Chicagoland Winemakers Inc.

689 West North Avenue
(North & 83 Plaza)
Elmhurst, Illinois 60126
(630) 834-0507 or (800) 226- BREW
info@chicagolandwinemakers.com

www.chicagolandwinemakers.com

MAKING WINE AT HOME

CONTENTS

INTRODUCTION

The practice of fermentation to make alcohol can be traced to at least 5000 years ago. It would seem that almost every culture devised ways to ferment one thing or another in an amazing variety. Although honey and various grains were used (sometimes in combination with fruit), wine made from grapes was also among the early beverages. As folk methods of fermentation evolved in various parts of the world, regional practices developed with differences which reflected local conditions and available ingredients. Over time, many of these different practices became ingrained as local traditions which were passed down from one generation to the next. To this day, some very old folk methods are still used in some places.

That so many different approaches were successful, owes primarily to the fact that fermentation itself is highly automatic and remarkably tolerant of all sorts of variations in recipe and procedure. It should not be surprising then to find many different ideas about winemaking in various sources.

While the automatic nature of fermentation means that winemaking is much easier than we might have imagined, learning about it is made more difficult by the confusion of disagreeing information. Our approach in the following is to bypass folk practice entirely in favor of more modern winery style techniques. We can not only achieve literally 100% reliability, but also take advantage of the many things we can do better than commercial winemakers because of the small batch size.

PROCESS OVERVIEW

Among other beverages, wine is the end result of alcoholic fermentation of sugar(s) in a largely automatic and spontaneous natural process involving yeast. The role of the winemaker is to prepare the ingredients and initiate fermentation. Throughout the process the winemaker also needs to maintain conditions which protect the wine from anything harmful. In one way or another, the following things are required:

1. A balanced recipe which provides nutrients, sugar and other components for healthy yeast; and later, pleasing flavor and aroma.
2. Cleanliness and sanitation to eliminate and exclude competing bacteria, molds and wild yeasts.
3. Highly limited air access. Only airless (anaerobic) fermentation yields alcohol from sugar. Wine must also be protected from prolonged contact with large amounts of air after fermentation is complete.
4. Temperatures generally in the range of 65 to 75 ^{O}F for fermentation and (ideally) 60 ^{O}F for

both bulk and bottle aging.

5. Protection from bright light, particularly sunlight.

These points are the basis for good winemaking as practiced commercially, or in the home. We will be concerned initially with proper batch preparation and inoculation with wine yeast. Once started, the yeast will carry out the fermentation with only limited handling by the winemaker.

We can divide the process into five stages:

1. Batch preparation and inoculation with wine yeast
2. Primary fermentation
3. Secondary fermentation
4. Bulk aging and preparation for bottling
5. Bottling and bottle aging

Taken one at a time, these will be easily learned while making a batch or two. We recommend five or six gal. batches until the new winemaker becomes familiar with the process. This approach offers excellent economy without sacrificing quality or reliability and yields 25 to 30 (750 ml.) bottles of wine.

HOME WINERY EQUIPMENT LIST

Specialty Items

Primary Fermenter - 10 or 20 Gal. Food Safe Plastic Bucket (Larger sizes are available)
Grape Crusher or Hard Fruit Crusher (For larger batches only)
Floating Glass Thermometer
Hydrometer and Test Jar (Set)
Fruit Press (For larger batches only)
Large Nylon Mesh Straining Bag
Racking Tube with Siphon Hose and Pinch Clamp
Sulfite Solution (Made with 2 oz. sulfite crystals per gal. water, keep in 1 gal. glass jug)
Secondary Fermenters - 2 or more 1 Gal. Glass Jugs
" " - 2 or more 5 Gal. (or larger) Glass Carboys or Demijohns
Fermentation Locks - 2 or more
White Rubber Drilled Stoppers - To fit fermentation locks to secondary fermenters
Carboy Brush - For 5 to 6.5 Gal. Carboys

Wine Bottle Brush
Oak Barrels(s) - 15 gal or larger (for larger batches only)

Household Items

Long Handled Spoon
Measuring Cups
Measuring Spoons
Gravy Baster - To withdraw samples for testing
Plastic Sheet , 32 Inch Sq. or larger - To cover primary fermenter (Cut from white garbage bag)
Large Elastic Loop - To hold plastic sheet on primary fermenter drumhead fashion.
Can be made from 10 or more rubber bands linked together
Funnel, Stainless Steel or Plastic, 5 inch diam. or larger

Bottling Supplies

Wine Bottles - 375, 750 ml. or 1.5 liter, cork or screw cap finish
Straight Wine Corks, #9x1.5 Inch or #9x1.75 Inch
Corking Tool - To compress and insert wine corks

Optional

Acid Testing Materials
Bottle Labels
Bottle Capsules - Aluminum or plastic to cover bottle tops
Automatic Bottle Filler
Bottle Rinser - Attaches to water faucet, automatic shut-off

Bottle Drain Tree - To hold and drain bottles after rinsing or sulfiting
Winemaker Batch Record Card - To keep recipe and processing records

ABOUT WINEMAKING RECIPES

Only when we use properly cultivated fresh grapes of the winegrape family (vitas vinifera) is no recipe needed. In most cases, grapes from this family provide the balance of sugars, fruit acids, enzymes, tannins and nutrients (phosphates and nitrogen compounds) necessary to make good wine. Assuming good quality winegrapes, the only additions necessary are sulfites to deactivate wild yeasts and bacteria, and pure cultured wine yeasts. This initial mixture before fermentation is called the *must.*

All other fruits, including concord and other native North American grapes, require a recipe which provides a balance of components similar to that of winegrapes. Sugar is an important component since the alcohol which will be in the wine is made from it. Fruit acids provide tart flavor and help with the keeping properties. Pectic enzymes help soften the fruit for release of its juices and color, etc. and help the wine to clear later. Tannins provide an astringent flavor component, and aid in clearing and better keeping. Phosphates and nitrogen compounds supply nutrients for healthy yeast and result in better fermentation. Only with proper balance of these components can a high quality wine result. Once the recipe ingredients have been assembled, the same equipment and general procedure can be applied to most of the wines we make.

Many fresh fruits are capable of at least two different styles of wine. Where possible, we have devised recipes for table wine using reduced amounts of fruit for less intense flavor, and social wine (sipping wine) using greater amounts of the same fruit. In most cases fruit flavors are highly modified by fermentation. Only a few types retain recognizable flavor of the source fruit, including concord grape, raspberry, elderberry and some types of sour cherries. Our own fruit wine recipes suggest the addition of winegrape concentrate along with the fruit to improve body and overall quality. Because of differences in fruit of the same general type, depending on the exact variety or the location where it was grown, we should not be overly concerned with high precision in the weight used. In most cases, there is at least some latitude and in some cases a great deal of flexibility in the poundage of fruit that is acceptable. Our own recipes often suggest a weight range rather than an exact amount. A bathroom scale is generally adequate. It is a good idea however to keep a good written record of the recipe, so that in future batches we can work toward the best possible wine from a particular ingredient.

USING SULFITE

Although wine can be made without the addition of sulfite, it provides unique benefits when properly used. It is primarily a food grade sanitizing agent, but also provides protection against oxidation, aids development of best flavor and aroma and helps the wine to clear. The below recommendations for its use result in much lower levels than commercial wines typically contain. We need less because our wines will not be subjected to the temperature and handling stress commercial wines must undergo. Those who have a sulfite allergy should avoid its use entirely. It is available for home use in two forms, sulfite crystals (powder) and campden tablets in pill form.

Make a stock sulfite solution for use on equipment from two oz. sulfite crystals dissolved in one gal. of water. All equipment must be clean and well rinsed, using the same standards of cleanliness you would for plates and saucers, etc. Then, just before contact with the must or wine, every article is sanitized by wetting with stock sulfite solution. Use the sulfite wet equipment as is - do not rinse with water. In this way, very small amounts of sulfite are added to the wine (from the wetted surfaces) as it is handled, and we will gain all its benefits without building detectable levels in the wine. We recommend this technique throughout the process, from start to finish.

For equipment of 20 to 60 gal. size, use double strength solution (4 oz. per gal.) and for wine bottles and corks, use half strength solution (one oz. per gal.) in the same way.

