Brehm Vineyards'
Chardonnay Grape Wine Guide *v1.1*

Introduction

Your ***Chardonnay Guide*** is for 20 liters of pressed and settled Chardonnay grape juice from one of three different vintages. The Chardonnay juices are from the White Salmon Vineyard in the Pacific Northwest's Columbia Gorge AVA. Each of these vintage juices will benefit from adjustment.

Chardonnay not only reflects the geographical region and particular site where grown, it is a canvas upon which the winemakers can freely express their style and preferences. A Chardonnay in the *Chablis* style is crisp, fermented dry without malolactic fermentation. It is fresh and clean with little to no oak flavoring. A *Burgundy* style chardonnay usually is fermented in the presence of oak, aged on the lees with much lees stirring *(batonnage)*. Chardonnay in the *Burgundy* style is a rich, fat, complicated wine.

This winemaking experience will impart two different styles on these white grape juices. All of these Chardonnay juices will allow you to explore these styles and help you find 'your' individual winemaking preference.

If you follow these instructions and monitor your winemaking progress in the included ***Chardonnay Grape Log***, you will produce 2+ cases of refined, premium chardonnay. We will guide you through the production of 5 gallons of a *Chablis* style chardonnay or 5 gallons of *Burgundy* style chardonnay. It is up to you to choose your future style.

There are many ways to produce these styles of wine. The methods described herein are personal, based on classic winemaking techniques that have been proven over decades. It is the way Peter Brehm, our winemaker, wishes to guide you through this production of fine wine - it is <u>not</u> the only way – Peter is still learning.

Grape Juice Fermentation

Grape juice fermentation refers to the conversion of grape juice into wine by the actions of yeast reproduction. Brehm Vineyards® provides you with your winemaking starting point and that is White Salmon Vineyard's Chardonnay juice.

Yeast are single celled organisms that, under anaerobic conditions (oxygen-free environments), can use sugar as a carbon source to grow and divide. As the yeast reproduces, sugar is converted into alcohol. This process is known as *alcoholic fermentation*. In winemaking, alcoholic fermentation by yeast is also known as the Primary Fermentation or Sugar Fermentation.

Within the grape juice, as the yeast multiply, the sugar is converted by the yeast into pyruvate. Through an enzymatic reaction, the pyruvate is converted to acetylaldehyde, releasing carbon dioxide (CO_2). The acetylaldehyde, through another enzymatic reaction, is converted to ethanol (ethyl alcohol) as a by-product.

The yeasts' production of ethanol is a natural part of their life cycle. It is not the primary

goal of the yeast to produce ethanol, but to produce energy carrying molecules to be used in other biological reactions by the yeast. It is the winemakers' goal that yeast consumes the sugar in the grapes and excretes alcohol.

Yeast is available in many varietes. Winemakers strive to use yeast that match their future wine's desired style, alcohol content, age, related enzymatic activity and fermentation characteristics (fast, slow, low, foam, etc). The presence of alcohol in higher concentrations will actually impede yeast growth and may eventually kill yeast.

Brehm Vineyards recommends Lalvin's CY3079 or DV10 winemaking yeast, though there are others that will work well for use with our ***Chardonnay Guide***.

In most cases, the sugar content of the grapes in conjunction with the use of proper winemaking yeast will eventually convert all of the sugar in the grape juice into alcohol. Grape juice that is 23.5% sugar (or 23.5° brix / balling) will produce a wine of approximately 14% alcohol.

Fermentation at a cool temperature in a closed fermentor does not allow as much evaporation of alcohol as within an open, warm fermentor. White wine fermentations usually produce higher alcohol per given sugar concentration than red fermentations.

Winemaking yeasts are usually not affected by alcohol in the fermenting juice if there is an adequate amount of nutrient sources until the concentration of the alcohol reaches 15+%; some are happy at 17%.

Winemaker Preparation

A good winemaker is ready for anything. Their equipment and fermentors are clean and sterile prior to taking receipt of their juice. This should be your goal as well.

Read through this comprehensive guide and the included ***Chardonnay Log*** so you will be prepared to make wine once you receive your juice. After receiving your juice, for approximately two weeks you are tending to the fermenting juice daily. This is not for a long period of time, but daily. A few hints to prepare yourself for this endeavor:

- Make sure that you read through and understand this ***Chardonnay Grape Guide*** before you notify your supplier (or Brehm Vineyards) to ship you the juice.

- Read and familiarize yourself with the ***Chardonnay Log***.

- Purchase and receive the necessary winemaking equipment.

- Read and understand all the instructions that come with your equipment as well as reading the recommended book.

- Familiarize yourself with the other books and articles posted at Brehm Vineyards' web site.

- It is also recommended that you read the books listed in the ***Chardonnay Log*** as ***Optional Equipment***.

Where To Ferment Your Juice

The location you choose to ferment your grapes should be cool, 55°F /13°C, dry and free of any airborne contaminates. Anything that falls into your juice can impart off flavors or cause other problems with the wine. A wash down floor is a real plus. Make sure to keep your winemaking environment as clean as possible.

Sterilize Equipment

Before, as well as during the primary sugar fermentation, other biological organisms such as fungi, bacteria, and naturally occurring wild yeast can, and will, contaminate your wine and compete with your selected *winemaking yeast* for critical nutrients. These biological infections can cause incomplete sugar fermentation, the creation of off flavors in the wine, as well as a host of other winemaking misfortunes. Therefore, it is very important that your winemaking equipment be as sterile as possible before you begin to ferment.

