

How should 1 calculate and make water additions to facilitate the fermentation of red musts?

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Red grapes can sometimes have sugar contents that may be high enough to cause stuck or sluggish fermentations. At harvest, grapes may have a Brix >26 and include dehydrated or raisined berries. During fermentation, the alcohol that is produced can be sufficient to kill the yeast or severely restrict its ability to take up glucose and fructose and hence prevent the fermentation from completing to the desired level. The addition of water to the must can prevent such problems and is legal in some regions (Anon, 2002).

The amount that needs to be added is determined by a balance between the maximum Brix at which alcoholic fermentation can proceed in a timely fashion, the wine style to be created and the government regulations governing water additions. Once the amount has been established, we can calculate the actual volume using Pearsons Square (Rankine, 1991):

$$\text{Volume of water to be added} = \frac{V(D - A)}{C - D}$$

where V = volume of must, D = desired Brix, A = initial Brix and C = Brix of water (i.e. zero).

For example, how much water do we need to add to lower 500 L of must from a Brix of 27 to 24?

$$\text{L of water required} = \frac{500(24 - 27)}{0 - 24} = 62.5 \text{ L or } 1.25\%$$

The volume of must is calculated from the tons of grapes multiplied by the expected yield (L per ton) from the press e.g. if the yield for the press is 650 L/ton and 3 tons are going to be crushed, the volume would be $650 \times 3 = 1950 \text{ L}$.

There are several sources of error in deciding how much water to add. The biggest source of error is heterogeneity in grape ripeness and consistency. Both can lead to inaccurate estimates of the initial Brix of the must and result in an under- or overestimate of the amount required. If the growing conditions are not optimal, there can be a wide variation in the Brix of berries not only between clusters but also within berries on the same cluster (e.g., a dense canopy can lead to the exposed side of a cluster being riper than the side facing the canopy). Some varieties are more prone to heterogeneity than others (e.g., Zinfandel). The consistency for the berries may also vary. Most berries may be soft but still contain the normal amount of pulp. Others, however, may have dehydrated to the extent of being harder and raisined. The latter type actually needs to absorb liquid before the sugar in the berry is released. This can lead to the Brix of the must not decreasing or actually going up even though there are clear signs that fermentation has commenced. Therefore, in order to make an accurate estimate of the initial Brix, we must ensure that the must is thoroughly mixed and that raisined berries are removed or given time to rehydrate before making an

estimate. If the heterogeneity or inconsistency of the berries is not high and you do not plan to cold soak, waiting 24 hours after crushing and making an estimate after or during a pumpover may be sufficient. If the heterogeneity and inconsistency are high, then it is better to do a 3-day cold soak to give raisined berries time to release their sugar.

There are other consequences of making water additions that we need to be aware of so that we do not create other problems. Firstly, by adding water, we are not only diluting the potential alcohol but also the desired components of our wine, i.e. flavors, phenols, acidity and pH. Secondly, the dilution of these components is not predictable by a simple linear model because of complex chemical equilibria being shifted to different extents depending on the compounds present in the must. For example, after a 5% water addition, buffering by carboxylic acids may prevent the titratable acidity from decreasing by a similar amount. Nevertheless, we can counterbalance the dilution of flavors and phenols by conducting a saignée immediately after crushing. The challenge is that the removal of juice occurs before we can make an accurate estimate of the initial Brix. Adding tartaric acid, preferably after cold soak or just before alcoholic fermentation, can ameliorate changes in titratable acidity and pH.

References

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