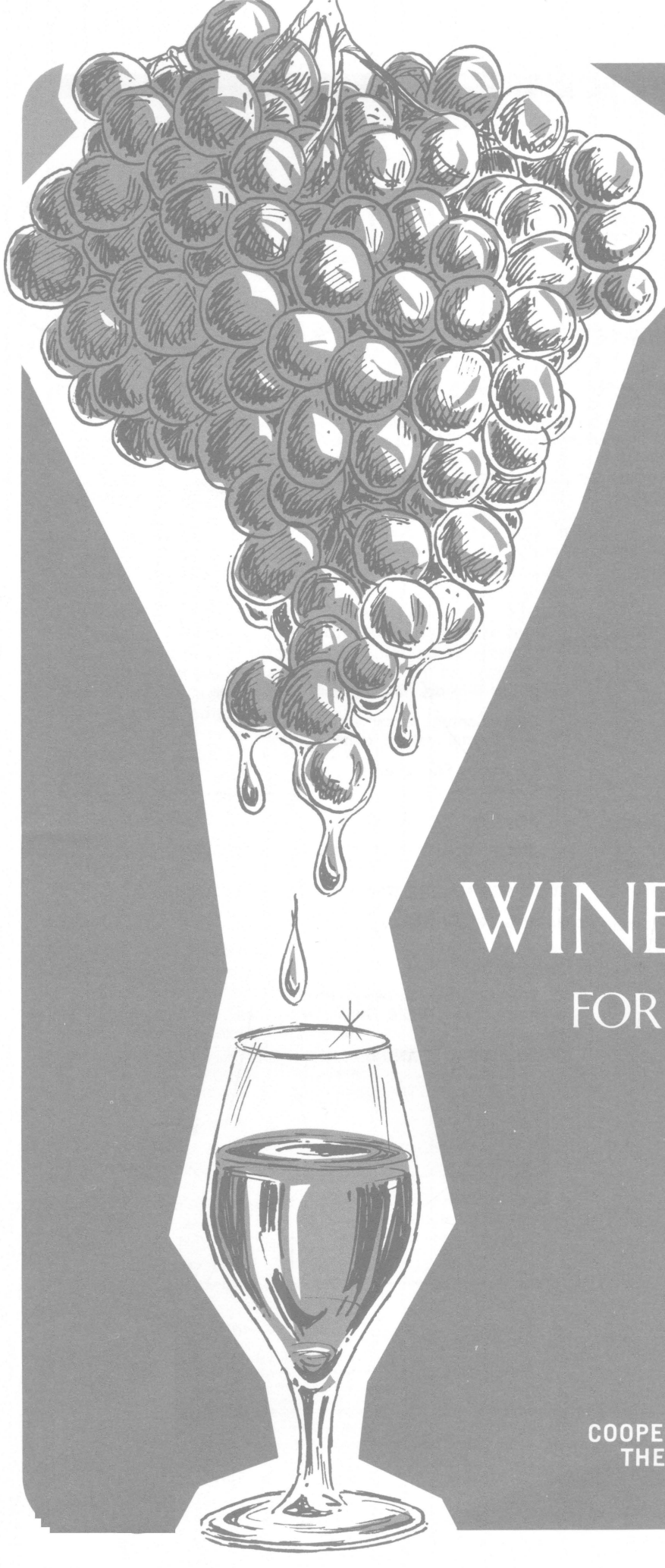
Bulletin 549



WINE MAKING

FOR THE AMATEUR

COOPERATIVE EXTENSION SERVICE
THE OHIO STATE UNIVERSITY

WINE MAKING FOR THE AMATEUR

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WINE MAKING

Thousands of people are discovering the fun and challenge of making wines at home. Wine making, even for the beginner, presents few difficulties. The basic ingredients—fruit, sugar, yeast and other essentials—are readily available and the equipment need not be expensive.

The home wine maker is rewarded by a sense of accomplishment, and he has the added pleasure of serving his own product.

Wine making as a hobby may involve the production of less than a gallon, or as much as 200 gallons a year.[1] Many hobbyists have organized wine making societies, clubs, and guilds to socialize and trade experiences with other amateurs.

FERMENTATION

In wine making, fermentation refers principally to the conversion of grape juice to wine. During this process, certain yeasts convert sugar in the juice to alcohol, carbon dioxide, and other by-products such as glycerol, acetic and lactic acids. Although many yeasts are known to synthesize alcohol from sugar, the ones most widely used for wine making are known as "true yeasts." Of this group, various strains of *Saccharomyces cerevisiae* var. *ellipsoideus* are the most commonly used.

The over-all process of alcoholic fermentation may be represented by the following equation:

$$\underset{\substack{(Sugar)\\(glucose)}}{C_6H_{12}O_6} = \underset{(Alcohol)}{2C_2H_5OH} + \underset{(Carbon\ Dioxide)}{2CO_2}$$

From this simple equation, sugar is fermented to give 51.1 percent alcohol and 48.9 percent carbon dioxide. However, in practice the alcohol content is only about 90 to 95 percent of the theoretical maximum. The amount of loss depends on a number of factors, including amount and type of sugars present, alcohol evaporation, fermentation temperature, and yeast strain.

WINE TYPES

Although the basic fermentation process, conversion of sugar to alcohol by yeasts, is common to all wines, there is a great variation in the quality and types of wine produced. A general classification of wines may include the following: appetizer wines, red table (dinner) wines, white table (dinner) wines, dessert wines, and sparkling wines. Since the hobbyist is usually concerned with making table wines, the description of these wine types is as follows:

Red Table Wines—The characteristic color of red wines is usually obtained by fermenting colored grapes on the skins. This operation is performed after destemming and crushing, but before pressing, and generally takes from 3 to 5 days. During this period, the alcohol produced by fermentation extracts the red pigment from the skins to yield a colored wine. The skins and seeds are then removed by straining and pressing.

Red table wines, usually containing very little sugar (dry), are popularly consumed with the main course of the meal. Traditionally, they are favored with red meats, spaghetti, etc. The alcohol content of red table wines is usually from 10 to 14 percent. Although most are dry, some are slightly sweet and are known as "mellow red wines." Red table wines usually possess a pleasant astringent taste and are more robust in character than white table wines. Most popular wines of this class are burgundy, claret and red chianti. Rosé wines may be classified as red table wines. These pink wines are fruity, semi-sweet, and light in character.

White Table Wines—Unlike grapes for red wines, grapes (white and some colored) for white table wines are usually pressed immediately after crushing. This means the juice is fermented without the presence of grape skins. White table wines usually range in color from light yellow to light gold. Delicate in character, these wines are best served with white meats such as fowl and seafood. The degree of sweetness of white table wines varies from very dry to sweet depending on the particular wine. The most popular white types include chablis, rhine, moselle, and sauterne.

GRAPES

The grape is the most popular fruit for making wine. Although there are many species of grapes, only three are commercially important in the United States. They are *Vitis vinifera, V. labrusca* and *V. rotundifolia.*

The first, *V. vinifera,* provides the major commercial grapes of this country. In this country, California leads all states in grape and wine production and uses exclusively vinifera cultivars (varieties). Some of the major wine cultivars include Cabernet Sauvignon, Pinot noir, Zinfandel, White Riesling, Chardonnay, and Sylvaner. Since these cultivars have poor winter hardiness when grown in eastern United States, their supply to amateur wine makers is rather limited. For interested amateurs, a few vinifera cultivars may be obtained at fruit terminals in large cities and from select eastern growers.

Next in importance to *Vitis vinifera* of commercial importance in the United States is *V. labrusca* and other

[1] The U. S. Internal Revenue Service requires that all home wine makers file a copy of the U. S. Treasury form 1541 at least five days before wine production is started each year. For Ohio home wine makers, this form may be obtained from the Assistant Regional Commissioner, Internal Revenue Service, Alcohol and Tobacco Tax Div., Federal Office Bldg., Cincinnati, Ohio 45202. There is no charge for the permit which is simply a declaration to make wine for family use. The producer must be the head of a family and production must not exceed 200 gallons per year.

hybrids. These so-called labrusca or American type grapes possess a pronounced labrusca aroma and are relatively high in acidity and low in sugar content. In contrast to *V. vinifera* cultivars, most labrusca type grapes are "slip skinned," that is, the skins separate from the flesh quite readily. Also, labrusca grapes are generally more winter hardy than the vinifera cultivars. The major growing areas of American type grapes are the Great Lakes Region, Pacific Northwest, the midwest and eastern states from Delaware to New England. The most common cultivars of this type in Ohio are Concord, Catawba, Delaware, and Niagara.

The third species of commercial importance is *Vitis rotundifolia,* termed Muscadine type grapes. These should not be confused with Muscat cultivars of the European type grapes. Muscadine grapes are grown primarily in the southern states and include the cultivars Scuppernong, Hunt, Thomas, and Creek. Like the American type grapes, they contain high levels of acid and low amounts of sugar.

Another group of grapes gaining interest in the eastern United State is known as "French Hybrids." These grapes were produced by crossing the European type with one of the native American species. As indicated by this name, most of the breeding was performed in France. Generally, these selections are identified by a number and the breeder's name: Seibel 9549, Seyve Villard 12375, and Couderc 7120. Although French selections may be used for dessert purposes, their importance is in producing a more neutral type wine in the eastern United States.

