often successful **if** the original problem has been corrected. (1) First make a gallon of starter using either Pasteur Champagne or Prise de Mousse active dry yeast. (2) When the gallon of starter is active, add a gallon of the stuck wine to the starter. (3)

Wait until the starter becomes active again, and then add two gallons of stuck wine. (4) Wait until the starter is active again, and then add four gallons of stuck wine. (5) Continue this process of waiting until the starter is active and then doubling the volume until all of the stuck wine has been added.

Once active fermentation is underway, the wine should be monitored carefully by measuring the Brix twice a day. When the hydrometer reads less than zero, test the wine with a Clinitest tablet to be sure all the sugar is gone

Summary

Most fermentation problems can be avoided by adding a complete yeast supplement like Super Food before the fermentation is started, and most winemakers feel the extra insurance is worth the small additional cost.

Wines containing residual sugar are susceptible to both bacterial problems and stability problems, so stuck fermentations should be restarted quickly.

The "doubling the volume" method will start most stuck fermentations if the original problem has been eliminated.