Racking

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When a fermentation ceases, the suspended particles settle rapidly and form a sediment. The sediment, referred to as lees, usually consists of macerated grape tissue, dead yeast cells and yeast autolysis products. The young wine is separated from the lees by transferring the wine to another container, leaving the lees behind. This process is called racking.

Racking accomplishes several objectives:
1. It aids in wine clarification.

2. It prevents new wines from picking up off odors. For this reason, prompt and early racking, usually within a week or sooner, is recommended. Cottrell (1983) reported that bad odors arise in proportion to the depth of lees, and in some exponential manner with the time spent on the lees. Sometimes a day too long can be disastrous.

3. It discourages malolactic fermentation and other kinds of microbial spoilage.

4. Racking aerates and helps in aging (especially red wines) unless it is done under the blanket of N_2 or CO_2 gas.

Racking is a simple operation and is often done without consideration of its impact on wine quality. It should be done with planning and care. Special attention should be paid in those cases where racking needs to be done in the middle of a vintage, but is postponed due to inconvenience or lack of time. The racking procedure depends the on kind and style of the wine.

Racking White Wine

A white table wine with a fruity aroma should be racked early. This is very critical if the must is high in nonsoluble solids and the fermentation is conducted with no temperature control. Sometimes a white must fermented at low temperatures (e.g. 45ºF) is given a mid-fermentation racking. White wine should be racked gently and excessive aeration should always be avoided. Uncontrolled aeration of wine (during racking) causes a loss of fruitiness and a darkening of color.

To minimize air contact and oxidation, many vintners rack wine under nitrogen or carbon dioxide blanket.

The following steps will assist in reducing aeration of white wine during racking:

1. Check the pump for leaks, particularly on the suction side. Use of a defective pump for racking will cause excessive aeration.

2. Always use a short hose on the suction side.

3. When transferring wine from a fermentation tank to a receiving tank, connect the suction side to the racking valve and delivery side to the bottom most inlet on the receiving tank. Allow the wine to flow by gravity to the receiving tank until the level of wine in the receiving tank is above the inlet valve. Then gently start the pump and transfer the wine. To prevent lees from being sucked in during the transfer, slow down the pump when the liquid level (wine level) in the fermentor gets close to the lees surface. If you do not have a variable speed pump, you may still be able to contol the speed of the pump by partially closing the valve on the suction side of the pump.

4. Use an in-line sparging device to sparge the wine with N_2 or CO_2.

5. Add $S0_2$ to the wine as it is being racked. This will prevent oxidatlon.

6. Chilling wine before racking will help in settling the lees and discourage malolactic fermentation. But extra care should be taken to avoid aeration because more oxygen dissolves at a lower temperature.

7. Clean, sanitize, and sparge the receiving tank or container with nitrogen.

8. After careful racking, the receiving container must be kept completely full.

Racking Red Wine

In racking red wine, one of the first things to consider is a malolactic fermentation. If the wine has been throuah malolactic fermentation (ML), and looks translucent, it is ready or racking. If ML has not occurred and you intend to encourage it, then leave the wine on the lees, and maintain other conditions favorable to malolactic fermentation.

A key difference in racking red wine as opposed to white is that in red wine limited aeration during racking is desirable since it helps in aging.

Young red wines are rich in phenolic compounds such as pigments and tannins. These substances impart a coarse, astringent and bitter taste to wine. Aeration (oxidation) helps polymerize phenolic compounds. Oxygen also participates in numerous complex reactions that cause aging.

Since controlled or limited aeration is essential for aging, it should be done early in the life of a wine, preferably during the first racking. In a traditional approach, the wine is splashed. This also drives off some off odors.

In a modern approach oxygen is introduced on the suction side of the pump and the amount dissolved is monitored on the delivery side. It is important to note that each wine has a specific need for the amount of oxygen required and the degree of aeration should be experimentally determined.

Rector (1984) reported a method to determine the extent of aeration as follows. Prior to racking a wine, take a barrel or bottom-valve sample and aerate the wine by splashing it several times until you have achieved complete aeration as verified by an oxygen meter. Then tightly stopper aerated wine in a completely full bottle and monitor the dissolved oxygen level on a daily basis, trying to avoid additional aeration.

If oxygen levels decrease rapidly (in 1-3 days), then the wine typically can withstand more aeration.

Even though red wine can stand some aeration, caution should always be practiced not to overaerate the wine. This means maintaining adequate levels of free $S0_2$, topping wine barrels (twice a week in the beginning, once a week thereafter), and not splashing the wine during subsequent transfers.

Acid Addition
When the grapes have low acid and high pH levels at harvest, the addition of tartaric acid prior to the fermentation is recommended.

The amount of acid will depend on the style of wine and the effect of acid addition on pH reduction. The addition of acid will usually cause a reduction in pH; however, this reduction is not directly proportional to the amount of acid added. This is due to the presence of buffers in wine.

A laboratory trial should be conducted to observe the pH reduction in response to acid addition. This information must be taken into consideration when adding acid to bring the pH and titratable acid into a desirable range.

The amount of tartaric acid needed to increase the titratable acidity can be calculated using the enclosed table. For example, suppose you receive a must with 0.5% TA and you wish to raise it to 0.7%. Looking at the table, you will find that to raise the TA by 0.2%, you will need 7.5706 grams of tartaric acid per gallon of must. This figure can be multiplied by the volume of must (in gallons) to determine the total amount of tartaric acid needed.

Some of the acid will precipitate as potassium bitartrate during cold stabilization. Therefore, the amount of acid to be added should be increased slightly to compensate for this loss.

1. Cottrell, Thomas. (1983). Common errors in small wineries. Proceedings, Ohio Grape Wine Short Course.

2. Rector, Bruce. (1984). QEA's. Practical Winery. Sept/Oct.

Amount of tartaric acid required to raise titratable acidity.

% increase in TA	Grams of tartaric acid per gal.	% increase in TA	Grams of tartaric acid per gal.
0.01	0.3785	0.26	9.8417

0.02	0.7570	0.27	10.2203
0.03	1.1355	0.28	10.5988
0.04	1.5141	0.29	10.9773
0.05	1.8925	0.30	11.3559
0.06	2.2711	0.31	11.7344
0.07	2.6497	0.32	12.1129
0.08	3.0282	0.33	12.4914
0.09	3.4067	0.34	12.8700
0.10	3.7853	0.35	13.2485
0.11	4.1638	0.36	13.6270
0.12	4.5423	0.37	14.0056
0.13	4.9208	0.38	14.3841
0.14	5.2994	0.39	14.7626
0.15	5.6779	0.40	15.1412
0.16	6.0564	0.41	15.5197
0.17	6.4350	0.42	15.8982
0.18	6.8135	0.43	16.2767
0.19	7.1920	0.44	16.6553
0.20	7.5706	0.45	17.0338
0.21	7.9491	0.46	17.4123
0.22	8.3276	0.47	17.7909
0.23	8.7061	0.48	18.1694
0.24	9.0847	0.49	18.5479
0.25	9.4632	0.50	18.9265

For a large volume, the amount in grams per gallon can be converted to ounces per gallon or pounds per gallon by using the following:

No. of ounces = grams
28.35

No. of pounds = grams
453.6