Generally, a good wine can never be produced from poor wine cultivars. Therefore, selection of the proper cultivar is important in making a highly acceptable wine. Since many wine grapes are available and each has its own quality attributes, it is important to first decide upon the type of wine desired. Some cultivars produce a dark red wine, others yield a light red color, and still others make a rose type. The same degree of variation also occurs in other attributes such as aroma and flavor. American hybrids will usually produce wines with varying levels of the unmistakable fruity, labrusca character, in contrast to those French hybrid wines that are more neutral in aroma and flavor.

OTHER FRUITS

Good wines can be made from fruits other than grapes. Some of the common fruit wines are cider (apple), perry (pear), blackberry, cherry, and strawberry. If the wine is properly made, almost any common fruit will produce an acceptable product. Fully ripe fresh fruit is usually the best raw material. Processed fruit, such as frozen fruit, dried fruit, and fruit concentrates are generally more expensive and require more strict attention during processing.

GRAPE CULTIVARS

Since the grape is the principle fruit used for the production of wine, the evaluation of grape cultivars for wine has been in progress at the Ohio Agricultural Research and Development Center in Wooster, Ohio for several years. A brief statement concerning the sensory examination of several popular cultivars and selections should aid in selecting the correct grape for a particular wine type. Following are sensory characteristics of some wines made at the Research Center.

Standard American Cultivars

Catawba: This cultivar produces a distinctive labrusca white wine when the grapes are "cold pressed" immediately after crushing. The wine is usually tart and is used in champagne blends in the eastern United States. When the grapes are fermented on the skins, the wine is pink with labrusca character.

Concord: This cultivar yields a pronounced labrusca type wine which is usually tart and dark red in color. The wine has a tendency to be harsh and is accompanied by a fruity character.

Delaware: Generally, this cultivar produces a light golden wine with a slight flowery-fruity character. The wine may possess labrusca flavor and is an excellent cultivar for making champagne.

Niagara: This cultivar produces a white, very fruity labrusca wine with low total acidity. The cultivar yields a common eastern-type wine.

Other American Hybrids

Alden: This cultivar produces a light red wine with a slight spicy and muscat aroma. Generally, the wine is flat and has little character.

Bath: This cultivar yields a light red wine with mild labrusca and fruity character. Generally, it makes a good eastern-type wine.

Blue Eye: Generally, this cultivar produces a light red, tart wine. The wine is also thin in body and has a slight fruity flavor and aroma.

Fredonia: This cultivar yields a dark red-colored wine with a strong labrusca character similar to Concord. The wine usually has unsatisfactory balance and the overall quality is fair.

Steuben: Wine produced from this cultivar is light red, thin bodied and fruity. The cultivar yields a fair quality wine.

French-American Hybrids

Baco No. 1 (Baco Noir): The wine from this selection is dark red and possesses an astringent taste. Flavor and aroma are usually pleasant and the wine has good body.

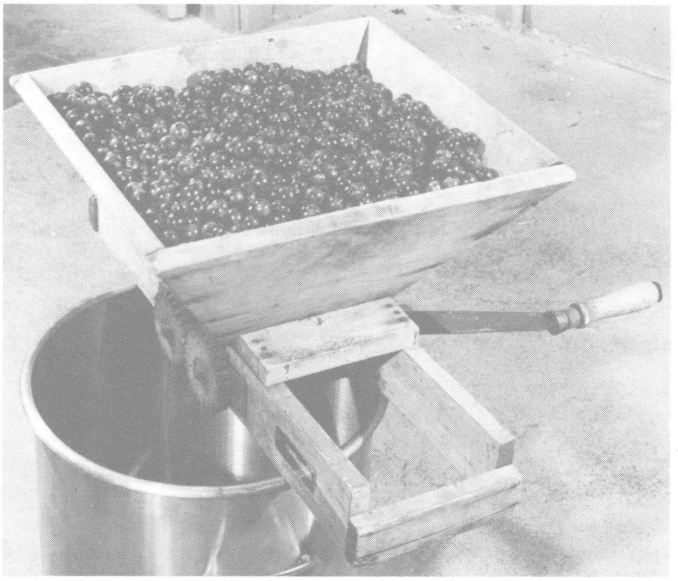
Seibel 5279 (Aurora): This grape produces a well-balanced white wine with fair body. The wine is characterized as being neutral and is considered good quality.

Seibel 7053 (Chancellor): This grape yields a dark red wine with an aroma which is not especially distinctive. It has a slightly fruity flavor, low acid, and fair body.

Seibel 9549 (DeChaunac): Wine produced from this hybrid is dark red in color and slightly thin in body. The flavor and aroma are characterized as neutral. Although astringent, the overall quality of the wine is very good.

Seibel 10878 (Chelois): Wine produced from Seibel 10878 has dark red color, good body, and agreeable aroma. It is also well-balanced and the quality is very good.

Seyve Villard 5276 (Seyval): This white selection produces a very light yellow wine with a slight fruity character. The wine is also well-balanced and the quality is very good.



Small Mechanical Crusher: Grapes are crushed by passing through a pair of rollers.

Seyve Villard 12375 (Villard Blanc): This selection produces a light yellow wine with fine aroma and taste. It has good balance and body, and usually yields a good wine.

Vidal 256: This grape produces medium yellow wine with good aroma. The wine is characterized as being neutral, slightly harsh and of good quality.

MATERIALS, EQUIPMENT AND METHODS

Most of the materials and equipment needed by a home wine maker can be obtained from amateur supply companies. Several of these companies are listed in this bulletin (See Appendix A). Also, addresses of many supply firms are found in books and related publications concerning home wine making (See Appendix B). Often suitable equipment, especially containers and juice extractors, can be purchased from local hardware and secondhand stores. However, avoid equipment constructed of iron, copper, and zinc coated materials. When in contact with wine, these metals will cause darkening and off-flavors in the finished product.

Specialized materials such as hydrometers and various chemicals can generally be obtained from local drugstores. Often the amateur is confronted with weighing chemicals essential in many steps in wine making. If a balance is not available, the druggist may assist by providing the correct amount of material. One may approximate the weight by using common units of volume measurements (See Appendix C).

Stemmers

In order to make the best quality wine, remove stems before fermentation. The stems contain a relatively high concentration of tannin (an astringent substance) which will affect wine quality if the stems are not removed from the berries. This added tannin usually results in a bitter or astringent product. Also, the wine can develop a "stemmy" taste, which is objectionable.

When the quantity of grapes is small, stem removal can be accomplished by hand or a home-made device. A workable stemmer can be made by driving many nails in a board with the head an inch from the surface and about one inch apart. The grape bunches are dragged over these nails, to separate the stems and berries. Another method is to strain the stems from the grapes by passing them through a wooden lattice.

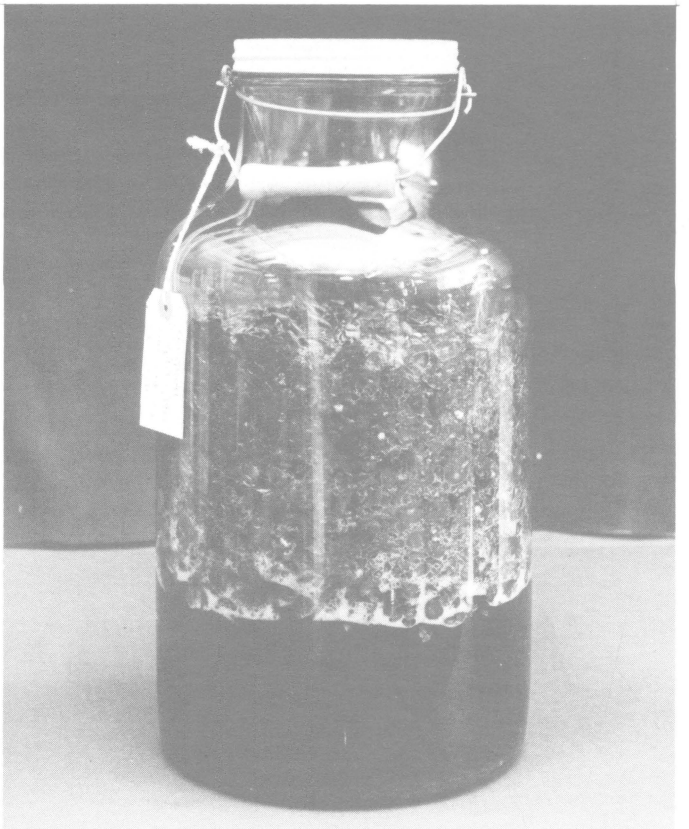
Crushers

To prepare the grapes for fermentation, berries must be crushed into a pulpy mass. Complete crushing is important in producing an acceptable product. Fermentation usually starts sooner and yields better wine color if the grapes are crushed properly.