First your equipment must be clean, then you should sterilize it. Most cleaning chemicals are basic, have a high pH. Once cleaned it is advisable to rinse the surfaces to contact the juice/wine with a dilute citric (acidic) acid solution to neutralize the cleaner's base. Only then are your prepared to sterilize.

Tradition in home winemaking has indicated that SO_2 (potassium metabisulphite) will sterilize equipment. This is inaccurate. SO_2 added directly to the wine does inhibit bacterial infections and does inhibit oxidation, but it does not sterilize. Heat, iodine and phosphoric acid will sterilize, but will not clean. Taking a tip from beer making folks, a 50% food grade phosphoric acid based chemical is recommended. Star San formulated by Five Star is what is recommended here. Star San should not be used on wood or porous material.

One ounce of Star San added to 5 gallons of water creates a sterilizing solution. Brief exposure by immersion or course (large droplet) spray will sterilize your equipment.

Clean and sterilize everything that the wine will be in contact with. While all sterilizer should be drained from equipment, it is not necessary to rinse before exposure to juice or wine.

If you are not using your equipment immediately, place it or hang it so it drains and drys. Once the carboys are thoroughly dry, you can simply cover the mouth of your carboy with some plastic wrap. Use a rubber band to secure the seal. Store until needed.

Receiving Your Juice

It has been our experience over the years that about one out of three pails of frozen grapes will slightly implode during the defrosting cycle causing the pail to appear dented. There is nothing wrong with the pail or the juice, it is the natural consequence of the ice thawing. However, you should not leave these pails upside down.

Swollen pails, pails venting CO_2, leaking pails (probably not usable), and any other serious conditions as a result of the shipment of the grapes should be received from the transport agent "***with exception***" to the specific condition. You should write a detailed description of the condition and have the driver, or agent write their name, date, and recognition of the condition on the bill of lading or air waybill BEFORE you leave with the pails. Please notify supplier, or Brehm Vineyards <u>immediately</u> of the problem.

How to Thaw Your Juice

Depending on the method used to ship you your ***Chardonnay*** juice, you will need to let the pail(s) of grape juice thaw for 1-4 days. It is important that you thaw your juice in an environment at constant temperature. You goal is to thaw the juice quickly and evenly. Room temperature, 70°F / 21°C, is ideal for thawing, but the ambient temperature for

white grape juice fermentation should be cooler, around 55 °F /13 °C.

Under no circumstances should you let your juice thaw slowly in a refrigerated environment. If you let the juice thaw out slowly, you greatly increase your chance of allowing bacteria, fungi or mold from taking hold and contaminating your grape juice. Once you add your yeast and the primary sugar fermentation begins, the bubbling CO_2 released as a by-product of the sugar to alcohol fermentation acts as a natural barrier against bacteria, fungi or molds. Take advantage of this CO_2 barrier by keeping the fermenting juice always sealed with an airlock when in carboys.

When you receive your pails of juice, to determine the degree of thawing, take one of the pails by the handle and twist the pail in your hand. If you can hear and feel the juice sloshing around inside, they are well on their way to being thawed. If you don't hear anything, then the juice is still frozen solid inside.

During the first day or two after you receive the juice, leave the lids on the pails. Flip the pails on their top in the morning, back on their bottom when you get home, and then turn them again on their top when you go to bed. The turning of the pails helps to mix the juice inside as well as speed the thawing process.

Each pail in Brehm Vineyards' ***juice*** is 20 liters of whole bunch pressed, settled white grape juice contained in a 6-gallon pail. There is roughly one gallon of air space above the juice. After a day or so of turning the pails over, go ahead and take the lids off the pails. Use stainless steel / food grade plastic spoon or your racking tube to stir your grape juice. Be sure to scrape the bottom of the pail while stirring. There is a layer of cream of tarter and sugar that settles at the bottom of the pail. You want to mix this in completely with the rest of the juice.

The temperature of the juice might still be cold. If there is still ice floating in the juice, this means you have about one more day until you can add your yeast. Stirring the grape juice will speed the thawing process. Try not to froth the juice or add excess air while stirring.

Chardonnay: Chablis and/or Burgundy

Once your pails of juice are completely thawed and mixed, we will guide you through two winemaking methods that produce two distinct styles of chardonnay. The *Chablis* method will produce a crisp, clean chardonnay with delicate fruit flavors. The *Burgundy* method will produce a full-bodied, rich, oak flavored chardonnay.
Use the following directions to prepare your juice for fermentation.

If you obtain 2 pails of Chardonnay, besides being a good idea, you can make two styles at the same time. Mark one 5-gallon carboy and one 3-liter jug 'CHABLIS' and mark another 5-gallon carboy and 3-liter jug 'BURGUNDY'.

Prepare Juice For Fermentation

Make sure that you have thoroughly mixed the juice in each pail. As you stir, be sure to scrape the bottom of the pails as to put back into the juice solution any cream of tartar and sugar that has precipitated to the bottom of the pail.

Once thoroughly mixed in the pail(s), siphon into a carboy. If you notice any airspace above

the juice in either carboy, use distilled water to top the juice up to the neck.

To avoid juice loss from foaming during fermentation, we will use a 3-liter jug for our yeast starter and then to ferment a portion of the juice from the carboy. The degree to which a juice will foam during fermentation is dependant on the activity of the yeast used, temperature and the rate of fermentation.

