



MoreWine's

MoreManual! on White Wine Making

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General Overview:

The goal of this paper is to help you understand the basic, overall wine-making process so you can learn to confidently make your own quality wine at home. It is highly recommended that this paper be read through completely before you start to make your wine. The reason for this is because wine-making is made up of a series of consecutive steps which build on and directly effect each other from the very beginning to the very end. Therefore, it's easy to see that in order to make the best wine possible you will need to make the best decisions possible at each of these steps, and in order to do that, you will need to have a general understanding of the overall process as a whole.

In general, wine-making is made up of the following steps:

- You obtain your juice, either by crushing, de-stemming, and pressing fresh fruit, or by reconstituting the juice from a kit.
- You test and adjust the juice so that it has the correct sugar level, Total Acidity%, Ph, and SO₂.
- You activate the wine yeast.
- You add the yeast and ferment your juice (preferably at a cooler temperature, 50°F-60°F).
- Once the ferment is over, you transfer the wine of off the sediment that has collected at the bottom of the fermentation vessel.
- You then re-test and adjust the wine for the Total Acidity%, pH, and SO₂. You may also choose to do a MaloLactic Fermentation (MLF), and/or add oak at this time.
- The rest of the process involves transferring the wine of off the sediment that will continue to precipitate out over time, "fining" it (making it clear-up), adjusting the Total Acidity%, pH, SO₂, and adding your oak. You will need to do this once every two to three months over the next 6-9 months.
- Finally, you bottle (or keg!) the wine.

We will now address each of these basic steps in greater detail. So, please read on and welcome to the world of wine-making!

Let's Begin,

1) Before the Crush:

Examine the fruit and remove any raisin or rotten/molded clusters. The fruit should ideally be in sound shape, free of defects and not blistered. If you are using fresh fruit, hopefully you will be able to pick when the sugars are in the correct range (18°-24° Brix*). If not, you will have to address this after you crush (either by adding sugar to raise the °Brix, or diluting the must to lower the sugars). If you are using a kit, you don't need to worry about this, as you will be diluting your concentrate to the correct sugar level during your first step, anyway.

***Note:** you measure the °Brix with a refractometer (MT700) or a standard hydrometer (MT310), -just take your reading off the °Brix scale and not the Specific Gravity scale. The grower, or your source for the grapes will be able to tell you where the °Brix are at because this determines when they are picked.

2) Crush the Grapes:

The goal here is to make sure that all of the berries have been sufficiently cracked open to allow the juice to be more easily extracted during the press. Unlike red grapes, when you crush for a white wine, you do not need to separate out the stems from the juice. In fact, you should leave them in because they will act as a framework to keep all of the skins from clumping together and plugging up the press. The exception to this is if you will be doing a cold-soak on the skins for any extended length of time (generally 2-12 hours). In this case, you will want to remove the stems at the crush, reserve them, do your soak, then add the stems back to the must when you press. The reason for removing the stems is because if they are left in the juice for an extended period of time, the tannins found in them will start to leach out and give the must a slightly harsh and bitter taste that will come through in the finished wine.

For small amounts, crushing can be done by hand. However, for larger amounts, you will probably want to purchase or rent a crusher-stemmer (WE220). The combination of juice, skins, seeds, and pulp is now called "must".

-Note that you will probably want to sulfite fairly soon after you crush in order to avoid any possible contamination of the must before you introduce your cultured starter, as well as to inhibit any enzymatic browning. Therefore, it might be a good practice to do the crush, take a sample of the juice for your tests, add your SO₂, then run your tests.

3) Testing the Must (to determine the possible additions needed in order to prepare the must for the addition of yeast):

This is the part that, while you may be tempted to not bother doing it because it is a hassle, you really should do it. Period. Making good wine is achieving a balance between all of your variables, and it is definitely a combination of both art and science. You need to know your numbers because very rarely will you naturally get a grape that has the perfect ratio of total acids, sugar, and pH. The quality of the grapes withstanding, the difference between you making a wine worthy of a box, or a wine that you will be proud of and hesitant to give away, is the balance of each these various elements with each other...So, let's test the must!

a) Test the Sugar:

As previously mentioned in the general overview, you measure the sugar level with a hydrometer (MT310). (You may also use a refractometer at the crush. However, once fermentation has begun, the presence of alcohol in the sample will throw the result off and you will have to then rely on a hydrometer for accurate sugar readings).

Ideally you want a sugar level of 18°-24° Brix, with 20°-23° Brix being the normal range for the start of a white wine.

-If your sugars are lower than 18° Brix, you can bump them up with table sugar (sucrose):

1.5 oz. of table sugar per US gallon raises the Brix by 1°

-If your sugars are higher than 24° Brix, you may choose to leave it and make something "big". However, if they are too high, depending on your yeast strain, you may get a wine that does not ferment all the way "dry" (less than 1% residual sugar). Now this may be what you are indeed after, if you want to make a "dessert"-type wine...but, if it isn't, you can avoid this by diluting the juice to the 18°-24° Brix range with water (Note that if you do this you will also be diluting your Total Acidity%, and this will need to be taken into consideration). Use filtered/distilled water, not from the tap if you can avoid it, because you neither want the chemicals found in tap water to inhibit your yeast, nor do you want to possibly contaminate the final flavour of your wine!

-If you are using a kit, then dilute the concentrate to the desired °Brix level and proceed from there.

If you don't have a scale (MT358):

1 tsp of table sugar = 5 grams (.17 oz.)

8.8 tsp of table sugar = 1.5 oz.

b) Test for the Total Acidity%:

Test the must with an acid test kit* (W500). Ideally you would want the TA% level to be in the .65%-.9% range. This is an important number to get right, so double-checking your results would be a good idea.

-If your result is much lower than .60% then you will need to raise it at least to this level.

-If your acids are in the .9%-1% range, then you will want to consider lowering them. One of the best way to do this would be to do a Malo Lactic Ferment ("MLF"- more on MLF later).