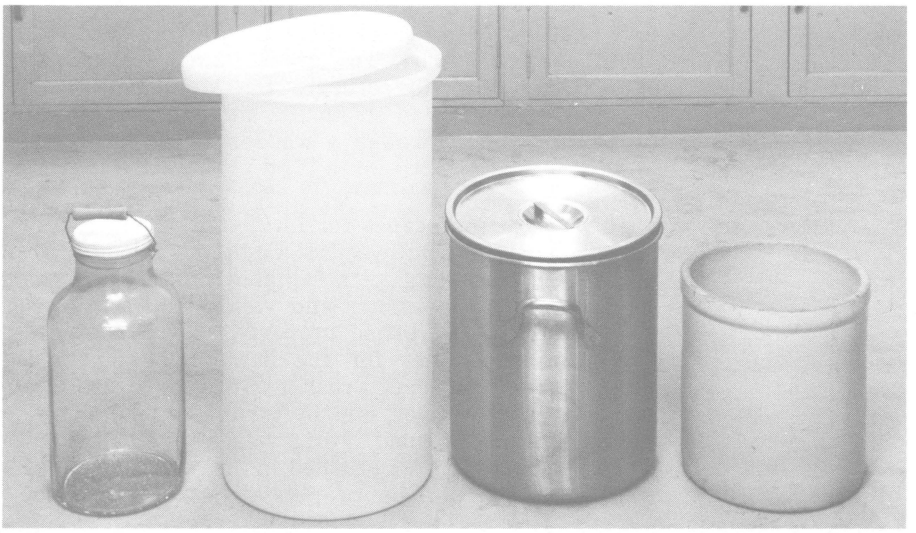
A popular crusher for the home wine maker is a small mechanical grape crusher. Grapes are transferred to the crusher hopper, and by turning a pair of rollers, the berries are crushed. For a relatively small quantity of wine, grapes can be crushed in any suitable container with a wooden plunger or potato masher.

Primary Fermentation Containers

After crushing, the grapes are usually transferred to a container for the initial fermentation-on-the-skins. However, the wine maker may want to eliminate this initial fermentation by immediately pressing the crushed grapes. This is frequently done on making white wine from white grapes and from some colored cultivars. The containers should be open-end cylindrical vessels of suitable volume. Generally, the container is filled to two-thirds of its capacity. This allows for expansion during the fermentation, and avoids over-flowing. Also, the containers should be covered with cheesecloth to keep out vinegar flies or other extraneous material.



Fermenting-on-the-skins: This fermentation extracts color from the grape skins to make red and pink wines. Note, the cap, skins and pulp, rise to surface during this fermentation.



Open-end Containers: For fermentation-on-the-skins, some containers include glass, plastic (polyethylene), stainless steel and stoneware.

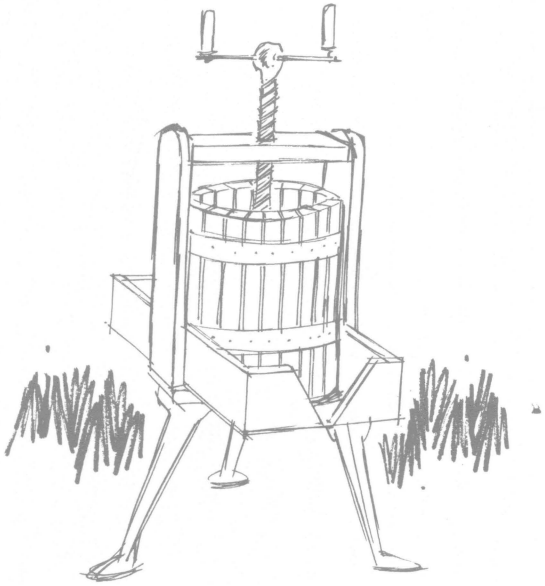
The most common containers used for this fermentation include plastic (polyethylene), glass, stoneware, stainless steel, and wood. Of this group, the polyethylene heavy-walled tanks are considered the best selection for the home wine maker. These containers are easily washed, light weight, resistant to shock, and relatively free from off-odors. Although glass containers can be used, careful handling is important because of their inability to withstand rough treatment. The same is true of stoneware containers (crocks). In addition, stoneware is extremely heavy to handle. Stainless steel tanks are excellent fermentation containers, but the cost usually prohibits their use by the amateur.

Presses

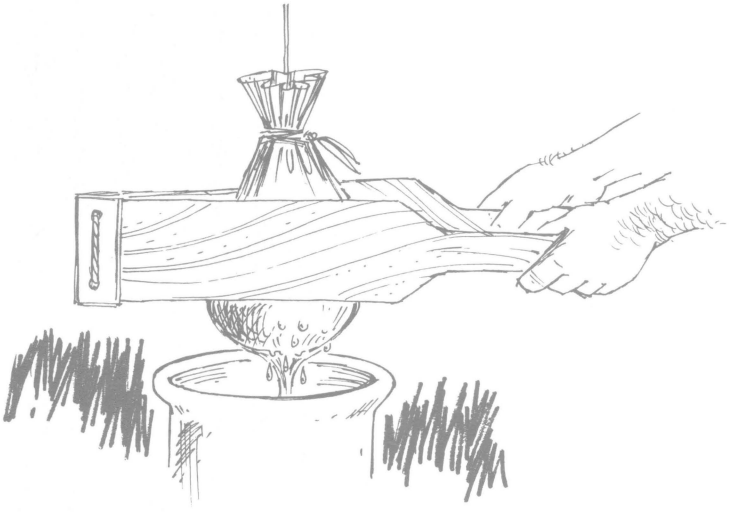
Several types of presses may be used to express juice or fermenting wine from the prepared crushed grapes. The most common type of press for making wine in the home is the basket press. The size ranges from small table models to floor presses which hold several bushels of grapes. The crushed grapes are placed in the basket compartment of the press and pressure is applied by turning down the screw with a ratchet. The pressure should be applied slowly so the juice rather than the crushed tissues flow through the cracks between the wooden staves.

Another type of press which will serve quite well is an ordinary cider press. However, most of these presses are too large, a disadvantage to the amateur in space and cost.

For the ambitious home wine maker, a small press can be built at a reasonable cost. Construction details for such a press have been published in Circular 194 of the New York Agricultural Experiment Station, Geneva, New York. This press requires a small hydraulic automobile jack and other materials which can be purchased locally. The capacity is approximately one bushel of crushed grapes. For small quantities of grapes, the juice or fermenting wine may be strained through cheesecloth. If one wishes to apply pressure, a sack may be made and suspended by a rope and pressed with a simple nutcracker type of press. This pressing device may be made at home by obtaining two wooden paddles and hinging them together with a rope.



Basket Press: This press is one type used for removing juice or fermenting wine from prepared grapes.



Nutcracker Press: This homemade press may be used for small quantities of grapes.

Sulfur Dioxide

After obtaining the grape must (crushed grapes or grape juice), the material is best treated with a small amount of sulfur dioxide. The main function of this compound is to inhibit the growth of undesirable microorganisms, especially wild yeasts and vinegar bacteria. If these microorganisms are not controlled, the wine may develop an off flavor and aroma. Another reason for using sulfur dioxide is to help prevent browning of the wine. This is especially critical in most white wines.

Sulfur dioxide is a colorless, non-flammable gas with a pungent odor. The gas is a sanitizing agent used to sterilize wine cooperage (wine containers) and can be generated by burning sulfur wicks or strips inside the container. For treating musts or wines, most wineries introduce sulfur dioxide by slowly bubbling the gas into filled tanks or other cooperage. Although convenient for commercial operations, this method is not practical for the home wine maker. The best method for the amateur is addition of sulfite salts, some of the most common salts being sodium sulfite, sodium bisulfite, and potassium metabisulfite. These compounds are dry chemicals and are convenient for the amateur in treating musts and wines.

Potassium metabisulfite is generally the most widely used sulfite salt. This chemical has slightly more than 50 percent available sulfur dioxide when in solution. Most drugstores and amateur wine suppliers handle this material for the home wine maker. In general, the supply of sulfite salt should be for only one season's operation since these salts lose their strength during storage. They should be kept in a cool, dry place.

After obtaining the crushed grapes or juice, treat raw material with 100 ppm (.01 percent) of sulfur dioxide. For each 2 gallons of juice or juice and skins add 1.4 grams or approximately ¼ teaspoon of potassium metabisulfite (Appendix C)[2]. It is best to dissolve this chemical in a small volume of juice, add it to the raw material, and stir thoroughly. After treating, let stand for at least 6 hours before adding a wine yeast starter.

Since the sulfur dioxide level will decrease after its addition, commercial wineries periodically add more during the latter stages of vinification, frequently at the time of racking. Generally, wineries strive for 20 to 30 ppm free sulfur dioxide in most wines. At this level, the sulfur dioxide will inhibit spoilage and oxidation which may occur over a period of time. The desired level of sulfur dioxide is obtained by precise methods usually too difficult for the beginner to employ. If an overdose does occur, the wine will possess an off odor, and pungent smell foreign to good quality wines. Most technical books on wine making and a few amateur books (See Appendix B) deal with sulfur dioxide application adequately for the serious home wine maker.