Once the alcohol percentage in the wine increases, the surface tension in the juice / wine decreases and foaming will not be a problem. At that point, you will add the fermenting juice from the jug back into their appropriate carboy to finish the sugar fermentation.

As an educational aside*:*
The freezing and thawing of juice (to a lesser degree in the crushed grapes than juice) efficiently separates and concentrates the principal components of the grapes. You may recall that ice burgs are made of ice without salt. As water freezes, sugars and acids are concentrated by density. Grape's principal acid is 'tartaric', which decreases in solubility with a decrease in temperature and/or an increase in alcohol, producing cream of tarter. You can adjust the amount of sugar by separating the frozen from the unfrozen. You can decrease the acidity by racking off the cream of tarter. This is not recommended here.

Chablis and/or Burgundy: Take Initial Measurements

Now that your juice has thawed it is time to take your first analysis of the wine. This is the starting point for the fermentation of your *Chablis* and/or *Burgundy* style wines you will make. The fermentation of both *Chablis* or *Burgundy* carboys will be quite similar, however, the winemaking for the *Chablis* and *Burgundy* style diverge after the sugar fermentation is complete.

Measure Temperature:
As with fermenting black grape must, temperature is very important for fermenting white grape juice. In general, you want to ferment your white grape juice between 50-55°F / 10-13°C until the juice reaches about 7-10° brix. Once the juice reaches that brix level, you want to raise the temperature of the juice to about 65°F / 18.3 °C to complete the fermentation.

Chardonnay juice fermentation tends to get stuck as the sugar level decreases. The slight increase in temperature will aid the yeast in finishing the sugar fermentation.

If you have access to a spare refrigerator, this can be an ideal place to ferment your grape juice. A cool spot in your garage can also be a good place to ferment your juice.

Record the **Temperature** in your ***Chardonnay Log***.

Yeast are able to ferment grape juice at low temperatures, albeit inefficiently. The natural yeast present on the grapes at the time of harvest will be greatly diminished by freezing. The survivors will start to multiply once the juice is thawed. The initial goal is to get the juice to 50-55°F / 10-13°C and maintain this temperature until the sugar level falls to about 7-10° brix.

Measure Sugar:
Degrees Brix or Degrees Balling are identical units for measuring the percentage of sugar in your grape must. Specific Gravity is another method for measuring sugar concentration in

your must. Please review the **Brix / Balling / Specific Gravity Chart** in your ***ChardonnayLog***. Degrees Brix and Balling will be used interchangeably throughout this guide.

To measure your brix starting point, take a sugar sample of the juice from each carboy separately and fill your hydrometer container. With the juice about one inch below the top of the jar, slowly insert the Hydrometer. Take the reading from the bottom of the meniscus between the hydrometer and the jar.

Record the degrees brix for the juice in your ***Chardonnay Log***. The temperature of the juice has an effect on the hydrometer reading, as does the alcohol content of the wine. These conditions are minor for our purposes.

Record the **Initial Degrees Brix** of the Chardonnay record it in your ***Chardonnay Log***.

Monitoring the degrees brix is your fermentation speedometer. It will show you where you are in the race to total conversion of sugar to alcohol. The race starts with a slow rate of sugar consumed per hour. A cold environment slows down the initial stages of fermentation, as well as its continuing rate of sugar conversion.

After 8° brix, the alcohol content in the fermenting juice will begin to be toxic to the yeast. The combination of the increasing alcohol concentration and the diminishing nutrients in the fermenting juice will cause the fermentation rate to dramatically decrease. To help the yeast finish the sugar fermentation, raise the temperature of the juice to about 65°F / 18.3 °C. This may be as simple as taking your carboys out of the refrigerator or placing the carboys in a warmer part of your house.
It is important that you monitor the temperature and the degrees brix in both your *Chablis* and/or *Burgundy* carboys once you have started their fermentation.

If you do both styles simultaneously, you must treat these carboys separately and equally when testing the temperature and degrees brix in each carboy. Because you are using two distinct styles of winemaking, you must be careful not to cross-contaminate the juice or resulting wines. After testing one wine, be sure to clean & *sterilize* your instruments thoroughly before testing the other wine.

The guide for **Chablis Fermentation** begins below. The guide for **Burgundy Fermentation** begins later.

CHABLIS FERMENTATION

Chablis: Add Lysozyme

We recommend the addition of 0.32 ounces (9 grams) of lysozyme. This is enough to add 500 parts per million of lysozyme to 5-gallons of juice. Take a cup of juice from the carboy and dissolve the lysozyme in it. Add the dissolved lysozyme to your *Chablis* carboy.
WARNING: Lysozyme is an enzyme isolated from egg whites. If you are allergic to egg whites, DO NOT add the lysozyme. We recommend that if you are allergic to egg whites that you only make Chardonnay juice in the Burgundy style.

When used in winemaking, lysozyme can postpone or prevent malolactic fermentation. Lysozyme's basic action is to poke holes in bacterial cell walls causing the bacteria to lyse, or basically pop due to an influx of liquid into the bacteria. This level of

lysozyme will inhibit a malolactic fermentation and preserve the crisp acidity and delicate fruit flavors in your *Chablis* style chardonnay.