3.8 grams Tartaric Acid per US Gallon raises TA by +.1%

If you don't have a scale:

1 level teaspoon Tartaric Acid per US Gallon raises TA by +.12%

1 tsp Tartaric acid = 5 grams.

***Note:** you can also check for the TA% with a pH meter. All you do is run the same test as with the acid test kit and titrate to pH 8.2, treating this as your endpoint in place of the colour change. You then deduce the results in exactly the same way.

When adding acids, you should be aware that a wine will most gracefully be able to absorb higher levels of an acid addition during the earlier stages than it will in the later, post-fermentation stages. Also, the earlier that you can introduce the acid addition, the more time you will have for it to react and interact with the other elements in the wine during its early development, thus allowing the addition to become better blended in the final, finished wine's flavour. Therefore, if you make your main (large) correction to the must, then, later on you will hopefully only need to make minor ones to your wine.

-This being said, however, it is also important to keep in mind that an introduced acidity becomes more apparent in a wine as it ages and the fruitiness starts to fade: an adjustment that maybe seemed to be just right early on might end up being a little too tart in six months to a year. Therefore, when making large adjustments to your must or wine, it's generally best to use a conservative, two-step approach: make one addition now (in the middle range of what you are shooting for), then, if it needs it, add a little more later.

Another factor to consider when calculating acid adjustments is that the TA% will drop .05%-.1%, or even more, naturally during fermentation, and if you will be doing a malo-lactic fermentation (MLF will be discussed in detail later), that will also lower your acid level by another .15%-.4%. So, based on the acid level that the grapes are at when harvested, as well as how you will be making your wine, you will need to keep all of these factors in mind when you make your initial adjustments. However, if

you are not sure of what you will be doing, then shoot for the .7% TA range for the must and go from there.

-Whatever amount you decide on, it would be a good idea to mix the acid with some of the juice from the must or wine before adding it to whatever you may be correcting. The idea here is to make sure that the crystals are completely dissolved so that your correction will be evenly dispersed and equally mixed in.

c) Check the pH:

Ideally the pH of a white wine would like to be in the 3.1-3.5 range. Above 3.6 and the wine will be unstable and will not have a long shelf life. Under 3.1, the wine may be too sour (especially if it's TA and RS (residual sugars) aren't balanced). If you have a pH meter (MT602-607), now is the time to use it. If you do not, it is probably safe to say that if your TA% and sugars are at their correct levels, then your pH level is fine.

A general fact that might be helpful when taking a wine's pH into account is that the higher the acid, the lower the pH. So, if your pH is high and you need to make acid adjustment, then this will also help to bring your pH down. The inverse is equally correct: if your pH is low, then lowering your acids (with a cold stabilization, chemical adjustment, or with a MLF) will raise your pH.

Note: While it's not as crucial as TA% from a possible adjustment point of view, knowing the pH of the must and subsequently of the wine is extremely important because it tells you how your sulfite additions will behave...

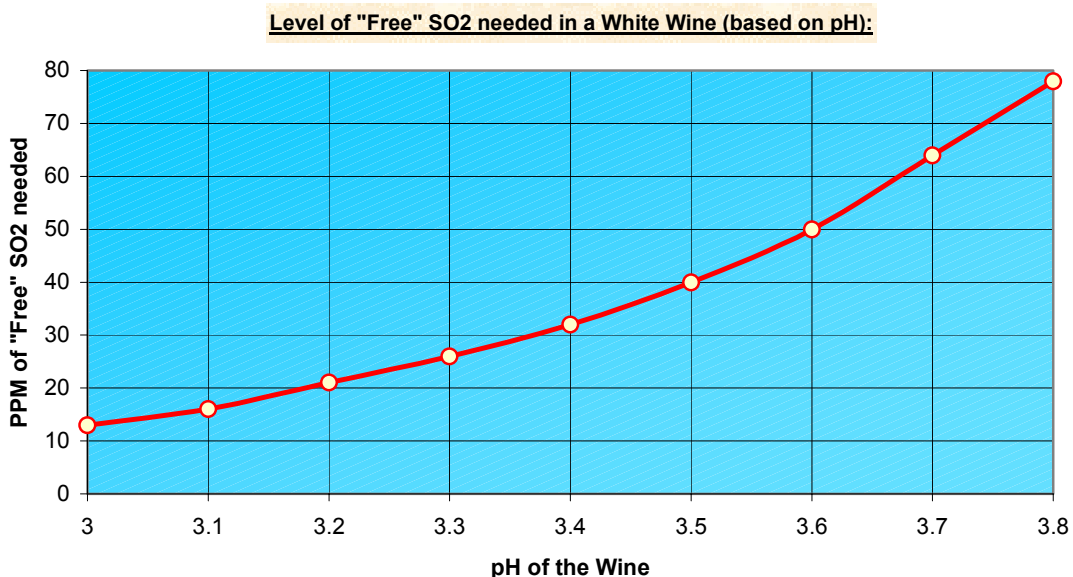
d) Test for the Sulfite Addition:

It is important to start this section with some information. Potassium Metabisulfite ("Sulfite", "Meta", "SO₂") (AD495) is used in winemaking in the post-crush/pre-inoculate stage for killing unwanted bacteria and wild yeast, thereby effectively creating a "clean slate" for the more desirable and SO₂-tolerant cultured yeasts to get in and do their job. It's used as a general sanitizer at all stages of the winemaking process. Post-ferment, it also prevents the enzymatic browning of white wines and guards against premature oxidation in both reds and whites. It preserves freshness and colour and it stabilizes a wine, thereby extending the shelf life of your labours. If a wine does not contain the required amount of SO₂, chances are that it won't gracefully make it past one year (depending on the pH). As all wine benefits from the aging process, wouldn't it make sense to try and understand what we need to do in order to make sure it will go the distance?... Of course it would. And therefore, I invite you to read on and enter the exciting world of sulfite additions!