Amelioration

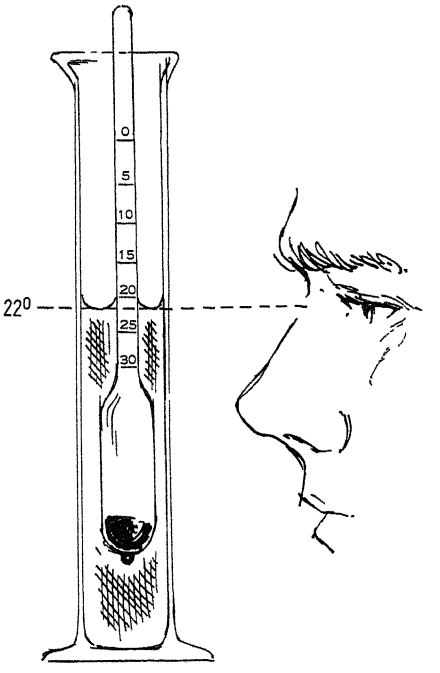
Since most fruits and eastern grapes are deficient in sugar (less than 22 percent), an important step in making wine in eastern United States is the addition of sugar. Adding the correct amount of sugar to the grape must is essential to obtain the desired level of alcohol. At 22 degrees Brix (approximately 22 percent sugar), the fermentation will yield about 12½ percent alcohol by volume. This alcohol content is a typical value for most table wines. In addition to correcting the sugar level, most fruits and eastern grapes require water to reduce their natural acidity or tartness. This adjustment is important in obtaining a balanced wine, especially for dry table wines.

Before ameliorating the grape must with sugar and water, the amateur should determine the sugar content of the raw material. The recommended instrument and procedure to determine this sugar content is described in the following paragraphs.

Hydrometer: The principle of Archimedes is used in the hydrometer, an instrument for determining the density of liquids. The hydrometer is one of the most important pieces of equipment that an amateur can own for making wine. It is used to measure the amount of sugar in grape juice, and determine the amount of sugar to be added to the must or wine for the desired alcohol level (11 to 13 percent).

The most common hydrometer used by the wine maker is calibrated and marked in the Brix scale. This scale relates the density of grape juice to sugar solutions of the same density and known sugar percentages. Since the majority of the dissolved solids in grape juice is sugar, the Brix value for practical purposes equals the percentage of sugar in the grape juice.

A Brix hydrometer is usually made of a cylindrical glass tube with a narrow stem containing the Brix scale. At the lower end of the hydrometer is placed a sufficient weight (mercury or shot) to cause the hydrometer to sink to a particular level in the juice. The depth to which it sinks is determined by the density (Brix) of the liquid. The lowest point of the meniscus (curved upper surface of the liquid) is read on the hydrometer. The eye of the observer should be placed in line with this surface, and the Brix value read on the hydrometer stem.



Reading a Brix Hydrometer: A proper measure of the Brix content of juice or wine samples is obtained by reading the Brix value on the hydrometer stem at eye level.

2 For 1 gallon or about 9.0 pounds of raw product, add 0.70 grams (⅛ teaspoon) of potassium metabisulfite to obtain 100 ppm of sulfur dioxide.

For accurate and consistent readings, the hydrometer should be washed, rinsed, and dried with a lint-free cloth before testing the grape juice. Also, the temperature of the juice should be recorded for the purpose of making a temperature correction. This correction is necessary because the hydrometer is usually standardized at a specific temperature of 68° Fahrenheit (20° Centigrade). For approximating this correction, add 0.1 to the Brix value for every 3° over 68° F., and subtract 0.1 for every 3° under 68° F. Another precaution in ensuring uniform readings is to immerse the hydrometer slowly into the juice. It is recommended that the instrument be immersed slightly beyond the point at which it floats naturally. Also, the hydrometer should float freely, not touching the sides of the container. The container most commonly used with the hydrometer is a glass cylinder, termed a **hydrometer cylinder.** This cylinder and Brix hydrometer are usually available from amateur wine suppliers (Appendix A).

Sugar Content: Immediately after crushing, test a sample of juice for its sugar content. This juice sample is obtained by straining a small quantity of the grape must through a layer of cheesecloth or other suitable material. Fill the glass cylinder to within a few inches of the top and immerse the Brix hydrometer in the juice. For accurate results, a Brix hydrometer with a scale between 15° to 25° Brix is considered best for testing most grapes. After making the temperature correction, the sugar content should be recorded for later reference.

Sugar Amelioration: After determining the sugar content of the grape must, the next step is to calculate and add the required amount of sugar (beet or cane sugar) to bring the original Brix value to approximately 22°. One practical method of estimating this amount is to add 0.125 pound (¼ cup) of sugar per gallon of must for every Brix value below 22°. For example, 10 gallons of juice (or juice and skins) at 15° Brix would require 8.75 pounds of sugar for a Brix reading of 22°. This method may be represented by the following formula:

$$S = 0.125\ C\ (B\text{-}A)$$

S = *Weight of sugar to be added to bring grape must to 22 degrees Brix.*
0.125 = *Factor, pounds of sugar to raise 1 gallon of grape must 1 degree Brix.*
C = *Gallons of grape must.*
B = *Desired degrees Brix (22°).*
A = *Original degrees Brix of grape must.*

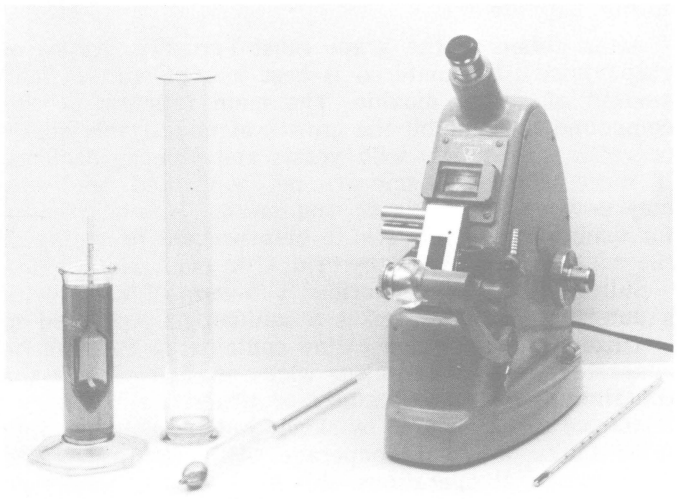
For those who wish a more accurate method, another formula may be used to calculate the amount of sugar to be added to the grape must. This formula is as follows:

$$S = W \times \frac{B\text{-}A}{(100\text{-}B)}$$

S = *Weight of sugar to be added to bring grape must to a desired degrees Brix.*
W = *Weight of grape must.*
B = *Desired degrees Brix.*
A = *Original degrees Brix of grape must.*

Thus, if it is desired to bring 100 pounds of grape must of 15° Brix to 22° Brix, the weight of sugar to be added would be as follows:

$$S = 100 \times \frac{22\text{-}15}{(100\text{-}22)} = 8.97\ lbs.$$



Laboratory Abbé Refractometer: In addition to the hydrometer (left), an Abbé refractometer may be used to find the amount of sugar in grape juice and fermenting wine.

After the sugar has been calculated and weighed, it is added to the juice or juice and skins and thoroughly stirred until the sugar is dissolved. At this point it is recommended that a hydrometer reading be taken to check the Brix of the adjusted must. The Brix should be close to the desired sugar level.

Syrup Amelioration: Since most eastern grapes are usually too tart for making most wines, it is recommended that a certain amount of water (syrup) be added to adjust their acidity. This amelioration is usually performed after pressing, and the addition of syrup is preferred to adding sugar and water separately.

To ameliorate, the first step is to prepare a syrup of the same 22 degree Brix as the original adjusted grape must. This is accomplished by adding 2.35 pounds (4¾ cups) of sugar to one gallon of water. After pressing the prepared grapes, add about 1½ pints of the 22° Brix syrup to every gallon of fermenting wine. This rate of amelioration is approximately 15 percent of the resulting wine volume and is sufficient for most eastern wines.

Amateurs who wish to control amelioration by a more exact method must become familiar with the chemical test for determining the total acidity of grape musts and wines. This chemical procedure is outlined in most amateur and technical wine making books (See Appendix B). After determining the total acidity, which involves some skill and practice, the fermenting juice should be ameliorated with syrup (same degree Brix as the original adjusted must) to a level approximating 0.80 percent acid. A further decrease in acidity will occur during fermentation and stabilization of the wine. A total acidity of approximately 0.60 percent is usually acceptable for most finished wines.

Yeast

A spontaneous fermentation will generally yield wine with undesirable flavor and too little alcohol. To consistently obtain a rapid and sound fermentation, the prepared grapes should be inoculated with a true wine yeast. Some of the important attributes of a wine yeast include rapid fermentation, high alcohol yield and toler-

ance, rapid settling of cells, and ability to ferment at low temperatures. There are several wine yeasts available, but two, Montrachet and Champagne, are generally recommended for the home wine maker. Both yeast strains are usually available from amateur wine suppliers (Appendix A).

Most yeast cultures can be purchased in a dry granular form or on an agar slant (test tube). For the home wine maker, the dried form appears to be the most practical. This form is usually packaged in a 5-gram aluminum packet and contains enough yeast to start about 5 gallons of wine. One should first disperse the dried yeast cells in a small volume of warm water (room temperature) before adding to juice or crushed grapes. It is recommended that the contents be swirled twice a day until the fermentation is active as indicated by bubbling and foaming. The addition of yeast should take place no sooner than 6 hours after the sulfur dioxide treatment.

