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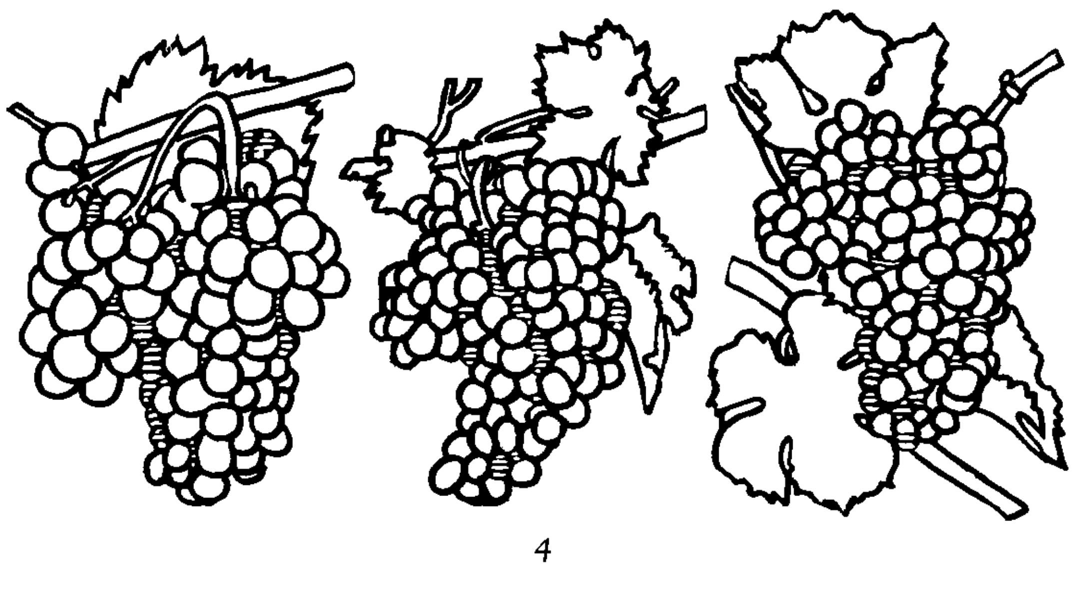
Composition and Quality of Grapes and Wine

The home winemaker has a choice of three raw materials for wine: freshly picked grapes, grape juice concentrate, or frozen must or juice. Of the three, it is generally recognized that the first offers the greatest quality potential and the second offers the most convenience. Both red and white grape juice concentrate is available from most vendors of home wine making supplies and is readily reconstituted by diluting with water. Follow the suppliers' directions to obtain juice of the desired strength. Varietal concentrate or the concentrated juice of different wine grape varieties is also available for home wine making. A few firms in California sell fresh frozen *vinifera* varietal grape must or juice. Limited evaluations suggest that wines made from frozen juice or must can be of acceptable quality when compared with wines made from fresh grapes. The obvious advantage to making wines from reconstituted grape concentrate or frozen must or juice is that they can be made at times other than the usual fall grape harvest.

The best raw material: fresh grapes

Fresh, ripe, varietal wine grapes remain the best raw material for making wine. Some home wine shops will accept orders for fresh varietal *vinifera* grapes before the harvest season. Home winemakers located near California's many coastal and foothill vineyards can purchase fresh wine grapes directly from a grower or from growers through wine grape grower associations. Growers can also be contacted through many University of California Cooperative Extension county farm advisor offices. A description of wine grape varieties, including usual harvest period, may be found in UC Publication 4069 (see **Selected References**). Place orders and make arrangements for delivery or pickup 3 months in advance (usually in June) to insure getting the quantity of each varietal desired.

In planning grape purchases, be aware that many growers who sell small quantities of grapes for home wine making pick into lug boxes that hold about 50



pounds of grapes each. Thus, 1 ton of grapes will require 40 boxes. Some growers may require a deposit for the lug boxes or you may have to provide your own picking containers. Make this arrangement at the time of your order; always return lug boxes clean and dry; large plastic tubs can be substituted for wooden boxes. Depending upon the variety and other factors, the home winemaker can usually expect that 1 ton of grapes for white wine will yield about 100 to 120 gallons of wine; 1 ton of red wine grapes will yield about 120 to 150 gallons of wine (the more press wine used, the higher the yield).

Aside from the form of raw material itself, several important factors influence wine quality. Foremost: Good wines can only be made from good grapes! Grape quality is directly related to the composition of the fruit when it is harvested. In turn, grape composition is influenced by climate. Premium wine grape varieties, such as Chardonnay, White Riesling, Gewürztraminer, Pinot noir, and Cabernet Sauvignon, are obtained from the cooler north, central, and south coastal California counties. Many foothill vineyards, as in California's Amador and El Dorado counties, yield good quality Zinfandel, Sauvignon blanc, French Colombard, Chenin blanc, Petite Sirah, and Barbera. Extensive research concludes that climate is the single most important factor affecting the composition and quality of California's wine grapes and hence the composition and quality of its wines. Specifically, in cooler climates, more grape acids, varietal grape aroma, and flavor compounds develop and, in the case of red types, tannins and color are retained at higher, more desirable levels. These compounds are directly related to wine quality. Table 1 shows the amounts of certain components of white and red wine grapes that are generally considered to be desirable for good quality wines.