Since the sulfite solution is used on already clean materials, the solution itself remains clean and may be reused for up to three months if stored in a glass jug with a non-metal cap. The sharp odor it displays as it ages or when wine contacts the wetted surfaces is normal.

We recommend campden tablets be used only initially per the recipe, and not again. By counting the tablets added, we can get an accurate dosage to disable any wild yeast or bacteria present. Campden and sulfite contain the same active chemical. Throughout fermentation and bulk aging, the sulfite-wet surfaces of containers, etc. assure a gentle but adequate sulfite addition.

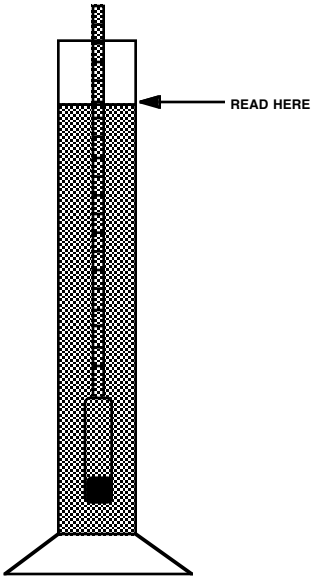
USING THE HYDROMETER

A Hydrometer is simply a float with a built in scale that shows the density of a liquid by how high or low it floats in that liquid. The most common hydrometer is made of glass which is entirely sealed closed and leak-tight. It consists of a stem with a weighted bulb at its bottom which causes the hydrometer to float with the stem upward. The stem contains inside it a graduated paper scale glued in place along the stem length. The reading on this scale is made where the liquid surface intersects the stem (see the illustration below). The heavier the liquid is, the higher the hydrometer will float in it, and the higher will be the density reading.

Among various ways to express liquid density, specific gravity (Sp. Gr. or SG) is convenient for

fermentation. It is simply the numeric ratio of the density of the liquid being measured compared to pure water at some definition temperature, usually 15 or 20 ^{O}C (59 or 68 ^{O}F). A specific gravity reading of 1.000 means the liquid has the same density as water. A reading of 1.080 means the liquid is 1.08 times as heavy as water.

Some hydrometers have a scale which shows the weight in grams of a liter of the liquid being measured. This scale is equivalent to specific gravity without the decimal point. By inserting the decimal point it is converted to SG.



We know that generally the more dissolved material a liquid contains, the heavier it will be and that this will be reflected in a higher density reading. This property allows hydrometers to be used to measure such things as the strength of battery acid or radiator coolant, or the sugar level in wine must before and during fermentation.

Since alcohol is produced from the sugar in a predictable way, the density reading before fermentation begins can also predict how much alcohol will be present in the finished wine if all the sugar is consumed. Many hydrometers have a second scale (in addition to density) which makes this prediction.

To make the reading, be sure the hydrometer, hydrometer jar and sampling device such as a gravy baster are clean and wet with sulfite solution. Place the hydrometer in the hydrometer jar and add liquid to be measured as necessary to float the hydrometer so that the stem protrudes above the

top of the jar. Spin the hydrometer several times to dislodge any bubbles on its surface and to be sure it finds its own free floating level.

Hold the jar at eye level so that you can sight across the liquid surface to make the reading. In most cases the liquid can be returned to its original container. Rinse and dry the hydrometer and return it to its shipping tube for safe keeping.

BATCH PREPARATION

The initial steps, in which the batch is set up for fermentation, are probably the most important in the entire process. In fact, batch preparation is most of what the winemaker actively does in making the wine. Once fermentation begins, the yeast carry out the process of converting sugar to alcohol automatically. At the same time, there is a very large outflow of bi-product CO_2 gas which clears virtually all air from the fermenters. This airless condition is necessary to make alcohol from the sugar, but also prevents the growth of most spoilage bacteria.

To gain the total reliability and high quality of modern winemaking, there are some things we need to do. To assure a smooth start-up and avoid later problems, follow these simple rules every batch:

1. When both sugar and water are called for in the recipe, use very warm water, about 105 to 120 ^{o}F. We want an initial batch mixture temperature of 95 to 100 ^{o}F if possible. If the mixture temperature is warmer than 100 ^{o}F, we can wait for it to cool before completing the recipe. If no sugar is added, room temperature water can be used.

2. Fresh fruit and grapes only:
   A. Spray with plain cold water to rinse off loose dirt and possible bugs, etc.
   B. Remove over-ripe and green portions. Use sound ripe fruit.
   C. Crush without breaking seeds or for tree fruit, remove pits and cut into 1/4 to _ inch pieced/slices, as appropriate for the fruit.
   D. Never fine-grind, puree or severely mash the fruit. The solids must be strained out later, and this will be impossible if the particles are too small. The yeast and enzymes will extract the juices, etc. very effectively without overdoing the preparation.
   E. Remove all stems and woody or leafy parts. They impart bitter or resiny flavors.

3. If sugar is needed, always add only half or less the poundage specified in the recipe. The best way to be sure of good mixing is to stir rapidly on one side of the fermenter to cause a top to bottom rotation of the batch. When completely dissolved and mixed, make a preliminary

hydrometer measurement. If you are not sure the sugar is completely dissolved, cover the fermenter and wait a few minutes. Then mix well and check the SG again to see if the reading is the same. Further sugar is then added only as necessary to reach the desired warm SG reading, regardless of poundage. Regard the recipe poundage as approximate or nominal only. If no water is used in the recipe, a heavy sugar syrup can be added to adjust SG The syrup can be made from approximately 2 parts sugar to 1 part water. Heat the water well and remove from the heat before adding the sugar.

Procedure Have all needed equipment and ingredients ready for use. Fresh fruit should be weighed, at least approximately, and prepared according to rule 2 above. Sanitize the primary fermenter by wetting with sulfite solution and place in it the prepared fruit, winegrape concentrate or juice, etc., and warm water according to the recipe. Then if sugar addition is necessary, add about half the amount called for in the recipe. In most cases, fresh winegrapes or processed winegrape products need little or no added sugar. For these ingredients, check SG before adding any sugar.

To adjust SG, each 8 oz. measuring cup of dry cane (household) sugar added to a 5 gal. batch increases SG by about 0.004. For example, if the preliminary hydrometer reading is 1.058 and the recipe asks for a starting gravity of 1.080, a 0.022 increase is needed. 5-1/2 cups of added sugar will give approximately this increase. After it is dissolved and well mixed, check SG again and if necessary trim with a small sugar addition.

If warm water is used in the recipe, ideally the temperature would be about 95 ^{O}F as the final recipe additions are made. However, we can tolerate a variance of four or five degrees either way without significant error in the hydrometer reading and sugar level.

Note: Because of liquid expansion, warmer temperatures produce a lower hydrometer reading and cooler temperatures a higher reading (more dense) on the same liquid. To adjust a cool starting SG to the warm (95 ^{O}F) reading, subtract 0.005 from the cool reading, and work to the lower number at the warm temperature. Our own recipes (Winemakers) already specify the starting SG's at warm conditions.

While stirring to dissolve the sugar, the remaining ingredients and additives except the wine yeast may be added. Use level measuring teaspoons. If acid testing is intended, withhold acid blend addition until the test has been completed. Then, add only the amount the test indicates is

needed. See Appendix III, ***Acid Testing.***

Cover the primary fermenter securely with plastic sheet held over the top (in drumhead fashion) with an elastic loop and allow the batch to cool to room temperature. Usually six or more hours will be necessary, but waiting 24 hours may be more convenient. Because both the equipment and the must are free of wild yeast, etc., no harm will come to the must for at least several days. It is wise however, to make a yeast starter within a day or so of reaching cool temperature.

YEAST STARTER FOR WINE

The following procedure is designed to give reliable start-up of 5 to 15 gal. of must using one package (usually 5 gm.) of any dried wine yeast. For larger batches, the quantities may be multiplied.

Before fermentation can begin, the yeast must acclimate to the batch in question and grow to a large population. A small portion of the must to be fermented (diluted with a little water) provides an ideal starter medium. Since air and warmth encourage yeast growth, the starter can be made in a warmer location (75 to 85 ^{O}F) while the main volume of must remains cool.