-To begin with, the actual amount needed is quite small, and is referred to as "ppm" (parts per million). There are two forms of sulfite that you need to be aware of: Bound SO₂ and Free SO₂. When you make your SO₂ addition, a portion of it binds with elements in the must or wine (acetaldehyde, yeast, bacteria, sugars, and oxygen) and is referred to as "bound". The rest of the addition remains unbound and is referred to as "free". It is this latter portion that we are interested in because only the "free" SO₂

brings you all of the previously mentioned benefits that your wine both needs and deserves.

The goal with SO₂ additions is to try to use the least amount needed in order to attain a beneficial saturation level (roughly 0.5 ppm molecular SO₂ for reds, and 0.8 ppm molecular SO₂ for whites), while trying to avoid adding too much, which would flaw the wine by giving it a sulfite smell and/or taste... What makes adjusting to this ideal level interesting is that the actual amount of SO₂ that will end up as “free” after you make your addition actually varies in direct relation to the pH of the must or wine! In short, the higher the pH the more SO₂ will be needed, and conversely, the lower the pH the less SO₂ will be needed to attain the ideal level... Take a moment now to look at the following chart and you will see how this all comes together:



So, by now you are asking “What does all this really mean to me?”, and more importantly, “How do I use this information?”... Well, it’s actually fairly straightforward. To begin, you will need to test the must or wine for its “free” SO₂ level. There are a few ways to do this, but by far the simplest way for the home wine-maker would be to use the kit made by CHEMetrics. It is a Ripper-method titration cell and it’s manufactured under the brand name “Titrets” (W510). One nice note about the Titrets is that since you are testing a white wine and the test uses a colour change as its indicator, it’s quite easy to come up with a clear and accurate result. (There are other factors involved that make the testing of red wines with “Titrets” more difficult and somewhat inaccurate, but for white-wine makers these happily don’t apply).

-Following the directions, test the must or wine with your sulfite test kit and find out where the “free” SO₂ level is. Now, if you happen to know your pH, you can then reference the chart and see exactly where the must or wine’s ideal sulfite level should be. The difference between these two numbers* will be what you will want to make up in order to bring the “free” SO₂ in the must or wine up to the appropriate level (*Note that, contrary to what you may think, this is indeed applicable to the must at the time of the crush because SO₂ is used in the grape-growing process and it may already be present even if you have not added it, yet..). So far, so easy... However, you can’t

just add in the difference as a straight quantity because, as you will remember, a portion of your addition will become “bound” and therefore will be useless to you...So, knowing this, how do you make sure that your SO₂ addition will contain the exact amount of the “free” SO₂ needed? Well, you could bite off the end of a bag and shake it until the billowing cloud “looked about right”..., or, if you’re not feeling lucky that day, you could opt to use the following equation!:

$$\frac{\text{PPM of “free” SO}_2 \text{ needed} \times 3.785 \times \text{Gallons (US) of wine you are adjusting}}{0.57 \text{ (the actual \% of SO}_2 \text{ that will become “free” in your addition)}}$$

-So, as an example:

If your sulfite test kit indicates that your wine has a “free” SO₂ level of 12 ppm, and say that it is a white with a pH of 3.4, then you know that according to the handy chart, a white with a pH of 3.4 would ideally like to have a “free” SO₂ level of 32ppm. So,

$$\begin{aligned} & 32 \quad (\text{where the ppm of “free” SO}_2 \text{ should be according to the chart based on the wines pH}) \\ & -12 \quad (\text{what the actual sulfite level of your must or wine is currently at, based on your test}) \\ & = 20 \quad \text{This is the amount of “free” SO}_2 \text{ that you will want to add in order to bring it} \\ & \text{up to the ideal level. So, let’s plug it in to the equation:} \end{aligned}$$

**-It is important to note that the number you get for the “ppm of “free” SO₂ needed” for your adjustment needs to have its decimal point moved three places to the left before you plug it in to the equation! In this example, the 20 ppm of “free” SO₂ needed to be added goes into the equation as .020...*

$$\frac{.020 \times 3.785 \times 5.5 \text{ (say you have 5.5 gallons)}}{0.57} = .730 \text{ grams of meta}$$

So, the magic number to add in order to get your 20 extra ppm of “free” SO₂ (to bring you up to the 32 ppm that you need), is .730 grams.

If you don’t have a scale:

$$\begin{aligned} & \frac{1}{4} \text{ tsp SO}_2 \text{ per 5 gallons (US)} = 50 \text{ ppm. Fudge accordingly.} \\ & \underline{1 \text{ tsp SO}_2 = 5.9 \text{ grams.}} \end{aligned}$$

-You can also make a 10% stock solution and add it via a graduated 5 ml pipette: In a 750 ml bottle (standard wine bottle size), put in 75 grams (circa: 12 tsp) of

potassium metabisulfite. Fill the bottle ½ full with warm water shake until crystals are dissolved, then top up with cold water. Add it according to the following table:

Amount of 10% SO₂ Solution Needed to Add:

	10 ppm:	30 ppm:	50 ppm:
Per Liter:	<u>.18 ml</u>	<u>.53 ml</u>	<u>.88 ml</u>
Per Gallon (US):	<u>.67 ml</u>	<u>2.00 ml</u>	<u>3.33 ml</u>

If you don't have a pH meter or an SO₂ test kit ("Titrets"):

-Typically, you can just add 50 ppm (1/4 tsp per 5 gallons) of SO₂ at the crush. On the other hand, if there were rotted or blistered clusters mixed in with your grapes, or you run your tests and find that you have a high sugar/low acid/high pH must, then you may want to add as much as 80-100 ppm for this first addition. True, this sounds like a lot to add, but keep in mind that the must just after the crush will have a lot of solids in solution, so a good portion of the 80-100 ppm SO₂ will become bound at this stage. (However, you will want to keep the SO₂ levels low if you will be doing a MLF (depending on the strain). In this case, do not add more than 50 ppm before you ferment).