For fermenting relatively large quantities of grapes (more than 10 gallons), it is best to prepare a yeast starter culture. This culture should be started a few days in advance in inoculating the prepared grapes. A one percent starter culture is usually needed to start the fermentation. Therefore, one must estimate the wine volume which is to be fermented. For 50 gallons of wine, one should obtain about 2 quarts of starting material. This is prepared by squeezing a small quantity of crushed grapes through a piece of clean cheesecloth. After obtaining about one quart of juice, dilute with water to two quarts and pasteurize by heating to a simmering boil (150-160°F.). Then, transfer the hot juice to a warm gallon jug (run hot water over the container just prior to filling) and stopper the jug with cotton. Place the container on a warm surface and allow it to cool to room temperature.

For inoculation with dried yeast, add about ½ teaspoon of yeast and replace cotton stopper. If an agar slant of yeast is used, pour a little of the pasteurized juice into the test tube and invert several times to loosen the yeast cells. Then, pour the mixture back into the jug. It may be necessary to repeat this operation if the yeast cells are not removed from the agar. After inoculation, the yeast starter should be ready to use in 2 or 3 days.

Secondary Fermentation Containers

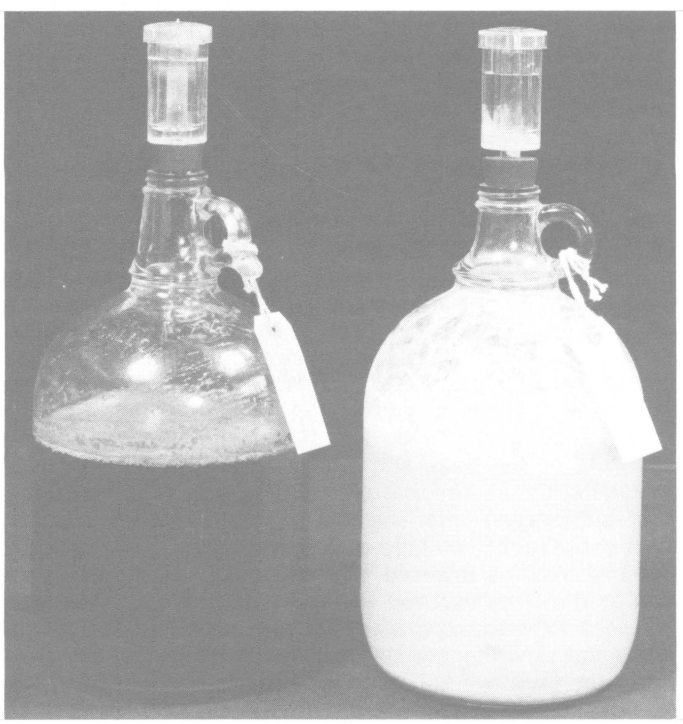
After the juice or fermenting wine is obtained by pressing, the fermentation is usually completed in glass containers or wooden barrels. The containers should not be filled more than two-thirds full. This prevents the over-flowing of containers during active fermentation. For the home wine maker, glass containers (jugs and carboys) are usually recommended, because they are easily obtained and kept in a sanitary condition. Although wood containers are best suited for quantities over 10 gallons, the home wine maker is usually not equipped to condition new barrels and prevent them from becoming sour. Methods of handling new and used barrels are listed in the following two paragraphs.

Conditioning New Barrels: It is essential to condition new barrels to remove wood tannins before using them in making wine. First, fill the barrels with water and allow to stand a few days to check for tightness. Then, empty and fill with a hot alkaline solution (2 pounds of soda ash or sodium carbonate per 50 gallons of water. After 24 hours, discard solution and immediately rinse barrels with a citric acid solution of the same concentration as the soda ash. Following this, rinse barrels with clean cold water. The best procedure is to fill the barrel completely full with water at least 3 times. For further conditioning which is recommended in most cases, the rinsed barrels should be filled with a lesser-quality wine and stored for at least a year.

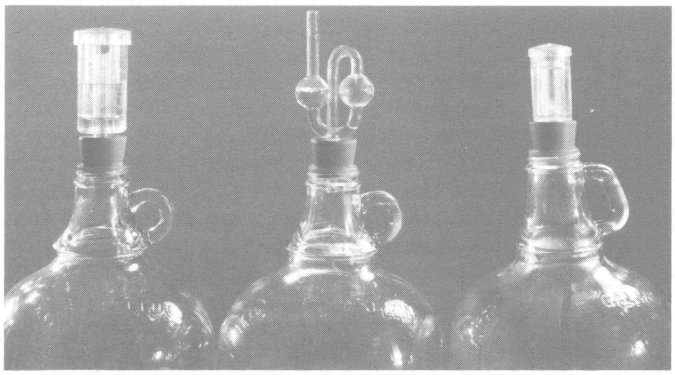
Cleaning and Storing Barrels: After drawing-off wine from a barrel, clean and sterilize the container to prevent spoilage. Rinse barrel and then fill with a hot alkaline solution (1 pound of soda ash or sodium carbonate per 50 gallons of water). After soaking overnight, empty solution and rinse barrel with cold water. After this rinsing, fill the barrel with a citric acid solution of the same proportion and let stand a few hours. Discard acid solution and rinse barrel several times with cold water. If the barrel is to be used within a few days, it should be filled with a 150 ppm sulfur dioxide solution (50 grams or 1¾ ozs. of potassium metabisulfite per 50 gallons of water). Before using the barrel again, it should be thoroughly rinsed with cold water. For storing an empty barrel for any length of time, a sulfur strip (½ dripless strip per 50 gallons) should be burned while the barrel is tightly closed. Repeat this procedure at regular intervals, usually once a month, and rinse before using. For care of the outside surface, brush barrel with a dilute alkaline solution, rinse, dry, and paint with a coat of linseed oil.

Water Seals

After the fermenting material is placed in the secondary fermentation containers (vessels with small openings), the contents must be protected from contact with air. This is accomplished by inserting a water seal



Active Fermentation: Two wines, red and white, are undergoing fermentation. Note, containers were filled about two-thirds full to avoid over-flowing.



Water Seals: These devices allow carbon dioxide to escape without letting air back into fermenting wine. This ensures an anaerobic (air-free) condition during fermentation.

(fermentation trap) into the container opening. These devices are constructed to allow carbon dioxide to escape without letting air back into the fermenting wine. The purpose is to ensure an anaerobic (air free) condition and prevent spoilage microorganisms from entering the fermentation container. There are several types of water seals on the market, and all seem to be satisfactory. However, home wine makers usually prefer plastic over glass, because it can withstand rough treatment. A simple but suitable water seal can be constructed by inserting a short piece of glass tubing into a stopper (cork or rubber) which is placed in the container opening. Attach a rubber hose to the exposed glass tube, and place the other end in a jar of water. The water seals should be kept in place until the fermentation ceases and bubbling stops.

Racking

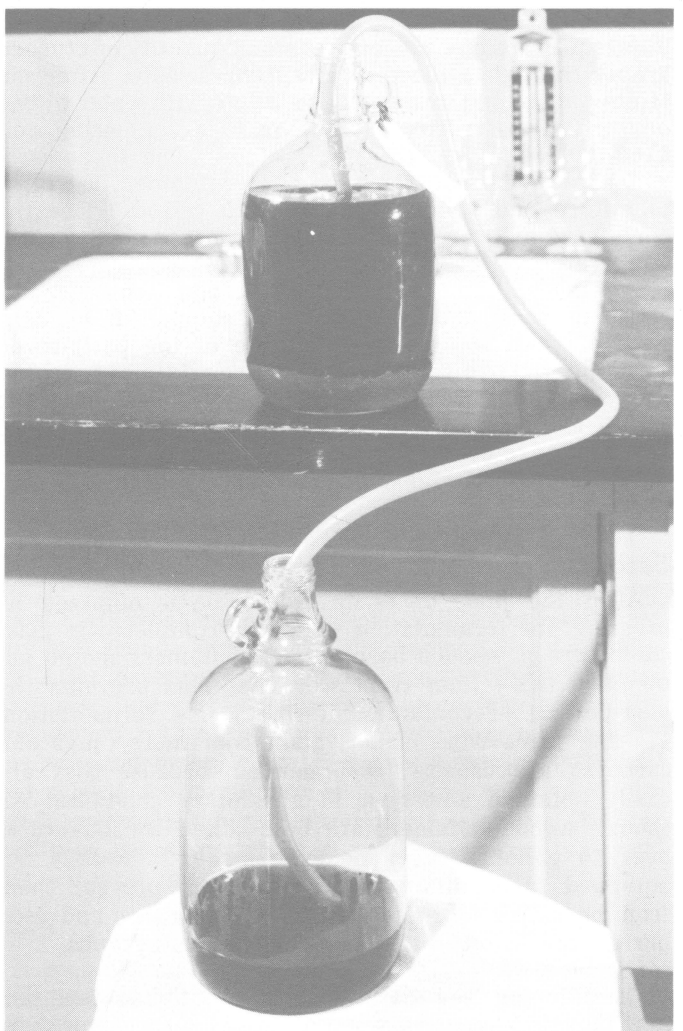
When the fermenting wine approaches completion, yeast cells begin to deposit on the bottom of the container. Generally, this deposit becomes compacted a few weeks after the fermentation ceases. At this time, the wine should be transferred to another clean container without disturbing the sediment. This operation is termed "racking" and is usually accomplished by siphoning the wine. Racking aids in clearing the wine by separating the wine from the dead yeast cells which eventually decompose and produce off-flavors. It is essential that the new container be filled completely full and the water seal inserted, since air must be kept from the wine.