BURGUNDY FERMENTATION

Burgundy: Add Oak Cubes and Tartaric Acid

We recommend addition of 1-1/2 ounces of medium-toasted, French oak cubes to your carboy. You will use these cubes to add oak complexity to your *Burgundy* wine. This will mimic barrel fermentation

After sugar fermentation, you will induce a malolactic fermentation in your *Burgundy* style chardonnay. The malolactic fermentation will cause the overall acidity of the wine to decrease. To compensate for this loss in acid, the addition of tartaric acid specified in your Log should be added at this time.

The increased acidity will help maintain the balance in the wine.

Tartaric acid addition is common to lower the pH in wines and to increase their acidity. In North America, Total Acidity is measured in grams of tartaric acid per 100 ml. In France, Total Acidity is measured in units of sulfuric acid per a given volume.

1 gram of tartaric acid per liter of juice/wine will raise the acidity 0.1%.

For more information on Total Acidity and pH, see **Chablis and Burgundy: Total Acidity and pH**.

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Chablis and/or Burgundy

Make a Yeast Starter

A 3 liter jug will serve as your **Yeast Starter.** Initially, a vigorously fermenting white grape juice will produce a lot of foam. It is quite difficult to ferment 5-gallons of white grape juice in a 5-gallon carboy without the juice bubbling out of the airlock due to foaming. Ideally, you would conduct your primary fermentation in a 6-1/2 gallon carboy and near end of fermentation transfer the wine to a 5-gallon carboy.

While the white grape juice is actively fermenting, the airspace above the juice is filled with carbon dioxide. This CO_2 layer prevents oxidation. Once the juice is fully fermented and you open the carboy, the CO_2 will seep out. At this point, it is necessary to minimize the wines contact with air. This is when you make sure that the wine in your 5-gallon carboy is filled up to the neck, minimizing the surface area of the wine.

For your ***Chardonnay***, you will ferment most of the juice in the carboy and a portion of it in a jug.

The yeast recommended for your ***Chardonnay wine*** has been freeze-dried. You can simply sprinkle the freeze-dried yeast into your juice and fermentation will eventually begin. This is a quick and dirty method and not very efficient.

A better way to add the yeast to your juice is to first create a **Yeast Starte**r. The starter is a way to wake up the yeast and build up a large, active population of healthy yeast. Adding a good starter to your juice will more efficiently, and quickly, ferment the sugar in the juice.

Since the yeast is freeze-dried, it must first be re-hydrated before the yeast can be used. Take 1 cup of water at 100°F / 38°C and add the

yeast to it. Do not mix the yeast into the water, simply pour the yeast over the water and let it sit for 20 minutes. Be sure to use a large bowl to hydrate the yeast because the yeast will foam.

Add the re-hydrated yeast to *the 3 liter* starter jug(s). Add juice from the carboy to the yeast. Fill the jug half way. Put on an air lock. Set the jug(s) in a dry, warm spot in your kitchen to get the yeast started fermenting. Within an hour you should start seeing activity. Add more juice to jug, no higher than its shoulder. Add air lock. Once you have an active fermenting jug, add it ALL back into the carboy. Then take back enough of the inoculated juice back into the jug to fill it to its shoulder. Within 2-6 hours you will be making wine. Make sure the foam does not exit the containers, draw off a bit into another bottle if necessary. Use airlocks to seal the jug and carboy.

Add The Yeast Starter

Once your grape juice has reached at least 45°F / 7.2°C, and you have a bubbling, active Yeast Starter prepared, it is time to begin the sugar fermentation.

Before you add the Yeast Starter, make sure you have record the following in your ***Chardonnay Log***:

- **Temperature** of *the* juice

- **Degrees brix** of *the* juice

It is also a good time to record any sensory perceptions you have about the grape juice including taste and smell.

Keep Juice at Proper Temperature

White grape juice should be fermented at a cool temperature, about 55°F / 13°C. Fermenting at a cool temperature preserves the delicate fruit flavors. Warmer fermentations tend to lose their fruit flavor and often can result in a bland flavor in the wine. To accomplish this, folks usually ferment their juice in the winter/spring when the ambient temperatures in their garages or basements are cool. If you live in Phoenix, Arizona, it may be hard to keep the temperature of your juice cool in September.

A spare refrigerator is an ideal place to ferment white juice. You can keep the temperature constant, and when the sugar level of the juice reaches about 7-10° Brix, you can easily raise the temperature of the refrigerator to help finish the sugar fermentation.

If you find your juice getting too warm, above 65°F / 18.3°C, you need to cool it down. Place towels tightly around fermentor with their ends in a cool water bath. Direct a fan at the wet towels so it creates an evaporative cooling affect on the fermentor. You can also pack ice around the carboys to cool them down.

Add Yeast Nutrient To Juice

A yeast nutrient is to be purchased as part of the ***Essential Equipment*** for your ***winemaking***. The yeast nutrient gives your growing yeast vitamins and minerals to keep them healthy while fermenting your grape must.

For each 5-gallons of juice, you will use about one rounded tablespoon of the yeast nutrient; this is roughly 15 grams. Follow the directions provided with your yeast nutrient and add 1/2 the appropriate amount once the wine begins to ferment. Add the second half at about 15° brix, no later than 12°brix.

Measuring progress of the yeast

Record the degrees brix or balling of the wine juice at least once a day. You will be able to track the progress of the yeast. As the fermentation progresses, there will be less and less sugar available. The degrees brix will get lower each day. Try to take the measurement at the same time each day. This way, you can chart sugar consumption as actual data points.