Post-ferment (and if the MLF is done), you may also want to augment the SO₂ level during your transfers, but by very little (25ppm...). Finally, you will add another 40-50 ppm at bottling time. By doing this you will only be maintaining a generic level of SO₂, and you obviously run the risk of having it be too much or too little. Still, this is still far better than not doing it at all.

-Just an important reminder: with all the benefits of potassium metabisulfite comes a need to respect its nature. Its fumes are highly caustic and care should be used when handling it (depending on how sensitive you are to it, you may want to use rubber gloves). You should avoid breathing it and do not get it in your mouth, or eyes.

e) Optional Possible Additions:

-Enzymes (Pectic): can be added in order to speed up the maceration process (the breaking down of the skins). This is done in a white wine primarily in order to increase the yield when the grapes are pressed. It will also help the wine to clear out quicker and this in turn makes later filtrations easier. However, it will also create more pulp and sediment that will end up at the bottom of your vessel after the press. In addition, enzymes require a contact time with the skins before fermentation starts in order to work, and if you are concerned with trying to limit the lag time from when you crushed the grapes to when you add your yeast (an example would be if it is very warm

outside and you do not have access to refrigeration and you did not want the must to start fermenting before you pitched your yeast), then this may not be worth the gamble.

This being said, if you do choose to use them, enzyme treatments come in both liquid and powder forms that are simply added to and mixed throughout the must at the time of the crush. Each product has a different set of criteria as to how much to use and how long it needs to be in contact with the skins in order to be effective.

-Note that if you are interested in extracting some of the varietal characteristics of the grape, along with a little colour and some extra nutrients, then you might want to consider putting your must through a “cold soak” before you press. (More on this later.)

- Yeast Nutrients/Fertilizer: is usually made up of DAP (Di-Ammonium Phosphate) and yeast extract blended together along with other vitamins and minerals and is used as a yeast energizer/fertilizer at the beginning of fermentation (an example of this would be “FERMAID K” (AD345). It is often used in white wines at the crush, as they are not fermented on the skins and are therefore deprived of a good source of nutrients. It is also good to add DAP to both reds and whites if you think you might have some residual sulfur on your grapes, because it will serve to strengthen the cultured yeast against the possible weakening effects that a higher than desired level of SO₂ would bring. (This being said, it is good to remember that cultured yeasts are tolerant of SO₂ within limits, but they are not immune to it if that level is too high.) Finally, the addition of a yeast nutrient to the must also helps to avoid possible stuck or sluggish fermentations. In short, the use of a yeast nutrient is probably a very good idea...

-Use: 1 pinch for a yeast starter / hydration

-Use: 1 tsp Per 5 gallons of must

-Use: 1 gram per gallon for FERMAID K

-Oak: It is interesting to note that you can simulate a “barrel fermentation” by adding oak chips (OAK264) or cubes (OAK560) to the must before you inoculate:

-Use: 1 Oz./ 5 gallons of Oak Shreds or,

-Use: 2 – 2.5 Oz./ 5 gallons of Oak Cubes (or ”Beans”)

4) **Make Your Additions to the Must:**

By now, you should have run your tests and know whether or not, and by how much, you will need to adjust the sugars and the TA% (will you be doing a MLF?...). If you will be using an enzyme and/or will be adding any yeast fertilizer/nutrient/DAP (or any oak for a “barrel ferment”), now is the time to do that.

You can combine all of these additions together and then just add them to the must/juice after you make your SO₂ addition. By waiting to add the other additions after the SO₂ addition, you allow the SO₂ time to start working before any nutrients are introduced. This makes sure that you will not be feeding any of the very organisms that

you are trying to eliminate! It also gives the SO₂ time to become “bound” and “free”, as well as to insure that it gets evenly distributed throughout the must. In addition, the SO₂ in its pre-distributed/pre “free” and “bound” (in short, highly concentrated) state can also render some of the nutrients in the yeast fertilizer ineffective as well as inhibiting your enzyme additions.

Make sure that your additions are completely dissolved into solution before you add them to the must/juice, and that the overall combined addition itself gets completely mixed into the must/juice.

-Note that you will want to avoid breathing the fumes that will result from the SO₂ addition. And, you will want to wait ½ hour for the SO₂ addition to stabilize into its “bound” and “free” forms before you introduce your yeast. Theoretically, the reaction of SO₂ as it goes to its “free” and “bound” forms is very quick, and as long as you ensure that gets completely mixed into the must (with no concentrated pockets), you should be able to pitch your yeast right after you make your addition. However, if you have used a larger amount of SO₂ (80-100 ppm) because the grapes were in bad shape (or because a calculation was botched), you should probably wait 3-4 hours before pitching your starter.

5) **Press or “Cold-Soak” the Must:**

With the must now properly adjusted, all that is left for you to decide is how long you want to wait until you press the juice off of the skins and initiate fermentation. You could choose to press immediately, thus keeping the juice light and fruity, or you may increase the contact time in order to pick up a little more complexity and body (but with a little less of the fruit coming through...). Or, perhaps you have chosen to use an enzyme and you want to be sure that it has enough time to do its work... One thing to be aware of is that while you may gain something from this extended contact time, you may also pick up herbaceous or otherwise undesirable flavours, as well. Also, if you will be soaking the grapes for more than 2 hours, you will want to cover the must with plastic wrap to keep the SO₂ from dissipating and make sure that you will be able to refrigerate the must to below 50°(F). Besides inhibiting the spontaneous start up of any wild bacteria or yeast during the soaking period, the colder temperature also provides the additional benefit of producing a more flavourful juice when pressed. However, if you are not sure of how long to soak or do not have access to refrigeration, you may want to limit the soaking period and/or just press as soon as you have made your adjustments to the must.