When the must has cooled to room temperature, or after 24 hours if fresh winegrapes or single-strength juice is involved, begin the procedure by first hydrating the wine yeast. Sprinkle the yeast on the surface of about _ cup of slightly warm water (about 100 ^{O}F) in a small container. Allow the yeast to settle into the water on its own for about 15 minutes. As the yeast hydrates, stir the must in the primary fermenter and remove about 2 cups to a clean mixing bowl. Add about 1 cup of water and stir vigorously to aerate. When the yeast has hydrated for about 15 minutes, stir until it is lump free, pour into the diluted must in the mixing bowl and cover the bowl loosely.

The starter should be allowed to stand until fermentation activity is obvious. Fruit solids and/or foam on the surface and further foaming when the starter is stirred are sufficient evidence of good activity. This will normally take a few hours but usually not more than a half day. The exact time will vary with different musts, yeast strains and temperatures. For musts which are hard to start, 1/4 teaspoon of yeast energizer may be added to the starter.

When you are sure of good activity, stir the starter well and pour gently to the surface of the must in the primary fermenter. There is no need to stir the starter into the must. The yeast will grow and spread throughout the large volume on its own. Fermentation should begin within 24 to 48 hours, even if the must is quite cool.

The starter procedure may be repeated on the same must without harm. Too much yeast cannot be added. More yeast simply reduces the lag period (growth stage) before fermentation begins.

A similar technique also may be used to restart a stuck fermentation, with the following change: When two or three cups are fermenting, add another two cups or so of the stuck must. When fermentation is again established, add more stuck must, increasing the volume in stages this way until 20 or 25% of the stuck volume is fermenting; then pour it back. Adding about 1/4 teaspoon yeast energizer per gal of stuck must is also helpful.

FERMENTATION OF WINE

Wine fermentation can be divided into two stages.

I. Primary Fermentation This initial stage accomplishes two things. Most of the sugar present is converted to alcohol and CO_2 gas in this most active and frothy part of the process. And when fruit solids are present, the desirable juices and color, etc. are extracted from the solids to become part of the wine.

Because of the relatively high sugar level, the conversion to alcohol is rapid, causing considerable foaming and expansion of the must as the gas bubbles out. Primary fermenters are larger than the batch volume to allow headspace for this expansion and have large top openings for easy access to the liquid. During the primary fermentation, we have only three simple tasks.

1. When fruit solids are present, the vigorous bubbling brings them to the surface, forming a floating mass called the *cap*. The cap should be broken up and stirred down into the liquid three or four times each day using a large spoon or other stirrer wet with sulfite solution. If no solids are present, stir vigorously once or twice daily. Keep the fermenter covered the rest of the time.

2. Monitor the temperature of the fermenting must at least once a day throughout primary fermentation using a floating glass thermometer. Sufficient heat is generated by the fermentation to raise the temperature of the must. As it warms, it ferments faster, generates heat faster, and tends to warm itself further, and so on. We need to prevent this snowballing effect. Try to maintain temperature in the range of 65 to 75 ^{o}F. If cooling (for small batches) is necessary, a sealed plastic bag containing a dozen or more ice cubes can be floated in the primary fermenter to cool the must rapidly without diluting it. A cooler location is also helpful.

3. Monitor the density (SG) daily with the hydrometer. As the sugar which makes the liquid heavy is converted to alcohol, the density decreases dramatically. With these daily readings, we are following the disappearance of the sugar and therefore the progress of the fermentation itself.

It is by virtue of SG alone that we will know how far fermentation has progressed, not by counting days. In this way we can gear our handling of each batch to the individual behavior of that batch. Since our sampling and measurement equipment is sanitized (wet with sulfite solution), no harm is done by the testing, and all samples are returned to the fermenter. Daily measurement of SG during primary fermentation is a key element of reliable winemaking.

In most cases when we are fermenting with fruit solids in the primary fermenter, an SG range of 1.040 to 1.020 is a good time to remove the pulp, and to transfer the liquid to secondary fermenters. For canned or frozen fruit, we may wish to remove the solids sooner (at higher SG) since the processing will already have softened the fruit. With fresh winegrapes or very firm fruit, we may wish to ferment to a lower SG.

Wines being made with processed juices or concentrates will have no fruit solids in the primary and can be allowed to ferment below SG 1.010 to promote better settling before transfer to full secondary fermenters to complete fermentation. The time necessary to reach these SG's is usually about 3 to 7 days.

II. Pressing & Straining During primary fermentation of batches containing fruit solids, all desirable components of the pulp become part of the liquid. It is largely exhausted of its juices, etc., and further contact with the degraded solids can only harm the wine. The solids must be removed as thoroughly as is practical before the wine is transferred to secondary fermenters. For small batches (5 to 10 gal.), an easy way to strain out the solids and recover the juice is to line a side bucket with the straining bag. Then pour or scoop the must to the bucket until almost full. Siphon from underneath the fabric directly to the secondary fermenters, adding more must during the siphoning until all the must has been transferred to the bucket. Then, gather the straining bag at its top and twist the bag to squeeze most of the juice from the pulp. Excessive squeezing should be avoided, particularly for soft pulpy fruits. Straining alone may be best for these fruits since any solids squeezed through the fabric will later form an increased sediment layer and reduce our yield. Grapes or fruits with firm texture may be squeezed more strongly. In any case, it best to take a little extra time with the solids removal.

This same basic technique can also be used with larger batches using fresh winegrapes. The output from the fruit press can be strained through the bag before transfer to secondary fermenters. See Appendix II, ***Using The Wine Press***.

III. Secondary Fermentation As less and less sugar is present, the rate of fermentation slows and the reduced outflow of CO_2 gas is less able to protect the wine from air. Secondary fermenters are closed vessels fitted with gas vents called fermentation locks which exclude air completely. The locks are partly filled with sulfite solution to provide an air seal and a bacteria

barrier as well. Before applying fermentation locks to glass secondaries, dry both the rubber stoppers and the inside necks of the glass jugs so that the locks will stay in place without using excessive insertion force. Most plastic is not recommended for secondary fermenters - glass is generally preferred.

A Processed Juices or Concentrate When making wine from ingredients that do not contain fruit solids, fermentation can be continued in the primary fermenter to an SG range of 1.010 to 1.000 before *racking* it to secondary. Many kit wines will contain this instruction. To promote better settling of the yeast, allow the wine to rest without stirring for a half day or so before racking to secondary fermenter(s). Then the wine can finish its fermentation under fermentation lock in full carboy(s) without further handling or gravity checks. The finishing fermentation should be carried out at a temperature of 70 to 75 ^{O}F. When the wine shows no sign of activity, it should be racked again to begin bulk aging.

Rack means to transfer so as to leave most of the sediment behind. In small batches, this is best done by siphoning, using the racking tube and siphon hose assembly (equipment list, pg.3) . The racking tube has a sediment guard attached at the inlet end which avoids most of the sediment automatically. Self-starting siphon/racking tubes are also available in several sizes for smaller or larger batches.

B Fresh Fruit or Grapes Since these wines are usually strained and racked to secondary fermenters while fermentation is still quite vigorous (SG 1.040 to 1.020), there is usually significant foaming activity. We recommend using additional glass containers of 1 gal. or 4 liter size to provide extra headspace to contain the foam. Siphon to the smaller containers first, about 3/4 full and then to the larger ones.

Even though strained, these wines will develop significantly greater amounts of sediments in the secondary fermenters. If the wine is allowed to stand on these heavier sediments for an extended time, off odor or flavor can result. For this reason, the wine will need to be racked again fairly soon. To identify the racking point, measure the SG daily in the larger secondaries. When the SG reaches the range of 1.005 to 1.000 (usually just a few days), then rack the larger fermenters and top-up by racking from the smaller ones. Topped-up means filled into the neck of the jug, but not touching the rubber stopper. Place the topped-up jug(s) in a 70 to 75 ^{O}F location until all bubbling has stopped. Then, rack the wine away from the remaining sediments and top-up with a little clean water or wine of similar type and proceed with bulk aging.

In either case (A. Processed ingredients or B. fruit or grapes), during the racking to begin bulk aging, check the final SG and record the reading. To confirm that the sugar has been completely consumed, the final SG should be approximately as follows:

Fruit wines and light bodied wines - 0.990
Medium bodied wines - 0.992-3
Winegrape and full bodied wines - 0.995
High alcohol wines (15% or more) will finish a little lower.