For the home wine maker, a siphon hose is usually recommended for racking wine from one container to another. A plastic or rubber hose (6 feet) of about ⅜ to ½ inch inside diameter is generally adequate for most quantities of wine. After inserting the hose just under the wine surface, a common method of siphoning is to apply suction at the outlet end of the hose. When the drawing of the wine starts, the outlet should be placed immediately at the bottom of the receiving container and submerged into the wine. This prevents aeration, and consequent spoilage of the wine. While racking, the inlet should be lowered gradually, staying a few inches under the wine surface. Rack as much of the clear wine as possible without disturbing the sediment. If a little sediment is siphoned, this will not present any problem, for later rackings will usually elimate this material. Also, the height difference of the two containers should not be too great, or the wine entering the inlet end will form a vortex which disturbes the sediment.

Fining Agents

Although most wines will clear naturally through racking, it may be necessary to remove some of the suspended materials by fining (clarification). Fining should be performed by the home wine maker only on those wines which remain cloudy after a reasonable length of time (6 months). In many cases, fining wine by the amateur is quite unpredictable and may produce lower quality wine than the original product. Since many factors influence the effectiveness of the fining agents, no single material will satisfy all conditions and wine types. Before using a fining material, it would be best to test each agent in small samples. Usually, varying amounts of fining agents are added to a series of test samples, in order to determine the concentration for the best clarification. Some of the agents used commercially are as follows: gelatin, isinglass, egg whites, caseinates, bentonite, pectic enzymes and Sparkolloid. The last three agents are generally recommended for the amateur.

Bentonite: This material is a montmorillonite clay which swells tremendously in the presence of water. The recommended bentonite for fining is sodium bentonite in granular form, which is more easily mixed than the powdered bentonite. When this agent is added to wine,



Racking: After fermentation ceases, siphon wine into another container without disturbing sediment, lees. This is termed "racking" and is repeated periodically to aid in clearing wine.

the fining material is neutralized and the wine clears as flocculating particles settle. From 1 to 2 grams (about ¼ teaspoon) of bentonite per gallon is usually sufficient to clarify most wines. It is recommended that this amount of bentonite be sifted into hot water (near boiling) and stirred rapidly. Let stand a few days to promote swelling and stir again until creamy smooth before adding to the wine.

Pectic Enzymes: These enzymes are manufactured by several companies and are usually effective in clarifying wines. The hydrolytic action of these enzymes reduces the stabilizing properties of the pectins inherent in the grapes, and this allows the suspended particles to settle. These enzymes may be added to the crushed grapes or to the wine. When added to the crushed grapes, they have an added advantage of reducing the slipperiness of the grape musts, particularly slip-skinned cultivars and thereby aid in the pressing operation. Since the enzymic action depends on a number of factors, the amount to be added can only be approximated by the amateur. A suitable amount is about ½ gram (½ teaspoon) per gallon of crushed grapes or wine, and the enzymes may be added directly with a little stirring.

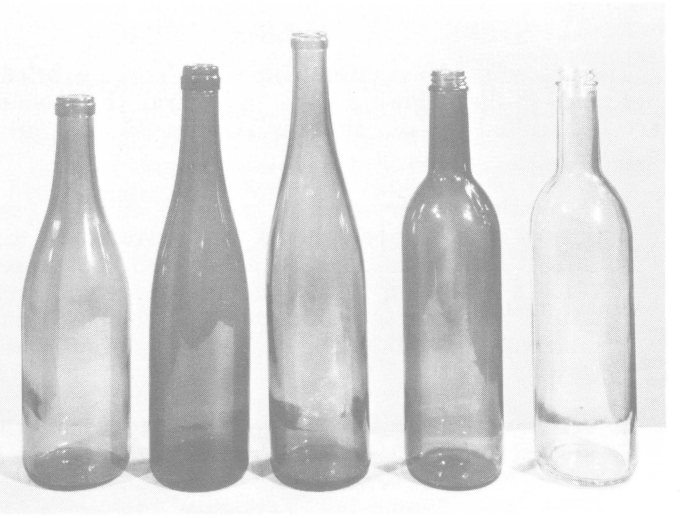
Sparkolloid: This material is a proprietary fining agent which the manufacturer recommends for fining hard-to-clarify wines. Usually ½ to 1½ grams (½ to 1 teaspoon) is used for each gallon of wine. It is recommended that this amount of material be mixed with 1 to 2 cups of water. Then the mixture is brought to a boil while stirring and kept simmering for at least 30 minutes. The water lost during heating should be replaced and the suspension kept hot while treating the wine.

Storage Containers

Keep containers used for storing wine perfectly clean, completely filled, sealed and stored at a cool temperature (50° to 60° F.). The recommended containers for white or fruit wines are glass carboys and jugs. Also, red wines can be kept in glass, but they age better in wood. However, caution should be exercised in storing wines in wood containers. Many factors such as temperature, grape cultivar, and container size affect wine development. This is especially critical for storing small quantities of wine (less than 25 gallons), which tend to develop too fast and yield a woody flavor. It is best to store red wines in 50 gallon barrels and keep them filled to capacity. Generally, one to three years storage in 50-gallon barrels is desired for most red wines.

Bottles

Although a wide variety of glass bottles can be used for most wines, it is best to store the finished wines in traditional wine bottles. Certainly, storing wine in customary bottles has aesthetic appeal for the taster. It is essential to use clean bottles for storing wines. New bottles should be rinsed with hot water and dried before bottling begins. Used bottles can be used, but they should be washed in hot water with detergent and rinsed several times with fresh water. Also, the bottles should be thoroughly dried before using. The most popular container is the ⅕-gallon size, available in many styles. Generally, clear white, greenish or brown bottles are used for white wines while green or greenish-brown is preferred for red wines.



Wine Bottles: A wide variety of bottles can be used for wines. Left to right, Burgundy-type, green, burgundy; German-type, brown, rhine; German-type, green, moselle; Bordeaux-type, green, claret; and Bordeaux-type, clear glass, sauterne.

Corks and Caps

After cleaning the bottles, fill with wine to slightly below the closure (½ inch) and with a minimum amount of aeration. This is done by using a small siphon hose. The small air space between the closure and wine is essential in preventing oxidation in the wines. The most common closures used in bottling wines are corks and screw caps. Each should be washed, rinsed and drained before securing on the bottles.

A recommended method for cleaning and preparing corks for bottling is to soak the corks for about an hour in a dilute solution of sulfur dioxide (½ teaspoon of potassium metabisulfite per gallon of water). Then rinse with clean water and drain well before inserting into the bottle. The corks should be straight, not tapered, and at least 1½ inches long. Wine corks and simple corking machines are usually available from suppliers listed in Appendix A. After corking, the bottles should be allowed to stand upright for 1 to 2 days to equalize the air pressure in the bottles. They should be placed on their sides while in storage to keep the corks moist. Bottled wines should be stored between 55° to 60° F.

Generally, screw caps are used for storing wines which will be consumed in a relatively short period of time. The recommended screw cap for the home wine maker is one with a convex polyethylene liner. This type of cap prevents air leakage into the wine, thus reducing the amount of oxidation which may occur during storage. Store on sides or upright.

After placing the closure, an attractive capsule and label may be added. Capsules are made of either aluminum or lead foil. The former is usually recommended, because it is easily applied to the bottle. Capsules and the necessary equipment to apply them are available from most amateur wine suppliers. These firms also have attractive labels which add a finishing touch to the wine bottle. Any label should include essential information such as wine type, year produced, and varieties.

STEPS FOR MAKING WINE

The procedure for making table wines (dry) is briefly described in the following steps. In general, these wines are best suited for the amateur and should offer little difficulty.

1. **Harvesting:** After selecting a grape cultivar (see page 4), the grapes should be harvested at maturity. This is usually the date when the grapes reach a maximum sugar content. Only sound fruit should be used for making wine. Decomposed and underripe fruit should be eliminated before processing.

2. **Destemming:** For making good quality wines, the stems should be removed from the fruit. This is accomplished by several methods as explained under the heading "Stemmers" (see page 5).

3. **Crushing:** Immediately after destemming, the grapes should be crushed and placed in a clean container for further processing (see "Crushers," page 5).

4. **Must Preparation: White Wine:** In order to achieve a white wine with delicate flavor, it is usually recommended that white grapes be pressed immediately after crushing. This practice is also used in making white wine for certain colored grape varieties such as Delaware and Catawba.

   a. **Pressing:** After crushing, press grapes as soon as possible (see "Presses," page 6).

   b. **Yield:** Estimate the volume of the pressed juices and record this amount for further reference concerning amelioration and sulfur dioxide addition.

   c. **Sulfur Dioxide:** Add 100 ppm (0.01%) sulfur dioxide to the freshly pressed juice. This amount is approximately ¼ teaspoon of potassium metabisulfite for every 2 gallons of juice (see "Sulfur Dioxide," page 7).

   d. **Brix Reading:** Remove a small quantity of juice and determine its Brix content (sugar approximation) by using a hydrometer (see "Amelioration-Hydrometer," page 7).

   e. **Sugar Amelioration:** After determining the Brix of the juice, add a specific amount of sugar to bring the original Brix value to 22°. This amount of sugar can be estimated by adding 0.125 pound (¼ cup) per gallon of juice for every Brix value below 22° (see "Sugar Amelioration," page 8).

   f. **Syrup Amelioration:** Although this step is optional, it is recommended that most eastern wines be ameliorated with water (syrup). In general, the addition of 1½ pints of 22° Brix syrup to every gallon of juice is sufficient for most eastern wines (see "Syrup Amerlioration," page 8).

   g. **Yeast:** A wine yeast culture should be added to the prepared grape juice no sooner than 6 hours after the addition of sulfur dioxide. In general, a 1% active yeast starter culture is used, or 1 gram of dried yeast for every gallon of grape must (see "Yeast," page 8).

   h. **Secondary Fermentation Containers:** After preparing the grape must, transfer material to a suitable container and fill to only two-thirds of its capacity to avoid over-flowing during fermentation. For the amateur, glass containers (jugs and carboys) are generally best for making white wines (see "Secondary Fermentation Containers," page 9).

