MUST ADJUSTMENTS

By

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High quality fruit requires little or no pre fermentation adjustments. But, perfect fruit is difficult to obtain so pre fermentation must adjustments are commonplace. For warm climate grapes, the most frequently made must adjustments are sulfur dioxide, acid and yeast nutrients.

When completely ripe, grapes grown in warm viticulture regions like San Diego are often deficient in acid. When fermenting warm climate fruit, winemakers often add tartaric acid to the must to increase the titratable acidity and produce a wine with better balance. Sometimes grapes grown in warm regions are not picked quickly enough and they contain too much sugar. Then, the winemaker may add a small amount of water to the crushed grapes to reduce the alcohol content of the wine.

Some vineyards produce grapes that are deficient in nitrogen year after year. Musts that are low in nitrogen ferment poorly and they often produce stinking fermentations. Winemakers add small amounts of di-ammonium phosphate and proprietary yeast foods to these musts to help the yeast complete fermentation and to minimize hydrogen sulfide production.

Sulfur Dioxide (SO_2)

Small amounts of sulfur dioxide (SO_2) can help winemakers control fermentations by deactivating enzymes that cause browning and by suppressing unwanted microbes. Reasonable amounts of SO_2 will **not** kill wild yeast. However, the added SO_2 can suppress wild yeast activity for several hours and it can also subdue most wine bacteria. Malolactic bacteria are sensitive to sulfur dioxide, so pre fermentation sulfur dioxide additions should be limited to 50 PPM or less if malolactic fermentation is desired later in the winemaking process. Many winemakers add from 30 to 50 PPM of SO_2 when red grapes are crushed and from 50 to 100 PPM for white grapes.

The following table can be used to determine the number of grams of potassium metabisulfite needed.

SO2	POUNDS OF GRAPES									
(ppm)	**100**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1,000**
10	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0
20	1.6	3.2	4.8	6.4	8.0	10	11	13	14	16
30	2.4	4.8	7.2	10	12	14	17	19	22	24
40	3.2	6.4	10	13	16	19	22	25	29	32
50	4.0	8.0	12	16	20	24	28	32	36	40
60	4.8	10	14	19	24	29	33	38	43	48
70	5.6	11	17	22	28	33	39	45	50	56
80	6.4	13	19	25	32	38	45	51	57	64
90	7.2	14	22	29	36	43	50	57	65	72
100	8.0	16	24	32	40	48	56	64	72	80

Sulfur dioxide is more effective when it is added early and it is uniformly distributed throughout the must. Commercial wineries often have an SO_2 container and a metering pump mounted on the crusher and sulfur dioxide is automatically dispensed anytime grapes go through the crusher. Home winemakers usually dissolve potassium metabisulfite powder in a small amount of water and add the sulfite solution as the grapes are crushed.

Acidity

The tart taste of wine is directly related to how much acid is present, and wines containing too much or too little acid will taste out of balance. Local grapes are often too low in acid and tartaric acid additions to musts are routinely made. White wines are often finished with a bit of residual sugar, so most home winemakers prefer to ferment white juice when the titratable acid (TA) is between 6 and 9 grams/liter (0.6 – 0.9 %). Red musts are often adjusted to a titratable acid content of 6 or 7 g/l before starting fermentation. Acidity and tannin level both contribute to roughness, so musts for "big red wines" are often adjusted to a titratable acid of about 6 g/l.

Care is needed when making acid adjustments because the TA of the wine is difficult to predict from juice values. There are several reasons that the TA values of the finished wine often differ from the values predicted from the juice. (1) Titratable acid decreases when potassium bitartrate precipitates during fermentation. (2) Yeasts metabolize small amounts of malic acid during fermentation and the TA decreases as the malic acid is consumed. (3) Bacteria convert malic acid into lactic acid during malolactic fermentation. Malic acid produces two protons but lactic acid produces only one proton so the TA decreases during malolactic fermentation. (4) Yeasts produce succinic acid and small amounts of other organic acids during fermentation, and the additional acids cause the TA to increase. Sometimes the increase in TA is about equal to the decrease, so the TA of the wine is about equal to the TA of the starting juice. But this is not always the case and differences of 1.5 grams per liter can occur. So, adjusting juice acidity involves more than just an arithmetic exercise. Some experience is needed.

Wine quality is better if large acid adjustments are made **before** the fermentation is started. Therefore, most winemakers start making measurements as soon as juice is available and they make any needed acid adjustments before the yeast is added. Always be conservative when making acid adjustments. Adding a little more acid is easy, but removing too much acid from a wine is difficult.

Yeast Nutrients

Healthy fermentations contain about 100 million yeast cells per milliliter of liquid, and the yeast must reproduce many times in order to produce such a large numbers of cells. The yeast requires nitrogen, oxygen, vitamins, minerals, amino acids, etc. to produce new yeast cells, and sluggish or stuck fermentations often occur when musts lack these necessary materials. Large wineries measure nutrient levels in juice and adjust accordingly. Small wineries and home winemakers simply add minimal quantities of nutrients to all of their fermentations. They consider the extra nutrients an insurance policy.

All nitrogen and yeast nutrients should be used with care because excessive quantities can produce off-odors and other problems in the finished wine. Many winemakers add half a gram each of DAP and SuperFood (or other proprietary yeast nutrient) for each gallon of must or juice when they start a fermentation. Then, the same size dose may be added a couple of day's later if the fermentation seems too sluggish. Directions provided by the manufacturer should be carefully followed.

In addition to sluggish fermentations, yeast also produce hydrogen sulfide when musts lack nitrogen. Fermenting must should be carefully smelled each day and small additions (~1 gram per gallon) of di-ammonium phosphate (DAP) should be made as soon as a stinking fermentation is detected. But, extra nitrogen should **not be added** to any fermentation after the alcohol has reached nine or ten percent. The high alcohol level prevents yeast cells from utilizing the added nitrogen and excessive amounts may remain in the wine.

Yeast may also produce excessive amounts of hydrogen sulfide when musts are deficient in pantothenic acid. Pantothenic acid is vitamin B-3 and it is available at any drugstore. The yeast needs only small amounts of this vitamin, and an addition of two tablets of pantothenic acid to a ton of grapes is very cheap insurance.