-As for the press itself, you can use anything from a nylon mesh bag (BAG24) into a food-grade bucket (MM300) for smaller batches, to an actual wine press that can be purchased or rented for the day (WE110-WE160).

a) **“Free-Run” and “Pressed”:**

When you press the wine from the skins, a large portion of it will run through the press before any pressure has been applied to the skins. This is called “free-run”, for obvious reasons, and it is believed to make a better wine than the portion that will have

to be squeezed out of the skins, referred to as “pressed”. The reason that the “pressed” portion is not as good as the “free” portion is that while the act of pressing does yield more wine, it also extracts some of the harsher tannins from the skins. It is for this reason that it is a good idea to press lightly and to taste the run-off frequently in order to monitor the end point for each press. This will be fairly evident because the wine will start to taste “thin” and have a slightly astringent quality. You may even want to separate these two portions of your press and ferment them individually. You can always blend them, but you won’t be able to separate them at a later date!....

b) Settling Out the Solids:

After you press, a large amount of solids will settle out in your vessel over the next 12-24 hours. It is generally believed that if you wait and rack the cleared-up portion before you pitch your yeast, it will make a better wine. -Note that if you do this, you should remember to cover the surface of the wine with plastic wrap to keep the SO₂ from dissipating, and if you can keep it cool that would be preferable.

-Rack the clear portion of the must off of the layer of solids into the vessel you will be fermenting in (carboys (FE330 and FE320), barrels...), filling it only $\frac{3}{4}$ full and top it with an airlock (FE370). The extra space at the top of the vessel is required because you will need to allow room for the head of foam that will result from fermentation.

6) Prepare the Yeast Starter:

This is done in two steps if using a dry yeast, or only one if using a liquid strain:

-Dry Yeast:

First you hydrate the yeast, following the directions on the packet. This is quite simply just pouring the contents of the packet into a cup/bowl containing the specified amount of warm water (usually 10 ml’s of water per gram of yeast is about right) and waiting until it becomes active- you will usually see signs of activity in 10-15 minutes depending on the strain*. It is important to make sure that the water is bottled/filtered (distilled is best) to avoid any chemicals that might retard the yeasts awakening, and that the water’s temperature is at around 100°. The reason for the water being warm is that yeast will be more active at warmer temperatures. Remember that warm is good (around 95°-105°), but if you make it too hot, you can also poach them...It is also a good idea to add a pinch of a complete yeast fertilizer to the warm water before adding your yeast (this will aid them in their revival process).

***Note:** that you do not want to exceed 30 minutes during this initial stage (using only water) because the yeast will use up whatever stored energy they had in them to hydrate themselves and will be ready to take in nutrients immediately after you start to see signs of activity. In general, if you add the yeast to the warm water, wait 20 minutes, then proceed to the next stage, you will be fine.

Once the yeast has become active, it is time to begin the second step: building up your starter. Ideally you want a large population of healthy, active yeast in order to get your fermentation off and running, thereby crowding out any other possible

undesirable contaminants (wild yeast, bacteria, etc.). So, in order to start the multiplying process, you need to feed your starter. This is best done by adding ½ of your initial water volume in juice/must to the newly revived yeast. For example, if you used 50 ml's of water (for 5 grams of yeast), then you simply add 25 ml's of juice/must into the starter. You then wait until it is actively fermenting (this usually takes around 15-30 minutes) and then you are ready to pitch.

-Attention, relevant explanation!: The reason for the two steps in this process: first hydrate, then build up in a 50% juice solution before pitching, as opposed to just adding the yeast from the water directly into the must, is because the newly awakened yeast are not yet completely hardy and need to acclimate themselves to your must. By using the two steps, you avoid shocking the yeast and create a buffer zone between the water and the must. This insures that your starter population will be well adjusted, and as healthy and as vigorous as possible right from the start.

-Liquid Yeast:

Since the yeast is already hydrated, you only need to carry out the second step from above, namely building your starter up in a 50% juice/water solution for all of the same reasons. Again, you can add a pinch of yeast fertilizer to liven things up, if so desired.

A Note About Juice: If you are using the juice from fresh grapes in your yeast starter build-up, make sure that you take your juice from the recently-crushed grapes before you make your SO₂ addition. If you are using a kit, you can use grapes (or oranges) from the store as a source for fresh, sulfite free juice. However, if you are using pre-packaged juice from a store, remember that many of them contain sulfites in order to preserve them (and you don't know how much was used...). Therefore, if you can find organic/non-treated juice this would be a much better choice...Remember that a high level of sulfites could possibly compromise your yeast in its early developing stages, so if at all possible, take care to avoid them when building up your starter...However, if you can't find fresh fruit and have no choice but to use a possibly suspect juice for your starter, don't despair, use it. Cultured yeasts are quite hardy, and remember that you will be diluting the juice at this stage by half with water and that this will dilute any potential sulfite presence. So, in fact, the chances are that you will be perfectly fine. The presence of sulfites in some store-bought juices is only mentioned here in order to help you understand all of the possible factors at work so that you can make the best choices possible.

7) Pitch Your Yeast Starter:

When you pitch your starter, you will just want to distribute the yeast over the top of the must/juice in an even, wide layer. At this early stage, you do not want to mix it in. The goal here is to increase the surface area of the yeast so that the largest number of cells will be exposed to oxygen, thus aiding their reproduction. If you happened to have an oxygenation system (FE375) this would be a great boost for the yeast. Only at

this beginning stage in the wine-making process will oxygen be your friend, and after you start to see signs of fermentation you will want to avoid it completely for the rest of the wine-making process.

a) Temperature for Fermentation:

Setting the correct temperature is a two-step process. While a white wine will ideally want to ferment in the 55°(F) range, this is too cold to get the yeast established. So, what you do is pitch your yeast at room temperature 65°-70°(F), and after you see signs of fermentation (usually in 12-24 hours after pitching) you then lower the temperature to 50°-60°(F) and ferment accordingly.