Must Preparation: Rosé and Red Wines: Unlike white wine production, red wines require an operation for extracting color from the grape skins. The preferred method of extracting color is to ferment the juice on the skins. This fermentation produces alcohol which acts as a solvent in extracting various color pigments from the grape skins. Another method of extracting color is to heat (145° F.) the crushed grapes prior to pressing. If this method is used, the pressed juice should be treated according to the procedure for white grapes (previous section entitled, "Must Preparation: White Wines").

Since fermenting-on-the-skins is the recommended method, the following procedure should be used in making red wines.

a. **Primary Fermentation Containers:** After crushing, place colored grapes in an open-end cylindrical container (polyethylene, glass, stoneware, stainless steel, or wood). The container should be filled to two-thirds of its capacity to allow for expansion during fermentation.

b. **Yield:** The volume or weight of the crushed grapes should be estimated and recorded for future reference (sulfur dioxide addition and sugar amelioration).

c. **Sulfur Dioxide:** From the estimated amount of crushed grapes, add 100 ppm (0.01%) of sulfur dioxide to the grape must. For this level of sulfur dioxide, add 1.4 grams or approximately ¼ teaspoon of potassium metabisulfite for each 2 gallons or 18 pounds of crushed grapes (see "Sulfur Dioxide," page 7).

d. **Brix Reading:** After the sulfur dioxide is added and stirred, secure a juice sample for determining the sugar content of the crushed grapes. This juice sample is obtained by straining a small quantity of grape must through a layer of cheesecloth. The Brix or sugar content is determined by using a hydrometer (see "Amelioration-Hydrometer", page 7).

e. **Sugar Amelioration:** If the Brix content is below 22°, add sugar to the grape must to bring the original Brix value to approximately 22°. One method of estimating this amount is to add 0.125

pound (¼ cup) of sugar per gallon (9 pounds) of must for every Brix value below 22° (see "Sugar Amelioration," page 8).

f. **Yeast:** The next step is to inoculate the grape must with a wine yeast. This addition of yeast should take place no sooner than 6 hours after the sulfur dioxide treatment. In general, a 1% active yeast starter is used, or 1 gram of dried yeast for every gallon of grape must (see "Yeast," page 8).

g. **Color Extraction:** In order to obtain red wines, the juice is fermented in the presence of the grape skins for a short period of time. During this fermentation-on-the-skins, the grape mass is stirred twice daily, punching the cap of the skins down into the fermenting juice, for good color extraction. The time to press the red wines is usually determined when the Brix reading drops to approximately one-half of the original sugar content (3 to 5 days). For rosé wines, the skins are usually kept on the fermenting juice about one day.

h. **Pressing:** When the Brix of fermenting grapes reaches 8° to 10° (in 3 to 5 days), press grapes to separate the skins from the fermenting juice (see "Presses," page 6).

i. **Syrup Amelioration:** After the fermenting juice is obtained, it is recommended that most eastern wines be ameliorated with syrup (22° Brix). Although this procedure is optional, a 15 percent amelioration of the resulting volume is usually sufficient to reduce the acidity of most wines to a more desirable level. Therefore, add 1½ pints of 22° Brix syrup to every gallon of fermenting juice (see "Syrup Amelioration," page 8).

j. **Secondary Fermentation Containers:** The next step is to transfer the fermenting juice to a suitable container, such as a glass jug, carboy, or wooden barrel and fill to two-thirds of its capacity to avoid over-flowing during fermentation.

5. **Fermentation:** At this point, each container should be equipped with a water seal to allow the carbon dioxide gas to escape, but prevent air from entering the container (see "Water Seals," page 9). After securing the water seals, store containers at a relatively cool temperature. A suitable temperature for most wines is 65° F. Depending upon a number of factors, the wine will usually bubble for 2 to 3 weeks. When the bubbling ceases, the fermentation is almost complete and the wine is nearly dry.

6. **Racking:** Six to eight weeks after yeast inoculation, most wines have formed a compact deposit (lees) at the bottom of the fermentation container. This sediment is mainly yeast cells and should be removed by racking (transferring wine from one container to another). For the amateur, the wine should be siphoned to a clean container and filled to its capacity (see "Racking," page 10). Replace water seal and then place wine back into storage. About mid-winter, most wines have completed their fermentation and are considered dry (less than 0.5 percent sugar).[3] Again, the wine is racked to capacity, but stoppered tightly (cork) without using the water seal.

7. **Cold Stabilization:** To further clarify the wine and prevent tartrate crystallization, wines should be temporarily stored at a temperature near freezing. After a cold storage period of approximately 3 weeks, the wines should be racked and filled to capacity.

8. **Fining:** Occasionally, some wines remain cloudy and require clarification by fining. For these wines, it is best to bring them to room temperature and introduce a suitable fining material (see "Fining Agents," page 10).

9. **Storing or Aging:** When storing wines, keep containers full, tightly sealed and stored at a cool temperature. It is recommended that white wines be stored in a glass container and red wines in wood (see "Storage Containers," page 11).

10. **Bottling:** By late spring, most of the wines should be ready for bottling, especially the white and rosé. However, if large quantities of red wines are stored (50 gallons), these wines may require additional aging. For bottling, siphon wines into clean bottles, seal and store at a cool temperature (see "Bottles" and "Corks and Caps," page 11).

MAKING SWEET WINES

Since table wines containing sugar are susceptible to refermentation, certain stabilization practices are usually required in making these wine types. The simplest method of producing sweet wines is to follow the proceeding section, "Steps for Making Wine," and sweeten these dry wines with sugar just before serving. Another method for making sweet wines is to sweeten a dry wine to taste and to pasteurize by heating to 150° F. for 20 minutes. Then place hot bottles on their sides to pasteurize the closures. A chemical preservative, potassium sorbate, may also be added to retard refermentation in sweet table wines. After the wine has been sweetened, the preservative should be added at concentrations between 0.02 and 0.04 percent. For this level, add approximately 1 gram for every gallon of wine.

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[3] A simple method for determining low levels of sugar is to use a proprietary product termed "Dextrocheck" or "Clinitest." These products are usually available from wine supply companies or drugstores. Directions for using are supplied with the product.

FRUIT WINES

Good wines can also be made from fruits other than grapes. In general, the procedure for making these wines is the same as grape wines. However, certain steps are modified for converting fruits to wine. The two steps most frequently altered are juice extraction and amelioration (water addition). These modifications are employed for fruit because their morphological characteristics differ greatly and their acidity is higher. Also, most fruits contain lower levels of yeast nutrients than grapes. Therefore, adding one-half teaspoon of yeast nutrient for every gallon of juice is recommended for an active fermentation.

To prevent haziness and increase juice yields, the addition of pectic enzymes (¼ teaspoon per gallon) to the crushed fruit is recommended for most fruit wines. Both materials (yeast nutrients and pectic enzymes) are usually available from wine supply companies (Appendix A). Also, it is advisable to ferment most fruit wines at 70° to 75° F. to promote a vigorous fermentation.

Since the cost of other fruit is usually high, the procedures listed below for making fruit wines have been abbreviated to a recipe form accommodating small quantities of fruit. If large amounts are fermented, it is recommended that the reader follow the steps for making grape wine as outlined in the previous sections of this bulletin. However, this procedure should be altered to include modifications dealing with juice extraction, yeast nutrients and amelioration practices. In either case, the amateur should read the earlier sections of this bulletin to become familiar with wine making techniques before attempting fruit wine production.

Sour Cherry

After removing the stems and any spoiled fruit, the cherries are crushed without breaking the pits. Add an equal amount of water to the crushed fruit and introduce about ⅛ teaspoon of potassium metabisulfite per gallon of fruit-water mixture. Allow the preparation to stand for at least 6 hours or overnight. Then add yeast and ferment for 3 to 4 days. After obtaining the fermenting juice by pressing or straining through cheesecloth, add approximately 2 pounds of sugar for every gallon of fermenting product. Stir until the sugar is dissolved and transfer the fermenting wine to glass carboys or jugs. Insert a water seal into the container and allow fermentation to proceed to completion. When bubbling ceases and the wine is fairly clear, siphon (rack) the wine into another clean glass container and fill each vessel to its capacity. Thereafter, follow the procedure as given in the outline steps for grape wines.