If the wine does not ferment completely to the final SG given above, taste it to see if it is sweeter than desired. If it is, refer to the ***Yeast Starter For Wine*** section and instruction on how to restart a stuck fermentation. Otherwise proceed with normal bulk aging.

BULK AGING WINE

The following information is restricted to the use of glass secondary fermenters only. Oak barrels are not recommended for 5 or 6 gal. batches. Refer to the special instructions in Appendix IV, ***Using Oak Barrels***.

When the wine first finishes fermentation, we should expect it to be somewhat harsh and dead dry, often with a pronounced bitterness. Proper bulk aging of our wine will provide enough time for the wine to throw its heavier sediments and to develop enough smoothness so that the flavor adjustments which precede bottling can be carried out more confidently. As aging progresses, we will find the wine improves steadily, but remains quite dry. A few teaspoons of wine may be withdrawn during racking to check flavor and aroma development. White wines especially (and sometimes others) may remain somewhat cloudy throughout bulk aging. Sweetness, clarity and other characteristics will be corrected or adjusted before the wine is bottled.

Bulk aging in glass is very simple: Place the carboy(s) in an area away from bright light with cool (ideally 60 ^{O}F) and constant temperature and rack the wine every one to three months using sulfite-wet equipment. Top-up with a small amount of water or wine from a freshly opened bottle. The glass carboys must be kept topped-up throughout bulk aging to protect the wine from contact with too much air. During this and all future rackings (until bottling) use a wood block or thick book under one side of the carboy so that it is tipped at an angle. Place the racking tube inlet in the lowest part of the carboy to transfer as much wine as possible. This will minimize the amount of water (or wine) needed for topping-up. If unsure of the water quality, it may be boiled briefly and cooled before adding. If a little sediment is carried over during racking, it will resettle and have no ill effect.

During this handling, the wine receives slight air contact and a very small addition of sulfite from the wetted equipment. Both are very beneficial to the development of best aroma and flavor. Clean the fermentation lock and refill with fresh sulfite solution at each racking.

There is no single bulk aging period which should be applied to all wines. Generally the lighter bodied types may be bottled after four to eight months while the heavier ones may need ten or twelve months. The wine should be free of heavy sedimentation and no longer highly rough or bitter tasting. Longer bulk aging favors reduced bottle aging sediments and better flavor development before bottling. Since the wine cannot reach its best quality in bulk however, earlier bottling favors faster drinkability. The decision to bottle is best made through periodic tasting of the wine during racking. No harm will be done by bulk aging longer than above, but after some point little is gained.

During bulk aging, try to maintain a constant temperature as close to 60 ^{O}F as you can and to avoid bright light. Although most home winemakers cannot maintain perfect aging conditions, we can generally get excellent results using a cool corner of the basement or storage area. An area with exposed masonry (brick, concrete or stone) which can be enclosed with an insulating material such as wood or sheet foam can provide an excellent aging enclosure for bulk and bottle aging. A temperature controller is available to use with a small air conditioner in any enclosed area to which an air conditioner can be fitted. It will maintain the temperature you set.

Even though we try to maintain constant temperature, seasonal changes may cause the wine to expand or contract in volume with the result that the liquid level in the neck of the jug moves up or down. Contraction during cooling can cause some sulfite solution in the fermentation lock to siphon back into the wine. This will not harm the wine, but will require the lock to be refilled. During expansion, the liquid may rise enough to contact the rubber stopper. Remove a little wine to correct this. It is a good idea to check the condition of the fermentation locks and carboys at least once a month. If the lock goes dry, air will contact the wine and may cause spoilage or oxidation.

Although the improvement in bulk is often dramatic, the wine cannot reach its best flavor, aroma and smoothness in bulk. It must have additional time <u>bottle aging</u> to reach peak quality.

PREPARING THE WINE FOR BOTTLING

At the beginning of the process our major input was to prepare the batch for fermentation. But the original recipe set only the basic style of the wine. Before bottling, our final direct input is to fine tune the flavors to suite personal taste, and if necessary to clarify the wine. Whatever the combination of operations we elect to use in preparing the wine for bottling, the order in which we do them should follow the order in which we discuss them below. When all additions (except oak chips) are complete, the wine should be returned to full glass containers for a few weeks of final settling before it is bottled.

In order that the additions necessary to adjust sweetness, etc. can be stirred gently into the wine, rack it to a sulfite-wet primary fermenter. If you are unsure at any point if more of a given addition (sweetness or tartness, etc.) is desirable, test its effect in a small amount of the wine on the side before making the addition to the whole batch.

1. Flavor Adjustment Options

Sweetness If the wine contains any residual sugar, i.e. it did not reach the expected terminal SG as discussed in the section on fermentation, or if sweetening is planned, wine stabilizer along with some sulfite must be added to prevent renewed fermentation. Sulfite must be used with the stabilizer to prevent an off odor from developing. If sulfite-wet equipment has been used throughout fermentation and aging no additional separate sulfite addition is needed. If sulfite-wet equipment has not been used throughout processing, add a generous 1/4 teaspoon of sulfite crystals along with 3 level teaspoons stabilizer directly to each 5 or 6 gal. of wine.

Wines made from winegrapes (or processed winegrape products) may not need sweetening if a dry finish is desired. However, most fruit wines will generally be better if they are sweetened at

least a little. Even if a dry style is desired, small amounts of sugar syrup will round and increase flavor without any evident sweetness. A good dry wine does not necessarily contain zero sugar.

Prepare a sugar syrup for sweetening from about 2 parts (vol.) dry cane sugar to about 1-1/2 parts (vol.) water. Heat the water alone until steaming hot and then remove from the heat before adding the sugar. Stir until nearly dissolved, then return to the heat and continue stirring and simmer about 5 minutes. The following guide suggests conservative amounts of syrup to be added to 5 gal of overly dry wine. If glycerine (discussed below) is to be added, make the addition before the sweetness is set.

Dry Finish	Fruit Wines - Add 2 to 4 fl. oz. syrup Winegrapes - Add 0 to 4 fl. oz. syrup
Off-Dry Finish	Both Types - Add 3 to 10 fl. oz. syrup
Medium Or Sweeter	Both Types - Add 10 to 20 fl. oz. syrup

Tartness If the wine is judged to lack the "snap" of adequate tartness, simply add acid blend to taste. A few teaspoons in 5 gal. may be enough. Sweeter wines may be preferred with more tartness than dry ones. Remember to test in small amounts first before adding to your batch.

Fruit Flavors (Social and dessert wines only) Most fruits lose their original flavor during fermentation and produce a vinous or wine flavored result. This is discussed briefly in the earlier recipe discussion. Where the intended use is as table wine, the vinous result might be preferred. But for social wine styles we have the option to add fruit extract flavors, including cherry, plum, blackberry, etc. to enhance the source fruit flavor. One or two bottles of the cordial extract flavor is generally enough in five gal. of wine.

Smoothness (High alcohol wines only) Wines of 14% or more alcohol will be improved in smoothness and body by the addition of 4 fl. oz. of glycerine or Finishing Formula to each 5 gal. Glycerine also imparts a slight sweetness to the wine. The approximate alcohol content can be determined from the starting SG

Vitamin C (Ascorbic Acid) For wines which are delicate or easily oxidized and cannot be kept in a cool location, add 1 level teaspoon of vitamin C powder to 5 gal. for better keeping.

Oak Flavoring And Mellowing (Especially for dry red wines) For 5 or 10 gal batches, we recommend the use of oak chips (in glass carboys) instead of small barrels. See ***Using Oak Barrels***. We can achieve much of the benefit of oak contact while retaining the safety and economy of glass carboys.

Oaking a wine is often the only treatment being done before bottling. However, if any of the flavor adjustments discussed above are planned in addition to oak chips, these additions should be carried out before siphoning onto the chips. The use of oak chips is normally the last step before bottling, because during the time the wine rests on the chips, they absorb wine and expand greatly. Unless other wine of similar type is used to top-up, this lost wine would create too much head space to continue bulk aging safely.