-Note that while you can ferment a white wine at warmer temperatures, you will lose much of the bouquet and fruitiness of the wine if you do so. One nice and easy way to do avoid this is to use a temperature controller (FE600 or FE610) with an old refrigerator. You just put the probe in the fridge, set the control to 55° and the device turns the fridge off and on, maintaining your desired degree setting. Then, when the fermentation part is over, the fridge just doubles as a wine cellar for the rest of the year! However, if you will be doing white's, and you don't have access to temperature control, you will want to keep it as cool as possible.

8) End of Fermentation, “Topping-Up”:

When the hydrometer shows 0° Brix, it is time to rack (R310) the wine off of the layer of solids at the bottom of the vessel (unless you will be doing a MLF, as will be discussed in the next section). This is done so that the wine can safely finish fermenting until it is completely dry*. The reason that the wine needs to be removed from this sediment is that a prolonged exposure to it might cause reactions that could generate off-flavours and otherwise ruin the wine. This layer of solids that has been dropping out and accumulating at the bottom of the vessel is referred to as the “gross lees” for the initial large deposit you will get directly after fermentation, and then as just the “lees” for the smaller amounts you will get on subsequent settling-out periods.

*It is important to note that even though the hydrometer may read 0° Brix, there are still sugars present in the wine and fermentation is still taking place. It is the presence of alcohol that throws-off the reading. In fact, for a true reading of 0° Brix in a wine you will need to be closer to -1.5°/-2° Brix on a hydrometer (for this reason, as your fermentation approaches 0° Brix, you may want to invest in a +5° / -5° hydrometer (MT318). However, once your wine is truly under 0°Brix you will need to check the “dryness” (or the “residual sugar” level) with a test called a Clinitest (MT920). It is a tablet that gets dissolved in .5 ml of the wine and you then check the results against a colour chart (MT921). Wines generally ferment to dryness in about a month...

-It is also very important that you start to limit the wine's exposure to oxygen from here on out, and to this end the ¾ filled vessels are consolidated and filled to the top in order to minimize the headspace (and therefore the surface area that could potentially be exposed to any oxygen). This is referred to as “topping-up”, and is done

because with the wine now still, you are no longer generating the constant supply of CO₂ that protected the wine from any O₂ contact during fermentation.

One way to help avoid any potential O₂ contact with your wine is to invest in a small gas set-up. This is quite simply a small tank of inert gas (5lb size: CO₂* (D1050), Nitrogen (D1054), or Argon), a regulator (D1060 for CO₂ and D1070 for N), and some tubing (you could even add a dispensing- wand (KEG850) to make it really convenient...). Once you are set-up, all you do is flush the vessel you are racking into with the inert gas (this displaces the O₂), and then transfer! No O₂, no problem...

Another bonus to having a gas set-up is that not only can you flush half-consumed bottles of wine (thereby preserving their flavour better than if they are just left to react with the oxygen that entered the bottle when you poured it), you could even use it to push the wine in a keggling system (KEG420). The beauty of the keggling set-up is that you could use gas-pressure in place of a pump for a gentler filtration, pull off a single glass of wine without having to open up an entire bottle, blend at any time in the ageing process, and best of all, all of this is done in an entirely enclosed system! Once again, no O₂ contact.

**-Note that CO₂ is only to be used for flushing, or laying a blanket off gas. If you will be using gas to push the wine (filtration, serving from a keg, etc.), you will want to use Nitrogen or Argon. The reason for this is that CO₂ will go into solution under low pressures and the other gasses will not. In other words, if you use CO₂, you could inadvertently carbonate your wine! On the other hand, if that was what you were after, this would be a perfect way to do sparkling wines for the home wine-maker!*

9) MaloLactic Fermentation (“Secondary Fermentation”):

Once the initial fermentation is over, you may choose to do a MLF. It is often used to soften the harsh edges of an overly acidic wine, but it is mostly known in white wines for the diacetyl flavours it produces (it is the cause of that “butter” flavour so commonly found in Chardonnay’s and Sauvignon Blanc’s). It is a bacterial culture that attacks the malic acid (the harshest of the three acids naturally found in the grape: the other two being citric and tartaric) and turns it into lactic acid (the softer acid that is in milk). It comes in various forms, but the easiest to use by far is the freeze-dried packet that does not need to be re-constituted before being pitched (“Viniflora Oenos” (DYWM), from Chr. Hansen, and “Enoferm Alpha” (DYWM1), from Lallemand, are two examples of this).

-One thing to remember is that doing a MLF is also a great way to lower the TA% level of your must or wine if you happen to need to lower the acidity. *However, if your acids are low and you would still like to do a MLF, you will need to bump up the TA level of your must or wine before you inoculate in order to compensate for the potential loss of acids that will occur.* As the ML culture attacks specifically the malic acid, you would then make your adjustment with tartaric acid only.

-Initiating a MLF is more difficult in a white wine than it is for a red one. The reason for this is that the ML culture would ideally like to be in an environment where there is a low level of alcohol, a high level of nutrients, an ambient temperature of around 75°(F), and little to no SO₂....The reason why this is so difficult for the wine-

maker is because when you make a white wine, you ideally want to ferment at 55°F), you ferment off of the skins (so, no bountiful nutrient source is present...), you want to maintain a protective level of SO₂, and of course there will be alcohol present... So, what it comes down to is that if you want to do a MLF, you will most likely have to make some compromises.

However, this being said, it is important to note that each strain of ML has varying degrees of tolerance with regards to each of these factors. For example, Viniflora Oenos will work at temperatures > 63°F, while Enoferm Alpha will work at temperatures > 55°F. Both have comparable pH tolerances. As far as SO₂ is concerned, Viniflora Oenos prefers to have levels under 20 ppm, while Enoferm Alpha can tolerate levels of 50 ppm... So, depending on your wine's conditions (and the availability of various strains of ML), you may be able to better match the ML to the task at hand- like being able to keep SO₂ levels slightly higher on a high pH wine, or by not having to raise the temperature to ensure that the "secondary fermentation" goes to completion.