Once the vigorous bubbling from fermentation subsides in the carboy, go ahead and add the fermenting juice from the *3 liter* jug into the carboy.

When the juice reaches 7-10° brix, move the carboy to a warmer location so the temperature of the juice can rise to about 65°F / 18.3°C. This increase in temperature will help the yeast finish the primary sugar fermentation.

Know Your Wine

It is essential that you become one with your wine throughout the winemaking process. Even though the wine can't talk, it will be able to communicate with you in many ways.

- *Smell your wine.* From start to finish, you must smell your wine. Fruit and alcohol and other natural grape and wine smells will be apparent.

Also apparent is the presence of Hydrogen Sulfide (H_2S). H_2S smells like rotten eggs or sulfur and can be perceived at the level of a few molecules per million. By smelling your wine, you can take action early to prevent problems later.

- *Taste your wine.* As the juice ferments, you will be able to notice that the sweet taste of the sugar will subside as the fermentation progresses. Tasting your wine is a critical way to monitor the health of the wine as it ages.

Residual Sugar Testing

If, using your hydrometer, the wine measures less than 0° on the brix / balling scale, this does not mean that the sugar fermentation is complete. Residual sugar may remain.

A hydrometer is simply not accurate enough to measure the small amount of sugar left in the wine. Wine is not considered 'stable' until it is 0.2% or less residual sugar. There is not a risk of sugar-related bacterial degradation or the wine starting to re-ferment at 0.2% or less. Once all signs of CO_2 production have stopped, use the Dextro-Check Kit to perform the Residual Sugar test. Use a 10-drop (0.5 ml) sample of the wine to determine how much residual sugar is remaining in the wine.

Record the percentage of **Residual Sugar** in your ***Chardonnay Log***.
If the residual sugar measures above 0.2%, keep your wine warm at about 70°F / 21.1°C until you measure the residual sugar at 0.2% or less.

Chablis:
Send a sample to a wine lab

Once your residual sugar test shows your *Chablis* wine has 0.2% residual sugar or less, an accurate measurement of the wine's pH is necessary. Act promptly – time is important.

Send a sample of the *Chablis* wine to a wine-testing laboratory for **pH** test. The pH of the wine is important in determining how much SO_2 to add to protect the wine from oxidation.

For more information on Total Acidity and pH, see **Chablis and Burgundy: Total Acidity and pH**.

Many laboratories have specific procedures for receiving samples of either the unfermented juice, or the finished wine. It is advisable to contact the laboratory before sending them a sample so that you follow the proper procedures and that you send the correct volume of wine for the tests you will have performed.

Please see the list of recommended testing laboratories at the end of your ***Chardonnay Log***.

Chablis:
Initial SO2 addition

Based on the results of the pH of the wine from your *Chablis* carboy, immediately add the appropriate amount of SO_2 and move the carboy back to a cool location 55°- 65°F / 12.8°-18.3°C.
To determine the amount of SO_2 to add, please see the **Chablis and Burgundy: pH & SO_2 Additions**.

Also, now that your *Chablis* carboy has finished the sugar fermentation, you will begin *batonnage*, or stirring of the lees. Please see **Chablis and Burgundy: *Batonnage* - Stirring the Lees**.

Burgundy:
After Sugar Fermentation

Once the sugar fermentation is complete, and residual sugar testing shows 0.3% residual sugar or less, add the malolactic bacteria. Store the wine at 70°F / 21.1°C. Please see **Burgundy: Induce Malolactic Fermentation** below.

Also, now that your *Burgundy* carboy has finished the sugar fermentation, you will begin *Batonnage*, or stirring of the lees. Please see **Chablis and Burgundy: *Batonnage* - Stirring the Lees.**

Batonnage and malolactic fermentation will be happening concurrently

Burgundy:
Induce Malolactic Fermentation

Malolactic Fermentation is also known as the secondary fermentation in winemaking. It is considered fermentation because CO_2 is released in the chemical process. Lactic acid bacteria use the malic acid in the wine as an energy source converting the malic acid into lactic acid and CO_2. Lactic acid is perceived to be softer and milder when compared to malic acid in tasting wine.

The malolactic cultures are often packaged for 60-gallons of wine. If the residual sugar of the wine is less than 0.3% and the wine temperature is about 70°F / 18°C, add 1/8 of the 60 gallon package of the malolactic powder into your carboy. Put the air locks back on your carboy. Save the remaining bacteria in the packet for future wines. Store, well sealed, in the freezer. (Will be good for about 1 year.)

Within a day or so of adding the malolactic bacteria, the malolactic fermentation will begin. Take a look at the bubbles forming along the edges of the carboy. The CO_2 bubbles formed during sugar fermentation tend to be larger than the pinpoint sized malolactic fermentation CO_2 bubbles.

This 'secondary' fermentation is as natural as gray hair. You should be aware that it is a natural occurrence in the life of wine. It is not an event you have the option to ignore (why we added lysozyme to prevent a malolatic fermentation in a Chablis style wine). Once the wine reaches about 70°F / 21°C, malolactic fermentation is almost spontaneous

in the wine due to naturally occurring lactic acid bacteria.
Malolactic fermentation can be inhibited by temperature, SO_2, alcohol content of the wine, clarity of the wine, isolation from the malolactic bugs (filtration), or by the addition of Lysozyme.