For each 5 gal. of wine, use about 2 oz. by weight of the chips. Soak them about 30 min. in _ strength sulfite solution. Drain the chips and rinse once lightly with water and place them in a sulfite-wet carboy before siphoning in the wine. Allow one to six months contact before bottling. For wines with heavier flavor or where more oak flavor is desired, simply allow more time on the chips. After a few weeks the oak chips will sink to the bottom of the carboy where they are easily left behind by racking at bottling time. To taste test the wine during the oak aging, use a short length of siphon hose attached to a gravy baster to sample from the center of the liquid volume. Oakiness will tend to "marry" into the wine during further bottle aging.

Blending Two Or More Wines In addition to any combination of the above changes, wines may be blended to create unique results or to correct opposing flaws, i.e. too dry vs. too sweet. Test various blends first in small amounts to determine the most pleasing proportions.

2. Fining And Clarifying The Wine Fining agents are normally added immediately after the flavor related additions (sweetness, tartness, etc.) are complete while the wine is still in the primary fermenter. However, if aging on oak chips and fining are both to be carried out on the same wine, the oaking should be done first as described above. Fining will then be the last step before bottling. To make up for the volume lost in the oak chips, extra wine will be necessary to top up the carboy in which the final settling takes place. This can be wine from another batch you have made or a purchased wine of similar type.

Red Wines usually will fall clear during bulk aging. Since fining and/or filtration may reduce the flavor and character of a good red wine, we recommend these measures only if necessary to clear a hazy wine before bottling. Note that the new kit wines produced in Canada are balanced to withstand treatment with a moderate fining agent. Red wines will tend to throw further sediments during bottle aging in any case, but since these sediments are typically fairly heavy, they are easily left behind by proper decanting from the bottle as the wine is served. Bottle aging

sediment in red wines is entirely normal and not a flaw in any sense, but merely visible evidence of flavor improvement.

White And Rose Wines should not throw more than slight sediments after bottling. Even though these wines may fall clear during bulk aging, unless they are fined, they tend to throw a fluffy and very visible sediment during bottle aging. Although the sediments do not harm the flavor, they are unsightly and may be mistaken as a sign of poor quality. Fining or fining followed by filtration will generally soften and improve white and rose wines and reduce or eliminate later bottle aging sediments.

For a fining agent to work well, it must be very thoroughly mixed into the wine. Add the fining agent after the flavor adjustments are complete, while the wine is still in the primary fermenter. If the wine is on oak chips, siphon it back to a primary fermenter. Stirring the wine slowly with a bottom to top motion, add the fining agent a little at a time. Siphon the wine back to a sulfite-wet carboy and place in a cool location.

Allow the wine to settle undisturbed for a minimum of one week. A few additional weeks of settling time can allow the finings to compact better for easier handling. Final racking and handling in preparation for bottling is discussed below.

3. Filtration The strongest technique for clearing a white or rose wine is fining followed by filtration. Filter media fine enough to produce star bright clarity will be clogged rapidly by a hazy wine. Fine the wine first and allow enough time for good settling to take place. Then siphon carefully away from the sediments before filtering to "polish" the wine to excellent clarity. For hazy red wine, filtering with a system which accommodates several grades of progressively finer filter pads is probably preferable to fining and filtration. After filtering with a coarse medium, a second pass through a finer medium will produce good clarity. The wine can generally be bottled immediately after any clearing treatment.

BOTTLING THE WINE

Generally, wine must age in bottle for some time before it will reach peak quality. Heavier wines or those with higher alcohol content may need several years. White and fruit wines or other lighter bodied wines can sometimes be at their best in less than a year.

To be ready for bottling, all flavor adjustments, clearing and final settling should be complete. Be sure wine stabilizer has been added if any sugar is present, whether residual or added for sweetening. Before beginning, have all needed materials ready for use. Bottles should be thoroughly clean and rinsed ahead of time and stored upside down. Wine should be placed in

position for a final racking a day or so ahead of time, especially if it is resting on sediments from fining. If wine corks are to be used, they should be soaked (submerged) in _ strength sulfite solution for at least 1/2 hour. Be sure to rinse in plain water before placing in corking tool. Sulfite is corrosive to metal parts of the corking mechanism.

Do not attempt to bottle directly from the bulk aging container. Rack the wine first to another container so that extra care can be taken in avoiding sediment. Once we have carefully siphoned off the clear wine, the bottoms may be transferred to smaller containers for re-settling and later recovery. These smaller containers can be topped up with some of the clear wine.

The clear wine may now be bottled as a second step in which all attention is given (where it is needed) to the bottle filling. To prepare the bottles for filling, the insides should be wetted with _ strength sulfite solution and allowed to drain onto a clean surface like paper toweling until one at a time each is turned upright for filling. Do not rinse with water. The small amount of dilute sulfite solution remaining is desirable.

Place the siphon outlet at the bottom of the bottle before starting the flow to minimize aeration. Fill to a level which will allow one inch or so of space below the bottom of the cork. If using an automatic bottle filler, the wine is released at the bottom of the bottle automatically. Fill to the very brim, and when the bottle filler is removed, its displacement generates the headspace needed. If more than a few bottles will be filled before corking, a dust cover of some sort may be used to protect them until they are corked. Have the corks handy (still in the soaking solution) along with a bowl or small bucket of clear water and some paper towel. Rinse the cork in the clear water just before placing in the corking tool. Compress the cork and blot any liquid released with paper towel. If using a hand corker, the bottle will need to be held upright somehow while you apply downward force. A wine bottle carton may be used or a second person can steady the bottle for you. If the corker has an adjustment for depth, try to insert so that the cork is flush with the bottle top or very slightly indented. None of the cork should protrude from the bottle top.

After corking, let the bottles stand upright for a day or two to relieve any compressed air which might be in the space under the cork. When laying down in a wine rack or bin, try to arrange a slight butt down neck up angle, 5 or 6 degrees angle off horizontal. With the neck end elevated a little, aging sediments will tend to build at the bottle bottom where they are easier to avoid during serving. The wine need only touch the cork to maintain a good seal. Just as with bulk aging, try to keep the wine as close as possible to 60 ^{O}F for bottle aging.

Plastic stoppers or screw caps (with the appropriate bottles) work well enough for short term bottle aging
The bottles may then be stored upright since neither stoppers nor screw caps needs to be wet to maintain a good seal.

Only with adequate bottle aging can we enjoy the full quality possible in the wines we make at home. Too often we find that by the time we begin to experience the best of the wine, we have only a few bottles remaining. While sampling the wine periodically to follow its development, try to set some aside for at least one year. Making another wine soon after bottling is a good way to divert attention from the previous batch to allow it more bottle aging time.

Certainly one of the great pleasures of making really good wines is sharing them with others. Whether with dinner guests at home or as a casual gift between households, they never fail to impress and are greatly appreciated. For a nicer presentation, excellent materials are available for labeling and capsuling your wine
to achieve a professional appearance. This can be done any time after bottling. Cheers!

APPENDIX I

A BRIEF WINEMAKERS GLOSSARY

Acid (Fruit Acid) Tart tasting compounds necessary for good flavor, healthy yeast and good keeping properties in wine.

Carboy A 3 to 6-1/2 gal. glass container with a narrow neck. Glass only is suitable for secondary fermentation and bulk aging wine.

Fermentation Lock (Air Lock) Gas vent device fitted to the tops of secondary fermenters to relieve outflow of CO_2 during secondary fermentation and to maintain an air seal during aging. Use sulfite solution inside as sealing liquid.

Finings (Fining Agents) Clarifiers which are stirred into wine before bottling to cause the wine to clear by settling.

Hydrometer Floating device to measure liquid density. Applied to winemaking, it reflects the sugar content before and during fermentation.

Lees The sediment deposited as a wine ages.

Must The starting mixture which will become wine when fermented.

Primary Fermenter A fermentation vessel with large opening at the top to allow top access to the batch for the first part of fermentation. For small batches, the primary fermenter should be about twice the volume of final yield.

Racking The transfer of wine from one container to another so as to leave most of the sediments behind. Best done by siphoning in small batches.

Secondary Fermenter A fermentation vessel with a small opening at the top to which a fermentation lock is fitted for final fermentation and aging. Glass carboys are best for home use.