It should also be noted that, like the yeast and for the same reasons, the ML bacteria benefit greatly from a nutrient supplement. You can use yeast extract, or a formulated ML nutrient mix ("Acti ML" (AD347) from Lallemmand is a good example of this). However, unlike the yeast, the ML bacteria does not use any DAP, so this should not be a part of the nutrient mix.

-Use: 1 gram per gallon

For the home wine-maker, regardless of the type of strain used, the best way to initiate a MLF is to add it at the end of the initial fermentation (this allows the yeast to complete their fermentation without having to compete with the ML for nutrients).

The following guidelines are the generalized, "ideal" conditions for a successful MLF:

When the sugars fall to 0° Brix (once the initial fermentation is over):

-Allow the must to warm up to 70°-75°*(F)

-*Note that different brands will have different temperature tolerances. Ideally, you want to be able to keep the wine as close to the original fermentation temperature as possible while still providing the ML with an acceptable working temperature.

-Add ½ teaspoon of yeast extract/fertilizer or 1 gram per gallon of Acti ML into the wine you will be inoculating (take note that unlike yeast, ML will not take up any DAP, and if a large enough dose is present in the nutrient mix, it can make your wine taste salty...)

-Add ¼ tsp. of ML culture per 5 gallons (preferably of the freeze-dried version, as discussed above).

-Stir up the lees into the wine three times a week. If you don't happen to have a lees-stirrer (WE590), you could just use a rod or dowel (either hard wood or stainless would be preferable). It is important that once the wine has finished fermenting, you will want to avoid any exposure to air. So, keeping that in mind, take care not to aerate the wine when you stir up the lees during this stage.

-Note that once you have initiated your MLF, you really want to let it go through to completion. It is very difficult to re-initiate a stuck fermentation, but if you follow the steps as noted above, chances are you won't have to try.

Once you are sure it has gone to completion*, you will then want to immediately rack the wine off of the lees, bring the SO₂ level up to where it should be (unless you were able to keep it where you initially wanted it at), and put the wine through a cold-stabilization. (More on this in the following section)

*While there are ways to deduce whether or not it has come to completion (namely twisting the carboy and looking to see if there are any small bubbles coming up the sides of the carboy), the only way to be absolutely sure that it has finished is to run a chromatography test. Therefore, if you know you will be doing MLF's on a regular basis, you might want to invest in a home chromatography test (MT930).

10) Cold Stabilization:

A month or so after you have consolidated and topped-up your carboys, the wine will have gone completely dry, and the gross lees will have begun accumulating at the bottom of your vessel. It is time to cold stabilize the wine. The primary goal of this stage is to begin the clearing-up, or "fining" process of the wine.

-To do this, the wine is first checked with a Clinitest to make sure that it has finished fermenting (and that if a MLF has been initiated, a chromatography test indicates that it has gone to completion). The wine is then chilled to 45°-30° F°, and then just left at this temperature for 4-6 weeks. You'll know when cold stabilization is over because after this period, the wine should now be quite clear and the gross lees and tartrate crystals will have dropped out on the bottom of your carboy.

-If you do not have access to temperature control, try to find the coolest place you can and leave the wine there. (This usually works out to being in a closet, an air-conditioned room, or in the garage on the floor...).

-Note that you will want to replace your airlock with a solid stopper as soon as you are sure that fermentation has finished. However, if you are doing a MLF, you will want to be sure that it has gone to completion before stopping the carboy up. If not, then the CO₂ produced by the MLF will just push the stopper out, thus opening your wine up to the elements...Keep in mind that changes in the temperature can also push the stopper out. One way to avoid this is to put some plastic wrap over the stopper and secure it around the neck with a rubber band.

11) First Racking:

After you have completed your cold stabilization, you should have a layer of yeast and tartrate crystals at the bottom of the carboy, and the wine should be fairly clear. It is now time to transfer the wine. The primary goal of this first racking is to continue the clearing-up, or “fining” process of the wine, as well as to minimize the wine’s contact with the lees*. In addition to this, however, the SO₂, RS and the TA levels in the wine might need to be adjusted. So, whenever you need to do a transfer, it would be a good idea to test your wine and make any additions at the same time. This will limit the amount of times that the wine could come into contact with oxygen. (Note that for all transfers, you will want to leave the transfer tubing at the bottom of the receiving vessel in order to avoid any splashing).

*-Unless you want to do any “sur-lie” aging (leaving the wine in contact with the yeast bed in order to pick up certain qualities, namely mouth-feel and a “nutty”, “toasty” quality). The amount of time needed will vary based on temperature and the strain used, and should be done to taste. –Note that if you had any H₂S (“rotten-egg” smell) problems, do not prolong your exposure to the yeast bed.

-Test the TA% and the SO₂ levels of your wine (you may also want to test the pH again, as well, as it can shift and this will affect your ideal SO₂ level... this was explained earlier in the “Sulfite” section). Calculate any additions, dilute them in a little water or wine, and place them in the bottom of the vessel that you will be transferring into. By doing this you will help to insure that it all gets mixed together thoroughly. Then proceed with your transfer.

-If you will be using any fining agents, such as Sparkaloid or Bentonite, now is the time to use them. Prepare them according to their instructions and mix them little by little (in a steady stream) into the new carboy at the same time that you do your transfer. Again, the idea here is that everything gets mixed together completely. Note that the wine will probably clear out on it’s own, but it may take a while and you might end up with a layer of sediment in the bottle. And remember, there is always filtration...

-If you are not planning on using any oak, you may want to add a little tannin to the wine. The tannin not only helps the flavour (adding a little astringency), it also boosts the efficacy of some of your fining agents (namely: isinglass and geletan).

-Use: ¼ tsp per 5 gallons (US).