NOTE: The malolactic fermentation in your *Burgundy* carboy may take weeks to months to complete, so it is important that you are able to see the tiny bubbles that form during this secondary fermentation.

As you continue the *batonnage* with your *Burgundy* carboy, you may notice that these bubbles have stopped forming. This may be an indication that the malolactic fermentation is complete. At this point, it is important that you verify this by sending a sample to a wine-testing laboratory.

Burgundy:
Send a sample to a wine lab

With no pressure in your fermentation lock and no sign of bubbles in the wine, you think that the malolactic fermentation is complete. Make sure that the wine has had 6 full weeks of being at 70°F / 21°C (after malolactic bacteria addition) before you send off a sample for testing. Remember that malolactic fermentation can take weeks to months to finish.

Paper chromatography is a test used by winemakers to gauge the beginning and progression of malolactic fermentaion. This is a test you can perform. Unfortunately it does not have the ability to detect very small residual amounts of malic acid that an enzymatic test can detect.

Do not stir your carboy for two days, allowing the lees to settle to the bottom of the carboy. Take your wine sample near the top of the carboy. Be sure to top up the carboy with distilled water after taking your sample.

Contact your testing laboratory before sending them the sample. You will want to have them test for **Malic Acid Conversion by an enzymatic method**. This will tell you if your malolactic fermentation is complete. If they confirm that the malolactic fermentation is complete, have them also test the **pH** of the wine.

Please see the list **Recommend Testing Laboratories** in the Log. This list is incomplete. If you are aware of other competent labs, please advise Brehm Vineyards®.

Burgundy:
Initial SO_2 addition

Upon receiving notification your wine has completed malolactic fermentation and based on the results of the pH from your carboy, immediately add the appropriate amount of SO_2 and move the carboy back to a cool location (55°- 65°F / 12.8° - 18.3°C).
To determine the amount of SO_2 to add, please see the **Chablis and Burgundy: pH & SO_2 Additions**.

Finishing Batonnage

Your *Burgundy* carboy has now finished both its primary sugar fermentation and its secondary malolactic fermentation. You have protected the wine by adding the first dose of SO_2 to the wine. Now you will simply finish the *batonnage* by stirring the lees for at least 2 months total.

The following sections of the ***Chardonnay Guide*** pertain to both your *Chablis* and *Burgundy* wines.

Chablis and Burgundy:
Batonnage - Stirring the Lees

Once the primary sugar fermentation has finished in both your *Chablis* and/or *Burgundy* carboys, for the next 8 weeks, you will be performing *Batonnage* on your wine.

Batonnage is the act of stirring the dead yeast cells, or the lees, back into solution in your wine. The lees are sediment at the bottom of your carboy. Once a week for two months, you will stir the lees up into the wine. Be careful not to introduce air to the wine. This is especially important when stirring the *Burgundy* carboy before SO_2 addition. Be diligent to sterilize your stirring tool (and whatever enters the wine) between exposures to carboys or barrels, and after!

Stirring the lees has been a technique long used by Burgundy winemakers. Exposing the wine to the lees adds complication to the flavor of the wine that would not be realized if you did not perform *batonnage*. *Batonnage* is used for many styles of white winemaking, especially in the production of chardonnay.

The actual effects on the wine as a result of *batonnage* are not clearly known. Testing has shown that wine allowed to aged *sur-lees*, or on the lees, will be less yellow in color than the same wine not aged on the lees. It has also been shown that tannins in the wine are attracted to the yeast cell walls and polysaccharides released by the lees. This means that the wine is made less tannic by aging on the lees.

Another benefit from *batonnage* is wine aged on the lees are less susceptible to turning pink due to oxidation. If you have ever made a white wine and had it oxidize on you, you will have noticed that the color of the wine took on a grayish-pink hue. This is due to oxidation of the wine. *Batonnage* adds complication to the flavor of the wine as well as playing a role in the final color of the wine.

It is very important that each time you stir the lees that you smell your wine. Hydrogen Sulfide can readily form in the lees even if the wine is properly sulifited. The *Chablis* wine has had sulfite added to it earlier, and this should assist in protecting the wine during *batonnage*.

In a *Burgundy* wine where SO_2 has not been added yet, but because the wine is actively undergoing malolactic fermentation, the CO_2 bubbles that form assist in purging the wine of Hydrogen Sulfide (H_2S) and oxygen. The wine may take on a peculiar odor during malolactic fermentation, but it will be distinct from H_2S, which smells like rotten eggs.

If, during *batonnage*, you smell H_2S in either wine style, it is important that you rack your wine off the lees immediately. If this happens, follow the directions under **Chablis and Burgundy: Gross Lees Racking**. Try to rack over only a small amount of the lees (so that there is a light dusting on the bottom of your carboy). At this point, your *batonnage* would be complete.

If you are making both styles Chardonnay,make sure that you do not contaminate your *Chablis* carboy with malolactic culture from your *Burgundy* carboy

when stirring the lees. Simply stirring up your *Burgundy* carboy and then using the same mixing spoon/stirring rod to mix your *Chablis* carboy is enough to inoculate your *Chablis* carboy with malolactic bacteria. You have protected that wine with lysozyme and SO_2, but it is advisable that you wash your mixing spoon/stirring rod thoroughly, and sterilize it in between mixing the carboys. Ideally, have 2 separate mixing spoons/stirring rods, one for each carboy.