Specific Gravity (SG) An expression of liquid density as a ratio to the density of water at a specified temperature. **Sulfite (Sulfite Solution)** Sodium or potassium meta-bisulfite or the solution made by dissolving the crystal in water. Stock solution is made with 2 oz. in one gal. of water. May be stored several months in glass with non-metal closure.

Top Up To fill secondary fermenters to the base of the neck or into the neck a little (not touching the rubber stopper) to minimize head space and exclude large amounts of standing air.

Wine Yeast Particular strains of yeast which give best behavior and flavor in making wine.

APPENDIX II

USING THE WINE PRESS

The procedure below is primarily for red grapes and other fruits which are fermented on the pulp and/or skins. With slight variation, white winegrapes are handled with a similar procedure.

Make sure the press and basket are clean and rinsed with hot water. Prop up the press as necessary so that a receiving container can be placed under the pour lip of the press basin. Load the basket as much as possible with fruit solids (the cap) from the top of the primary fermenter. Distribute the fruit solids uniformly to fill the basket. The wine (along with any solids in it) which drains off as the basket is being filled will be collected in the container under the pour lip. When the press basket is full, replace this container with a different container (under the pour lip) which is lined with the straining bag so that any further solids escaping the basket will be removed by straining. Pour the contents of the first (unlined) container back in the top of the press basket. The bed of solids already in the basket will act to strain out most of the solids in this liquid.

Place the press plate (or press plate halves and wood blocks) on top of the fruit solids and begin pressing. The press plate should remain level during pressing. Apply force intermittently, allowing time for the juice to run after each turn or two of the screw. As the solids become more compressed, go more slowly and/or wait longer before applying more force.

When the container (lined with the straining bag) is about 3/4 full, replace it with another lined container. If a second lined container is not available, use the unlined container temporarily until the lined container is available again. Lift the straining bag and siphon or pour the liquid that drains from it to the secondary fermenter(s). Repeat the above process as you continue pressing. If solids build up in the straining bag, it may be hand squeezed to recover the contained liquid.

The remaining wine or juice in the primary fermenter can also be strained free of solids separately using the straining bag. These solids may be added to the press basket for pressing if desired. One way or another all liquid should be strained to remove as much of the solids as practical.

After each use of the press, make sure everything is well rinsed so that fruit acids will not corrode the metal parts. Presses with ratchet mechanisms or other moving metal parts may be lubricated with a small amount of Vaseline.

APPENDIX III
ACID TESTING
PART A. MUST AND FINISHED WINE

Introduction

The fruit acids contained in wine musts are tart tasting compounds which are necessary both for good flavor and for good fermentation behavior. Acid testing provides control of this important characteristic, even though fruit and grapes may vary in acidity.

Total acid titration is a test in which an alkaline solution of known strength is added to a measured sample of wine or must liquid until all the acid in the sample has been neutralized. The volume of added alkaline solution is then a reliable measure of the total acid content (and tartness) in the wine or must. An indicator solution which changes color when all the acid has been neutralized is added to the test samples so that the neutral point can be identified.

As this test is applied to wine or must, it cannot give pinpoint accuracy and this should not be expected. The test is geared to avoid over-acidity while assuring adequate levels for good fermentation behavior. Low acid levels increase the likelihood of oxidation and "off" odors or flavors and cause a flat tasting wine with reduced keeping properties. On the other hand, excess acid is difficult to remove from an overly tart wine. The following test procedures are designed to provide adequate but conservative acid levels so that the winemaker will have latitude to adjust tartness to personal taste shortly before bottling. When acid testing, omit acid blend entirely from the recipe, until the amount needed is determined through acid testing.

When using winegrape concentrate or juice, or canned or frozen fruit, the must may be acid tested immediately when the batch is assembled. When fresh fruit or grapes are involved however, part of the acid content is not yet released to the liquid and is therefore not measurable. To obtain a more accurate measure, as soon as the must is prepared (except for acid addition),

prepare a test sample as follows: Stir the must well and remove about two cups of the mixture to a mixing bowl. Stir into it 1/4 teaspoon of pectic enzyme powder and knead it into the mixture by hand (squeezing well) for about one minute. Cover the bowl and let stand for about 24 hours at about 70 to 75 ^{O}F. Repeat the hand squeezing and kneading again and then pour the whole mixture through a strainer. Use samples of this liquid for the acid test.

Equipment

Two large identical wide mouth containers, one pint or more in size
Stainless steel or plastic teaspoon
Distilled water
Sodium hydroxide solution, 0.2 normal
Color indicating solution (phenolphthalein)
10 cc plastic syringe
15 cc sample measure (can be made from a used medicine vial by delivering 15 cc water with the syringe and marking at that level)
White surface (paper is ok) and bright lighting

Procedure

1. Using the 15 cc measure, deliver 15 cc solids-free must to each of the large glass containers.

2. Working on a white background, stir and add distilled water to both containers as necessary to produce a fairly thin color (the bottom of the container should be visible through the liquid). The containers must be filled to the same depth. Add about 50 cc. of distilled water for white musts and up to 400 cc for dark ones.

3. Add an equal amount of the color solution to each glass container also. About two to four drops is generally adequate, but be sure the amount is the same so we have duplicate containers.

4. Draw 10 cc of sodium hydroxide solution into the syringe, and recap the hydroxide bottle immediately. Begin the test with one container. Add about 1 cc of sodium hydroxide solution and stir, and repeat the addition and stirring until the test sample does not get significantly darker or change color with further hydroxide addition. Expect color changes during the test when working with red, purple or blue juices and ignore the changes. Look down through the liquid to evaluate darkness and lack of change. The usual final condition for various reds is a muddy black/gray color.

5. Refill the syringe and repeat the same procedure on the second sample, but this time, add only enough hydroxide to just reach the same color and darkness as that of the first sample in side by side comparison. The volume of hydroxide added is now just enough to have neutralized all the acid in the sample. This volume is call the endpoint and is converted to percent acid in the must as follows:

Read the volume of hydroxide added from the syringe in cc's. Each cc translates to 0.10% acidity in the must or wine. For example, if 4.5 cc hydroxide was required to just reach maximum darkness, the acid level is 0.45%

Some uncertainty in identifying the endpoint is normal. Make the call to the high side of the uncertainty range. This will result in a more conservative acid addition and allow latitude for later fine tuning by taste. Remember, to not expect high accuracy in the test. For our purposes, it is simply not needed. Approximate recommended starting acid levels are:

Red and fruit wines - 0.60 to 0.65%
White and sweeter wines - 0.70 to 0.75%
Port and sherry - 0.50%

To adjust acidity, one level measuring teaspoon of acid blend addition per gallon raises the acid level by 0.15%. If a must tests to 0.45% and we wish to have 0.60% acid, we will need to increase the acidity by 0.15%. Since one teaspoon per gallon gives this increase, five gallons of must will require an addition of five teaspoons of acid blend. To increase acidity 0.10%, 2/3 teaspoon per gal. (3 and 1/3 teaspoons in 5 gal.) acid blend should be added, and to increase by 0.20%, 1 and 1/3 teaspoons per gal. (6 and 2/3 teaspoons in 5 gal.) would be added.

7. Be sure to discard the test samples and clean and rinse the test equipment thoroughly. The chemicals used are poisonous. Store your acid testing supplies out of reach of children. Use the

glassware, etc. for acid testing only. With the ability to acid test, recipes can be devised from scratch and every batch can have proper acid balance regardless of variation in the fruit.

PART B. DURING ACTIVE FERMENTATION

In order to avoid the error in acid measurement caused by the temporary acidity of volatile acids which are present during active fermentation, normal acid testing needs to be done on wine must before fermentation begins. Volatile acids such as carbon dioxide gas (CO_2) released during fermentation or sulfur dioxide gas (SO_2) from sulfite use would cause a high-side error in the acid measurement. The normal test procedure as described in part A. measures total acidity and cannot discriminate between volatile (temporary) and fixed (permanent) acids. Total acid = volatile acid +fixed acid.