Elderberry

After obtaining well ripened fruit, remove berries from the stems and crush in an open-end container. Measure the amount of crushed fruit and add an equal amount of water. Treat each gallon of this fruit-water mixture with ⅛ teaspoon of potassium metabisulfite and let stand for at least 6 hours. Then inoculate with yeast and ferment-on-the-skins for 3 to 4 days. After pressing, adjust the original sugar content of the fermenting wine to 22° Brix. Add approximately 2 pounds of sugar for every gallon of fermenting wine. Dissolve the sugar by stirring, then transfer the fermenting juice to suitable containers such as glass carboys or jugs. Place a water seal in position and let the fermentation go to completion. Once the bubbling ceases, the wine is siphoned to a clean containers and filled to capacity. The remaining steps are the same as the procedure for grape wine.

Other Berry Wines

Small seeded fruits such as strawberries, blackberries, and raspberries are generally ameliorated with water to obtain an acceptable acidity level. First, the berries are crushed and diluted with an equal amount of water. Immediately treat this fruit preparation with potassium metabisulfite at a rate of ⅛ teaspoon per gallon. Let stand overnight, then add a wine yeast and ferment for 3 to 4 days on the skins. Remove the fermenting wine by squeezing through cheesecloth or by light pressing and add 2 pounds of sugar and transfer the fermenting wine to a glass carboy or jug. Place a water seal in position and leave the wine in this vessel until the fermentation is completed. At this point, siphon the wine to a clean container and fill to capacity. Proceed as in the procedure for grape wine.

Apple

Usually a blend of apples yields a better wine than one produced from only one apple variety. An acceptable wine can be made from a blend of Delicious, Jonathan and Stayman Winesap apple varieties. Apples of eating maturity are crushed and pressed to obtain the necessary amount of juice. Since obtaining apple juice is difficult for the home wine maker, it is often advisable to purchase the juice from a local cider mill. However, be sure to obtain fresh cider which has not been treated with a preservative, such as sodium benzoate or potassium sorbate. These materials will inhibit the fermentation and result in an unacceptable apple wine.

When fresh apple juice is obtained, immediately add ⅛ teaspoon of potassium metabisulfite for every gallon of product. Transfer the treated cider to a glass carboy or jug (two-thirds capacity) and let stand overnight. Then, add a wine yeast and insert a water seal in the vessel. When a vigorous fermentation is obtained, add about 1¼ pound of sugar per gallon of fermenting wine. As soon as the fermentation is completed, siphon the new wine to a clean container and fill to its capacity. Then follow the procedure as given in the discussion for grape wines.

Other Fruit Wines

Interesting wines can also be made from peaches, pears and plums. Crush sound, well ripened fruit in an open-end container and treat with ⅛ teaspoon of potassium metabisulfite for every gallon of raw material. Let stand overnight, then add a wine yeast and allow the fermentation to continue from 3 to 5 days. Remove the fermenting juice and add 1½ to 2 pounds of sugar per gallon of product. After stirring to dissolve the sugar, transfer the fermenting juice to a glass carboy or jug and fill two-thirds full. Insert a water seal in the container and continue the fermentation until bubbling ceases. At this stage, siphon the wine to a clean container, fill to its capacity, and proceed as for grape wine.

APPENDIX A

Suppliers for Home Wine Makers

Many wine making supplies can be obtained from small wineries which may be located in your vicinity. A partial list of companies that supply materials and equipment for amateur wine makers is as follows:

Arbolyn Winemaking Supplies
P. O. Box 663
West Columbia, South Carolina 29169

Berarducci Brothers Manufacturing Co.
Fifth Avenue and Pirl Street
McKeesport, Pennsylvania 15131

Columbus Wine Making Supplies
3373 Eakin Road
Columbus, Ohio 43204

The Compleat Winemaker
614 San Pablo Avenue
Albany, California 94706

Jim Dandy
P. O. Box 30230
Cincinnati, Ohio 45230

Julius Fessler
P. O. Box 2842
Oakland, California 94618

Milan Laboratory
57 Spring Street
New York, N. Y. 10012

Oregon Specialty Company
615 N. E. Sixty-Eighth Avenue
Portland, Oregon 97213

Presque Isle Wine Cellars
9440 Buffalo Road
North East, Pennsylvania 16428

The Purple Grape, Inc.
Box 15456
Columbus, Ohio 43215

Scott Laboratories, Inc.
860 South 19th Street
Richmond, California 94804

Semplex of U.S.A.
Box 12276
Minneapolis, Minnesota 55412

F. H. Steinbart Company
526 S. E. Grand Avenue
Portland, Oregon 97214

Vino Corporation
Box 7885
Rochester, New York 14606

Wine-Art Ohio
819 West Market Street
Akron, Ohio 44303

The Winemakers Shop
Bully Hill Road
Hammondsport, New York 14840

A. R. Zacher Company, Inc.
P. O. Box 1006
Fresno, California 93714

APPENDIX B

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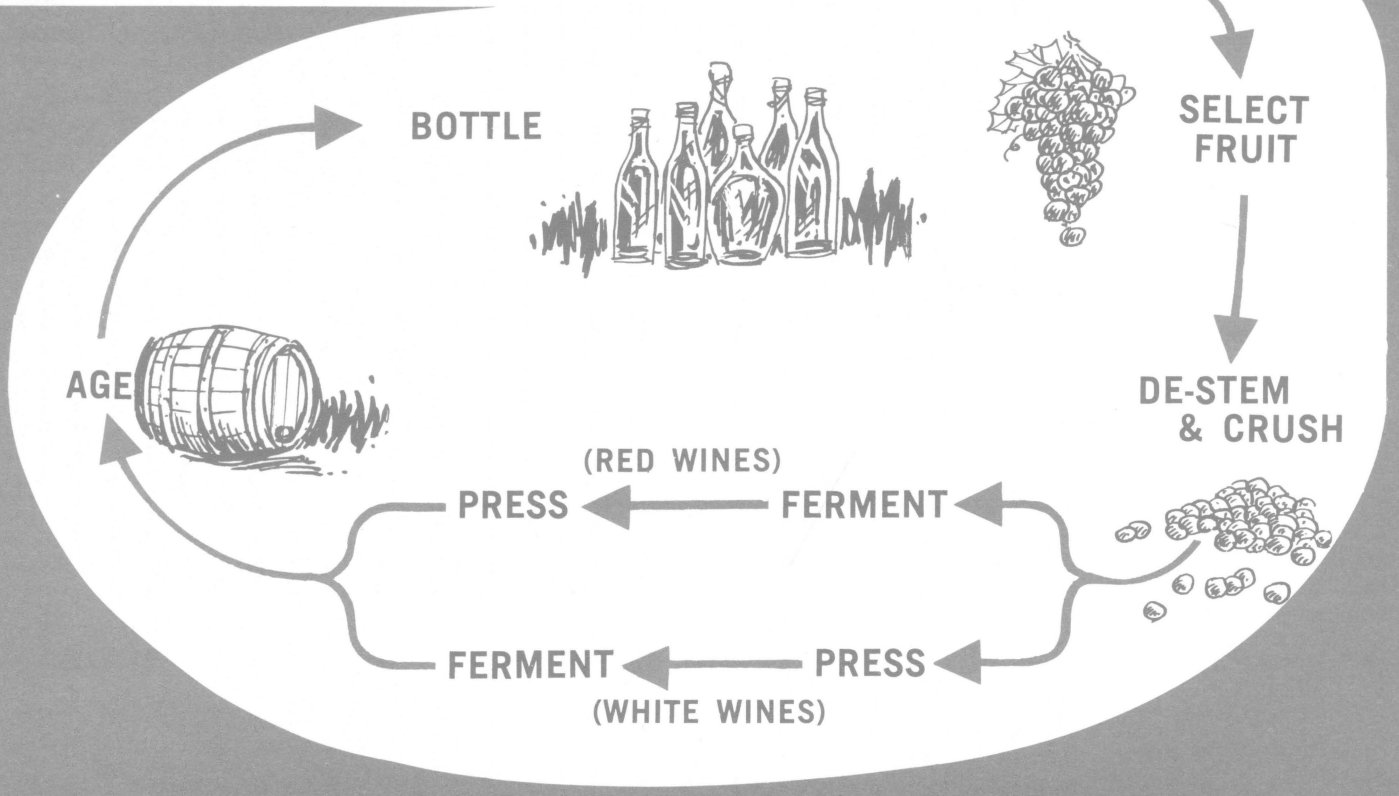
APPENDIX C

Approximate Weight of Wine Making Ingredients by Common Units of Measurement

Chemical	¼ Teaspoon	½ Teaspoon	1 Teaspoon	1 Tablespoon
	Grams			
Bentonite (granular)	1.6	3.2	6.0	17.6
Pectolytic enzyme (powder)	0.3	0.6	1.1	3.3
Potassium metabisulfite (granular)	1.7	3.2	5.9	17.0
Sparkolloid (powder)	0.3	0.6	1.2	3.4

References to commercial products or trade names are for educational purposes only. No discrimination is intended and no indorsement by the Cooperative Extension Service is implied for specific products or names.

GENERAL STEPS TO GOOD WINE MAKING



Amateur Wine Making—With the proper wine making materials including equipment and careful attention to details, the amateur can be successful in producing a high quality wine. The elements of wine making in the home are essentially the same as commercial operations; fruit selection, crushing, pressing, fermenting, aging, bottling and more. These practices are an important part of the wine making art and must be followed by the hobbiest to insure a good product.