Chablis and Burgundy: Post Batonnage Fining

After *batonnage*, the winemaking for both your *Chablis* and *Burgundy* carboys will be similar. However, these wines might be on different time schedules, with the *Chablis* wine most likely being bottled first.

Once *batonnage* is complete, you will want to clarify your wine. A wine can be clarified in many ways, through filtering, centrifugation and also through chemical methods. A very efficient and cost effective way to fine your wine is to use bentonite.

Bentonite is a clay that attracts particles in your wine and causes them to settle to the bottom of the carboy. Bentonite is quite specific in protein fining.

Use 7 grams (1/4 oz.) of bentonite per 5-gallons of wine. Follow the directions for preparation of the bentonite. Simply pour the bentonite slurry into each carboy at the appropriate time. Stir it while adding it into the wine. The chemical reaction happens quite fast and depends on the bentonite being progressively exposed to the wine.

Chablis and Burgundy: Cold Stabilization

Once you have added the bentonite to fine your wine, holding the wine at 35°- 40°F / 1.7-4.5°C for two to three weeks before bottling will help settle out cream of tartar, lessening deposits in the finished bottles. This is called cold stabilization.

This is purely a cosmetic procedure that will help clarify the wine. Precipitating out the cream of tarter in your carboy and then bottling the clarified wine prevents you from opening a bottle (or more importantly, having someone you gave a bottle to) opening that bottle and having cream of tarter crystals floating around in the glass.

Chablis and Burgundy: Gross Lees Racking

Once the wine falls clear through the actions of the bentonite and the cold stabilization (which will take from 7 to 21 days) it is time to rack your wine off of the lees and other sediment. In the case of the *Burgundy* carboy, you will be racking the wine off of the lees and oak cubes. The first racking off the lees is called the *Gross Lees Racking.*

To prepare for the Gross Lees Racking, you need to be sure that the wine is protected with SO_2. Add the appropriate amounts of SO_2 into the bottom of the receiving carboy. If making both styles, siphon the *Chablis* wine first to avoid malolactic bacteria contamination from the *Burgundy* wine.

In the case of the *Chablis* wine, you will be adding the same amount of SO_2 you added at the end of sugar fermentation. Refer to your ***Chardonnay Log*** to determining how much SO_2 you need to add.

For your *Burgundy* wine, since you had to wait until the end of the malolactic fermentation to add your initial dose of SO_2, you may not need to add this full amount of SO_2 at this point.

You need to determine how long it has been since you first added the SO_2. (*look it up in the Log*) Divide the number of weeks it has been since you added SO_2 by 10, and then multiply this number by the amount of SO_2 you added after malolactic fermentation.

For example, if you added 40 parts per million SO_2 to the *Burgundy* wine after it completed malolactic fermentation and it has been 6 weeks since that addition, then you will add the following amount of SO_2 to the wine at this racking:

(40 ppm) x (6 weeks/10) =
(40 ppm) x (0.6) = 24 ppm SO2

Racking entails siphoning or pumping the wine off the sediment into a sterile carboy. You must be very careful not to disturb the sediment in the carboy you are racking from. This is the material that makes the wine cloudy. This means that you must leave the carboy in a position so that you do not have to move it (and thereby disturb the sediment) before racking. Also make sure not to splash the wine or cause it to bubble in the carboy you are racking into. Allowing too much oxygen to be exposed to your wine can cause it to oxidize prematurely.

Rack as much of the wine as you can into your sterilized carboy(s). Leave an inch or two of wine above the sediment. You will want to rack this remaining wine into one of your 3-liter jugs. (Make sure you mark your jugs.) Most likely you will transfer over some of the sediment. Siphon off as much of the wine as you can minimizing the amount of sediment you transfer.

Place an airlock on your carboys and on your jugs. Allow the wine in the jugs to settle for a few hours and then rack this, without sediment, into their appropriate carboys.

It is extremely important to minimize the air contact with your wine. If you find that you do not have enough wine to top up the carboys, then you must use distilled water to top up the wine. You can also add sterilized glass beads or marbles to displace the wine, thereby eliminating airspace. If you have a supply of argon, nitrogen, or even CO_2, you may sparge the siphon hose, the carboy receiving and delivering the wine.

Record the **Smell** and **Taste** of the wine after the Gross Lees Racking in the ***Chardonnay Log***.

Chablis and Burgundy: Total Acidity and pH

The balance between acids and bases is a hypothetical measurement that quantifies the way elements are, and helps us predict the future. The pH of the wine affects the amount of free SO_2 that is available to the wine. The actual amount of SO_2 to add to a wine can only be determined once the pH of the wine is known. The pH of a wine can change dramatically between harvest and the end of fermentation.

Alcohol concentration, as well as the cold temperature will decrease the solubility of tartaric acid, causing it to settle to the bottom of the carboy as cream of tarter. Thus, since the overall Total Acidity (TA) is decreasing, there is a corresponding increase in the pH of the wine. After the sugar fermentation is

complete, it is a good time to check where the wine stands, especially if a malolactic fermentation is not planned.

The probability of a successful and complete malolactic fermentation is dependent on many things, most notably on the wine's pH.