Since some of the acid contained in fruit solids may not be released to the liquid before fermentation begins, we may wish to repeat the acid test after the solids are removed (while the wine is still fermenting) so that adjustments can be made as soon as possible. We can apply the normal test procedure to an actively fermenting must, if special sample preparation to eliminate the volatile acids is carried out first on a small sample as follows:

Measure an exact volume of solids-free liquid to be tested, for instance 8 fl. oz. (one measuring cup), into a stainless steel or enamel sauce pan. Cook this liquid down to approximately half volume and cool it to room temperature. Then pour it back into the original measurement container. Using small amounts of distilled water, rinse the residue from the sauce pan into the measurement container also. Then add only the additional distilled water necessary to reach the original volume (one cup in this example) and stir thoroughly.

Since the cooking will have eliminated all volatile acids and stopped any active fermentation, normal acid testing applied to this liquid gives only the fixed acid content. Note that during both bulk and bottle aging, acidity may be reduced by the formation of sediments composed in part of acid compounds. Acid testing a well aged wine could yield results lower than the fixed acid levels measured earlier in that same wine.

APPENDIX IV

PREPARING AND USING OAK BARRELS

Oak barrels have traditionally been used to age the finest (and most expensive) commercial wines.

Unfortunately some of the traditional amateur techniques for using barrels can lead to problems. It is wise to learn their special characteristics of preparation, use and maintenance before considering their use at home. Unless properly used, they can spoil a good wine and become permanently contaminated at the same time. If contamination occurs, crevices in the structure of the barrel, between staves, etc., protect spoilage bacteria from normal sanitizing agents which are effective on non-porous materials.

A few key properties explain the value and the potential problems in using oak barrels. The porous structure of the wood allows a very slow infusion of minute amounts of air. Through some very involved chemistry, the air dissolves in the damp oak and transfers very slowly to the wine inside the barrel. The slow infusion of air along with flavor and aroma contributed by the wood itself, brings about much of the improvement associated with barrel aging. The wood may also have some capacity to absorb harsh components from a young wine.

Since all these interactions depend upon contact with the wood, the rate at which they occur is influenced by the amount of wood surface per gallon of wine. This factor increases dramatically in small barrels, causing the rate of air and flavor addition to be too rapid. Small barrels are more likely to over-oak the wine before enough time can pass to benefit general aging. We recommend using barrels only in 10 gal. or larger batches. Oak chips which are a by-product from barrel makers and are the same high quality wood can be used in 5 or 6 gal. glass carboys to gain much of the benefit of wood contact. Oak chips are inexpensive and easy to use safely in glass.

Generally, barrels are not the best fermentation containers. As primary or secondary fermenters, they insulate against heat loss too well, are cumbersome to handle and are more difficult to clean. Use the equipment proven to be best for primary and secondary fermentation and the early stages of bulk aging. After the wine is free of heavy sedimentation, then using oak barrels for bulk aging will give excellent results. They should be used in addition to, not instead of other fermentation and aging equipment.

The most commonly available large barrels are 50 gal. used whiskey barrels which are completely charred inside. The char layer absorbs bad tasting components from the raw spirits during the aging time in the barrel. If the char layer is not removed before putting wine in the barrel, some of these bad tasting compounds as well as the whiskey taste will bleed back into the wine. If the barrel has been empty for some time, it may have become contaminated and should be regarded with suspicion.

Before opening a whiskey barrel to remove the char, mark the barrel head and stave tops in several corresponding spots so that the rotational position of the head versus the staves is defined. When the barrel is reassembled, the head can be returned exactly to its original position using these marks.

Remove the hoops from the top half only of the barrel, allowing the staves to spring open enough to remove the head. Remove the char from the head and the top half of the staves. Reassemble that end, taking care to align the head with the index marks as mentioned above. Then repeat the process on the other end of the barrel (never remove the hoops from both ends at the same time) and rinse out any loose char material thoroughly. It is now ready for treatment in the same way as a new barrel.

When beginning with a new dry barrel, the outside surfaces and hoops can be treated with boiled linseed oil to protect and improve appearance. Allow about two days for the linseed oil to cure before proceeding. We recommend that you do not drill a spigot hole in the barrel head. The wine can be removed by siphoning or pumping.

A cradle is necessary to support the barrel near its ends so that no weight is supported near the middle portion (bilge) of the barrel. If a pump is not used, the cradle height should be arranged to allow siphoning both to and from the barrel. Place the barrel, with bung hole up, on its cradle over a floor drain or outdoors where leakage won't be a problem.. Fill it with warm water and continue adding water to keep it full until the wood expands and seals to a leak free condition. If the barrel is still leaking after several days, locate the leak(s) and use barrel sealing wax worked in from the outside to seal the leak. The barrel does not need to be emptied to apply the wax.

Once the barrel is absolutely leak-tight, it must be treated with Barolkleen, a mixture of soda ash and lye (separate instructions) to condition the raw wood. The treatment is done only before the initial use of the barrel with wine and need not be repeated. After rinsing and neutralizing the residual Barolkleen with acid blend or citric acid, the barrel is ready for use.

The ideal conditions for aging in oak are the same as those for other containers. See Page 11, ***Bulk Aging Wine***. As with other aging containers, oak barrels must be kept full to minimize air contact. Since some volume will be lost to evaporation from the outside of the damp wood, extra wine should be available from small bottles to add as needed to keep the barrel topped up. We have only two simple tasks to carry out every month or so while aging in oak: Taste the wine to evaluate oakiness and top-up with extra wine from a freshly opened bottle. Smaller barrels produce faster results, and wines with less body and flavor will probably need less time. Also, as a barrel is used repeatedly, we should expect more time to be necessary. The only way to be sure of its condition at a given time is to taste the wine and use personal judgment. Generally, when the wine begins to display a definite oakiness, it is time to rack to other containers. From there it can be bottled or allowed to age further in bulk. Oak flavors will tend to blend into and become part of the wine during bottle aging.

If white wine or other more gently flavored wine is to be barrel aged, it is probably better to use 15 to 30 gal. barrels. Barrels for white wines need to be dedicated to that use alone. Once a barrel has been used for red wine it cannot later be used for white wine.

After removing wine from a barrel, rinse it thoroughly with plain water. If the barrel will be filled with another wine right away, wet it with sulfite solution of the proper strength (see page 5, ***Using Sulfite***) before placing the wine in it. If the barrel will not have a wine in it, fill it with a barrel keeping solution made with 2 oz. sulfite crystals and 2 teaspoons acid blend for each 5 gal. of barrel volume. Keep the barrel topped-up by adding regular strength (stock) sulfite solution. Empty the barrel and refill with fresh keeping solution each two or three months. If the barrel will be taken out of service for an extended period, remove the head from one end (as described above) so that the barrel can be dried quickly and thoroughly. A space heater can be directed into the barrel to dry it quickly. When the barrel is to be used again, reassemble and soak with water until leak free.

APPENDIX V

SPARKLING WINE INSTRUCTIONS

Preliminary Any still wine which is capable of further fermentation can be champagned. Alcohol content must be limited to levels which allow further fermentation after bottling. This is easily accomplished by using starting S.G.'s not higher than 1.085 (1.080 warm) for winegrape musts or 1.080 (1.075 warm) for fruit wine musts.

After fermentation is complete, bulk age the wine in normal fashion for four to eight months, and if necessary, use a fining agent to clear a hazy wine. The final S.G. should not be higher than those indicating complete fermentation (see ***Making Wine At Home***).

Bottle Fermentation

1. Rack the clear wine carefully to a sulfite-wet primary fermenter. Remove about 2 cups of wine and warm gently in a small enamel or stainless steel sauce pan. Turn off the heat and dissolve cane sugar according to the below guide. Be sure to proportion the sugar carefully for volumes other than 5 gal.
For each 5 gal. wine, add:

Full Champagne - 1-1/2 Level Measuring Cups Cane Sugar
Sparkling Wine - 3/4 " " " " "
Mild Sparkle - 1/4 " " " " "

2. Add the sugar solution prepared in step 1. and 1 level teaspoon of yeast energizer (for 5 gal.) to the wine and stir gently until well mixed.

3. Hydrate 1 package of champagne yeast in a little gently warm water (about 100 ^{O}F). Let the yeast soak into the water on its own for about 15 minutes. Then stir until smooth and lump free.