-If you would like to add some oak, you could choose to do it now, or you could wait and do it at your next transfer. When using oak, it is always good to err on the lighter side for the obvious reason that you can always add more later, but you will not be able to take it out. In general, it is best to use less and leave it in for a longer time:

2 –2.5 oz. of Oak Cubes (also called “Beans”) per 5 gallons (US)

12) Additional Rackings:

The purpose of these subsequent transfers is to continue the clarification process, to minimize the wine's contact with the lees and to make any corrections or additions that the wine might need. You will probably want to do this every three to four months until bottling time, which would be as soon as the wine is clear and it has been properly adjusted. (In fact, if your wine is clear, and the tests and your taste buds tell you it is correctly balanced, you do not need to subject it to any additional rackings. And, as long as you have allowed it to cold stabilize and the tartrate crystals have already precipitated out, you can go ahead and bottle).

Each time you rack the wine:

-If you made any acid adjustments, it would be a good idea to test the TA% and see if it needs more. However, don't just go by the numbers alone, taste the wine and see if you think it needs anything, or if it needs it at all.

-Test your SO₂ level, but you will probably not need to add any more sulfites until the final racking before bottling. However, if you are doing a MLF and were purposefully keeping the SO₂ levels low, then you will want to bring the SO₂ up to the appropriate level as soon as the ML has gone to completion. To recap, the goal of a successful MLF is to keep the SO₂ levels low so that the ML can stay healthy and finish its job. Then, once the coast is clear, you raise the SO₂ levels as soon as possible so that the wine now gets all of the protective and stabilizing benefits of the sulfites.

-If you are adding any oak, you can do so at any one of the transfers. You could even make an addition, taste it at the next transfer, and then add more if you think it needs it. Remember, less is more, and a little for a longer period of time is a good safe way to avoid over-oaking your wine.

*An interesting thing to keep in mind is that many wineries use both American and French oak (and sometimes Hungarian, as well) at various ratios in their wines to garner the best qualities that each of the different woods have to offer. You can easily simulate this by either creating your own blend in a single addition or by using some of one type of oak in one addition, and some of another in a second one. The presence of oak is a wonderful thing when used as a complimentary support for the wine, but it should not make you think of a 2x4 when you drink it!

-If you used Sparkaloid, and after two months of settling out the wine is still hazy, then you may want to try Bentonite. (Or just wait until it clears out naturally, or even filter).

13) Final racking (Residual Sugar):

This is the time when you make your final adjustments in order to prepare the wine for bottling. Is the SO₂ level right? Is the TA% correct? Is the oak just right? How about the RS?... Unlike red wines, white wines are usually bottled with a little bit of RS. How much, if any, is clearly a matter of style, type of grape, and of course, personal taste.

In general, the RS is matched fairly closely with the TA%. In other words, if you have a white wine with .65% TA, but your Clinitest shows you have .05-.1%RS level (dark green), and after tasting it you feel it could use a little sugar bump, then may want to add enough sugar to bring it up to .4%RS (for dry), or .6-.65%RS (for half-dry). Remember that the final amount needed for the RS bump is completely objective... In fact, you may find that between two different wines, even though their numbers are the same, the wine that has the higher pH (making it “softer”) will require less sugar than the one with the lower pH (making it more “sour”)! One other important factor that needs to be taken into account when considering RS sugar adjustments is that the amount of sugar needed should be balanced with the TA% of the wine, as well. Again, go by taste, and let the numbers only serve as a reference point.

-So, once you have decided on an amount, how will you be able to add, say, +.4% RS in a 5 gallon carboy (which actually holds circa 5.5 gallons)?...Well, get a hold of yourself, because here comes another equation!:

$$\frac{128 \text{ (ounces/gallon)} \times \text{?Gallons (of wine adjusted)} \times .00? \text{ (? = amount of RS desired)}}{1} = \text{ounces of sugar needed}$$

So, plugging in our variables, we get:

$$\frac{128 \text{ (ounces/gallon)} \times 5.5 \text{ Gallons (amount of wine being adjusted)} \times .004 \text{ (because we want to add .4%RS)}}{1} = 2.816$$

Therefore, in order to add +.4% RS into a 5.5 gallon carboy, we will need to add **2.816** ounces of sugar.

-Now, armed with your newfound knowledge, make all of your adjustments and do your transfer. Allow the wine to rest for a few weeks and then you will be ready to bottle.

-Note: when you make your RS adjustment, you will not immediately be able to use a Clinitest to verify your amount. This is because the Clinitest measures glucose, and it will take a few weeks before the sucrose in the table sugar to break down into glucose and fructose.

14) Bottling:

By now, the wine should be adjusted and the numbers where you want them to be. At this point, the main thing you need to be concerned with is making sure that the SO₂ is at the appropriate level and that you avoid aerating the wine as much as you can during the bottling process. So, let's just begin by calculating the SO₂ addition:

-Test the SO₂

-If you know the pH, then use the chart and look-up the amount needed.

-If you don't know the pH, then just use ¼ tsp per 5 gallons for the generic level. (It may, in fact, need a little more or less, but this way you will be covered.)

Next, make your additions and rack the wine into the carboy from which you will be bottling. Make sure that the bottles are rinsed and clean (you should probably sanitize them, as well), and that your corks (W430) and corker (W405) are at hand*. Then, using your same racking set-up (R310), but now with a bottle filler (B420) attached to the end of the transfer tube, fill and cork the bottles. -It is important to fill the bottles so that when the cork is in, there will be a 1/2 inch of airspace between the cork bottom and the wine itself.

* -You could also use 22oz. "beer" bottles with a crown cap, or you could even keg the wine...

Note that it will take about two months for the wine to get over the shock of the sulfite addition and the bottling, so you really should wait until you try it. When you finally do taste the product of your labours, know that it is only going to get better as it ages. Some wines may take a few years before they really come into their own. True, it might be quite drinkable now, but only with aging will it acquire all those extra flavours, "roundness", and an added complexity. So, knowing this you might want to try and set some aside. You will be happy that you did. After all, up to now you have worked for the wine, now let the wine finally start to work for you.