Temperature, SO_2 content, nutrient availability, the malolactic culture's activity characteristics as well as the alcohol percentage of the wine are all considerations. If the pH of the wine is less than 3.2, malolactic fermentation becomes more difficult. As the pH decreases, special cultures may be required. Malolactic bacteria are inhibited by wine with over 14.5% alcohol. At 15% only special cultures will work reliably. Temperatures below 65°F / 18°C will inhibit malolactic fermentation. Free and / or combined SO_2 inhibits malolactic fermentation.

Citric acid may only be added after malolactic fermentation; tartaric acid may be added at any time. You are not advised to add citric acid. Tartaric acid has the nasty habit of precipitating cream of tartar after addition to the wine. In your future wines, if it is necessary to add more tartaric acid, make sure to add it at least 6 weeks before bottling

Chablis and Burgundy: pH & SO_2 Additions

Sulfur Dioxide (SO_2) is a gas. Potassium Metabisulfite is used as a preservative in winemaking. When added to wine, the Potassium Metabisulfite will dissolve releasing SO_2. There are many methods for adding SO_2 to your wine and many different theories for when to add SO_2. Brehm Vineyards feels that as long as the wine is active, either undergoing the primary sugar fermentation or the secondary malolactic fermentation, that addition of SO_2 is not necessary with fruit in good condition. BV does believe it critical that exposure to the air be minimized and surface areas minimized.

There are some conditions that require an addition of SO_2 at harvest. The fruit provided for here was harvested clean and will hold up without SO_2, under conscientious winemaking care, until after sugar fermentation is complete in the case of the *Chablis* wine, or once the malic acid reduction (Malolactic Fermentation) is complete with the *Burgundy* wine.

Upon receipt of the laboratory results of your *Burgundy* wine sample, record these results in your ***Chardonnay Log.***

The pH of the wine, after completion of malolactic fermentation, will be the guide in determining how much SO_2 is necessary to properly preserve your wine. We use Potassium Metabisulfite to add SO_2 to wine. Read the tenths and hundredths position of your pH reading and this will tell you the amount of potassium metabisulfite, in parts per million to add to your wine.

Example: If the pH is 3.78 you should add 78 parts per million SO_2 to the wine. If the pH is 3.45, add 45 parts per million SO_2 to effectively protect the wine. Some chemists advocate an additional 10 parts per million (ppm) SO_2 be added for white wines.

Refer to the ***Chardonnay Log*** for a SO_2 addition chart and instructions for making a solution of SO_2 for easy addition to your wine.

- You must add SO_2 (in the form of Potassium Metabisulfite) as soon as the sugar

fermentation is complete for the *Chablis* Carboy.

- You must add SO_2 (in the form of Potassium Metabisulfite) as soon as the malolactic fermentation is complete for the *Burgundy* Carboy.

Chablis and Burgundy: Bottling

The wine is now stable. We have maintained a free SO_2 presence in the wine to inhibit oxidation. Your wines should be young and aggressive, but pleasant without any off smells or flavors.

After the *Gross Lees Racking*, allow the wine to settle for 3 more weeks. The wine is now finally ready for bottling. Add the final amount of SO_2 to the bottom of the carboy from which you will bottle. Beware of the fumes of SO_2. This amount of SO_2 is based on the pH of the wine. This should be the <u>same</u> amount you added after you received the laboratory report. (Do not worry that you added SO_2 a few weeks earlier. The bottling process introduces a lot of oxygen to the wine and it is important that you protect the wine by adding a full dose of SO_2 prior to bottling.) Rack without splashing the wine. Set the carboy(s) on a bench or shelf from which you can siphon the wine.

Many winemakers will sparge their receiving carboy with Carbon Dioxide (CO_2) or Nitrogen (N_2) before racking. This is a definite plus. It reduces oxidation significantly. It may cause a slight spritz if CO_2 is used.

I recommend beer, wine, soda or champagne bottles that can receive a crown cap for bottling. Bottle caps are extremely cost effective. Corks cost a lot of money and often offer an inferior seal when compared to crown caps. You need to spend at least $45.00 on a corker to get one that really works. The most recent corks I bought were over 20¢ each. If you chose to use corks, use good ones and a floor model rental corker would be appropriate.

I do not want to project an image of a 'Wacko'. I use corks in my wine bottles because I do not want to distract the recipient from tasting the wine and the grapes. Here you are paying me for my best thoughts. For use in your home, for the best, economical seal available, bottle with crown caps. The wine will age with crown caps equally as well if the bottle were corked, often better. Cheap corks are not worth what you pay for them.

If you decide to use corks and rent or buy a corker, make sure to get an irised floor model:

- Don't soak your corks before bottling. Use #9 corks with a light paraffin coating of good quality at least 1-1/2 inches long. I am unimpressed with various foam/plastic stoppers. Good quality cork discs placed on the ends of fused cork particles do a decent job for relatively short storage.

- Allow the corked bottles to stand upright for three days before putting them on their sides or upside down.

Chablis and Burgundy: Drinking the Wine

It is important that you allow your wine to breathe before consuming. Open your bottle at least an hour before you are going to pour it. Give the wine a good swirl in your glass before smelling or sipping.

The amount of SO_2 you used to protect the wine can cause the wine to taste sharp if you drink the wine soon after bottling. Allowing the wine to breathe will lessening this SO_2 effect.

Both the *Chablis* and *Burgundy* wines will be pleasurable in 6-9 months after bottling, but they will both hit their stride in 12-18 months.

Smaller bottles age faster than large.
Be sure to label your wine.

Good Winemaking!

Peter Brehm