4. Remove about 2 cups of the sweetened wine to a clean mixing bowl. Cover the primary

fermenter.
Aerate the 2 cups of wine by stirring vigorously and then add the yeast "solution" from step 3. Stir vigorously and pour into the wine in the primary fermenter.

Important Warning Considerable pressure from CO_2 gas builds during bottle fermentation and is dangerous in improper bottles. We recommend only sound champagne bottle be used. Please follow all instructions carefully.

5. Sterilize and rinse the champagne bottles and place upside down on paper toweling until each is ready to fill.

6. Siphon the wine gently to the bottles, leaving about 2 inches of headspace, and apply the closures immediately. During bottle filling, stir the wine in the primary fermenter every few bottles to prevent the yeast from settling out during bottle filling.

At this point it will be necessary to decide whether you later plan to remove the yeast sediments from the bottles and sweeten the wine to taste, or to leave the wine dry and decant from the sediments as you serve it.

A. Leave dry and decant Use metal crown caps or champagne stoppers and wire hoods for closures. Place the bottles upright at 70 to 75 ^{o}F for three or four weeks to complete bottle fermentation. Then move to a cool location for bottle aging (bottles upright). Remember the bottles are now fully pressurized and should be handled carefully. Most wines will improve dramatically with 6 months to a year of bottle aging.

B. Remove sediments and sweeten Place bottles neck down at about a 45 degree angle. Wine bottle cases may be propped up under one side to accomplish this angle. Leave at about 70 to 75 ^{o}F for three or four weeks to complete bottle fermentation. Then move to a cool location, maintaining the neck down position.

7. Wearing gloves and plastic lens glasses, give each bottle a sharp rap and quick quarter turn twist to dislodge and induce the yeast sediments toward the bottle neck. After several complete revolutions, increase the bottle angle about half way to vertical and continue the rap and rotate procedure for another several rotations. Finally, arrange the bottles completely upside down and

continue the rap and rotate routine. The goal in to get all the yeast into the neck of the bottle. If the wine is handled every day the whole procedure will take a number of weeks.

8. A day before disgorging the yeast sediment and sweetening, refrigerate the wine (still neck down) so that it will be thoroughly chilled. Prepare a brandy syrup for sweetening from a good quality brandy and cane sugar. We will need about one fl. oz. of the syrup for each bottle to be sweetened. Use about 16 oz. of brandy for 5 gal. The sugar will dissolve more easily it the brandy is first gently warmed over low heat in a covered sauce pan. With the flame off, add dry cane sugar in the approximate amounts given below and stir until dissolved. Then add additional brandy to reach a total volume of 25 oz. (for 25 bottles). Refrigerate the syrup well to get it ready for use.

A. Dry _ to 1 cup
B. Semi-dry 1-1/2 to 2 cups
C. Sweet 2-1/2 or more cups

9. To disgorge the sediments, the neck of the bottle will be frozen to encase the yeast in an ice plug. Prepare a freezing bath (in an insulated container if possible) from about 2 lbs. dry ice and a few quarts of denatured alcohol. Wearing gloves, break up the dry ice into fist size chunks and place in the container. Then, pour in denatured alcohol a little at a time, allowing the bubbling to quiet down after each addition. Continue until the liquid depth is at least four inches.

10. Have the mushroom stoppers, wire hoods, chilled brandy syrup and some means to measure the syrup ready for use. Working with one bottle at a time, immerse the neck end an inch or so in the freezing bath for about 15 to 30 seconds to freeze solid the wine in the neck of the bottle. Aim the bottle (now upright) into an empty bucket on its side and remove the bottle closure. The ice plug and yeast should expel into the bucket or may come out inside the hollow of the mushroom stopper. A dry cotton swab can be used to remove any remaining yeast from inside the bottle neck. Immediately add one oz. of the chilled brandy syrup and install a fresh mushroom stopper and wire hood. Swirl the bottle to mix the syrup into the wine. Age the wine in cool place for six months or more of bottle aging. Cheers!

APPENDIX VI

MAKING HIGH ALCOHOL WINES

PORT AND SHERRY

Wineries generally make these *fortified* wines by adding high proof brandy during fermentation to achieve about 20% alcohol. This addition stops fermentation at a point that leaves the wine at the sweetness the winemaker wants to have. Although we could apply this same technique to wines at home, we will find it far more economical (due to taxation) to make these wines by fermenting sugar to the maximum alcohol tolerance of our yeast. Given a good recipe and proper conditions, we can ferment to 19% alcohol or more. Then, a much smaller addition of brandy is needed.

Since the yeast cannot tolerate all at once the total sugar necessary to achieve maximum alcohol content, we recommend a starting SG no higher than 1.100 (1.095 warm). After fermentation is established in normal fashion, then a process of feeding measured amounts of sugar along with yeast energizer, usually in three increments, achieves the total sugar needed without harm to the

yeast. Heavy sherry and tawny port will need to be oxidized after high alcohol is attained. Air contact and a somewhat lower acid level, around 0.5% if possible, will facilitate the oxidation. Spoilage bacteria cannot harm the wine during this stage because of the high alcohol content. For these wines, use a 4 gal. recipe and do the oxidizing step in a 5 gal. carboy. Ruby port or dessert fruit wines which will not be oxidized, should be made to yield 5 gal. with acidity around 0.7 to 0.8%.

FRUIT WINES

To achieve the most pleasing results, we will need to limit the alcohol to levels which are in balance with the flavor intensity of the wine. Unless the wine has very intense flavor it is probably better not to make maximum alcohol in it. We have the option of using the feeding technique, but stopping after only one or two sugar additions. Even without feeding additional sugar, a starting SG of 1.100 translates to 14% or more alcohol, depending on how far the fermentation proceeds before stopping. Each 0.010 increase in SG contributes about 1.5% additional alcohol to the wine. After feeding additions are completed, continue with normal processing through bulk aging and preparation for bottling.

FEEDING TECHNIQUE

When the SG in the primary fermenter has fallen to about 1.070 to 1.080, add 1 lb. cane sugar (about 2 measuring cups) to a 4 gal. batch (or 1-1/4 lb. to 5 gal.) and _ teaspoon yeast energizer. The sugar may be dissolved in a little water before adding if desired. The SG increase from this addition should be about 0.010 in either case. Temperature at about 65 to 70 ^{O}F will maintain a steady but controlled fermentation. The next day, repeat the same sugar and yeast energizer additions to generate another 0.010 SG increase.

To maximize alcohol, repeat the additions a third time and rack the wine to a 5 gal. carboy and attach a fermentation lock with sulfite solution inside. At this point, the SG will have been increased by about 0.030 and the sugar total is equivalent to having started at an SG of 1.130. Place the carboy in a location where 72 to 74 ^{O}F can be maintained until fermentation stops. Cooler temperatures reduce yeast activity so that all sugar may not be used, and warmer temperatures increase the toxicity of the alcohol and kill the yeast before maximum alcohol has been achieved.

A final SG of 0.995 indicates more than 18.5% alcohol has been made. If higher alcohol is desired, we can add 750 ml. of a good 80 proof brandy. Added to 4 gal., this raises alcohol to about 19.5% and added to 5 gal., to about 19.3%.

PORT AND SHERRY

Once alcohol content of 18% or more is achieved, bacteria cannot live in the wine and the air contact and temperatures necessary to oxidize these wines will not cause spoilage. Rack the wine from its sediments to another carboy and stopper the top with a clean cotton plug or a fermentation lock without liquid inside. Place the carboy in a location where there is daily temperature variation. The warmer the high end of that range (up to about 90 ^{O}F), the faster the oxidation will take place. Taste the wine periodically to follow the development of the port or sherry flavor. Several months will normally be needed.

Sugar syrup or winegrape concentrate and 4 oz. of glycerine may be added to sweeten the wine at any time during the oxidation stage, but must be carried out at some time before bottling in any case. Sherry will be improved and cleared by fining with sparkolloid a few weeks before bottling. Port may profit from a few months on oak chips prior to bottling. This can be done before or after the wine is sweetened.

Because port and sherry are oxidized and contain high alcohol, these wines will improve during bottle aging for a long time. They will last almost indefinitely should one wish to set a bottle or two aside for special occasion 10 or 20 years in the future.

(630) 834-0507 EMAIL, CWINEMAKER@AOL.COM
WWW.CWINEMAKER.COM