Table 1. Desired sugar, acidity, and pH levels in ripe wine grapes

Wine type	Optimum sugar	Titratable acidity*	pH⁺
White wine grapes	20.5–22° Brix‡	8–10 g/L	3.2–3.4
Red wine grapes	22.5–24.5° Brix	6–8 g/L	3.3–3.5

*Values expressed as g tartaric acid per L.

⁺A measure of free hydrogen (acid) ions in a solution.

‡A measurement of soluble solids, roughly equal to percent sugar content.

Of interest to the winemaker are these major grape components: grape sugars, organic acids, aroma and flavor compounds, polyphenolic compounds or tannins, certain amino acids, and certain metallic ions, such as potassium. Fully mature or ripe grapes contain about an equal concentration of glucose and fructose, which are the simple sugars yeast ferment to form alcohol and carbon dioxide. Ripe grapes contain from 70 to 80 percent water by weight.

Depending upon the variety, the predominant organic acids in grapes are tartaric and malic acids. In addition to their contribution to the flavor and balance of wine, tartaric acid is involved in wine stability, while malic acid is involved in the malolactic fermentation (see **Glossary**). The complex nature of grapes and wine has been verified by the isolation and identification of more than 400 aroma and flavor compounds present. Such polyphenolic compounds as tannins are also important to wine flavor, stability, and aging, particularly in red wines. Certain amino acids have been shown to influence wine quality, but they are perhaps more important as a source of nitrogen for yeast cell metabolism. Such metallic ions as potassium are constituents important in wine quality and stability. Finally, while the individual and combined interactions and contributions of these grape and wine components to wine quality are complex, they become more understandable with study and experience.

Because climate or other factors are unreliable, it is not always possible to obtain grapes with optimal sugar, acid, and pH. Fortunately, home winemakers are not hampered by both the federal and state regulations that control amelioration in commercial wine making. Sugar levels that exceed 25° Brix can be lowered by adding water, to avoid difficulty with fermentation. The fermentation may even stop before dryness, resulting in incomplete fermentation. However, adding water to reduce a must's sugar content will also lower its acidity;

Which variety to select?

Distinctiveness or intensity of grape aroma varies widely between varieties of *Vitis vinifera* and within a variety depending upon climate, ripeness of the grapes, crop size, and other factors. Below is a listing of some well known and important varieties grouped according to their potential intensity of varietal aroma:

Distinctive white wine types. Muscat blanc (Muscat Canelli, Muscat Frontignan), Muscat of Alexandria, Orange Muscat, Symphony, White Riesling (Johannisberg Riesling), Chardonnay, Sauvignon blanc, Semillon, Emerald Riesling, Gewürztraminer, Sylvaner, Grey Riesling, Pinot blanc, Chenin blanc

Distinctive red wine types. Cabernet Sauvignon, Carmine, Barbera, Centurion, Pinot noir (Gamay Beaujolais), Merlot, Nebbiolo, Zinfandel, Ruby Cabernet, Grenache, Carnelian, Petite Sirah (Durif), Napa Gamay

Nondistinctive white wine types. Aligote, Burger, Thompson Seedless, Colombard (French Colombard), Green Hungarian, Palomino

Nondistinctive red wine types. Carignane, Mission, Charbono, Emperor, Flame Tokay, Refosco, Red Malaga, Valdepeñas such a change would be undesirable in a must already deficient in acidity. Thus, there are three options:

1. Ferment without adjustment.
2. Blend before fermentation with juice or must of the same variety that has moderate sugar and high acidity.
3. Before fermentation add water to lower sugar content and raise acidity to taste immediately after fermentation.

A must seriously deficient in acidity may also require acid addition before fermentation. Selection of the most suitable action will vary according to each lot and the winemaker's objectives.

Must or juice sugar and acid that fall well below levels shown in table 1 should be adjusted. A useful rule of thumb: To produce a wine of about 12 percent alcohol, the must or juice should be between 22° to 24° Brix. Sugar is increased by adding cane or beet sugar (sucrose). Use the following formula to calculate the amount of sugar to add to increase the °Brix:

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

where, S = weight of sugar to be added to increase must or juice to a desired °Brix

W = weight of grape must

B = desired °Brix

A = original °Brix of grape must

For example, if you want to raise the °Brix of 10 pounds of juice or must from 15 to 23, calculate the amount of sugar required as:

$$S = 10 \times \frac{22 - 15}{(100 - 23)} = 1.04 \text{ lb}$$

It should be apparent that large amounts of 15° Brix juice require proportionately larger quantities of sugar to raise the °Brix to the desired level. For example, 10.4 and 104 pounds of sugar would be needed to increase the °Brix from 15° to 23° with, respectively, 100 and 1,000 pounds of must or juice. Considering the high cost of sugar, riper grapes are obviously preferable.

A less accurate method for raising the sugar content by 1° Brix is to add 1.25 pounds sugar to each 10 gallons of juice or must.

Deficiencies in total acidity can be corrected similarly. Table 2 gives the amounts in grams (g) of tartaric acid that must be added to each gallon (gal) of must or juice to increase the titratable acidity (TA) from a given low level to either 6 or 8 g per liter (L). A TA of 6 g/L is considered a minimal acid level and a TA of 8 g/L is optimal acidity, especially for white wine. For example, to increase the TA of a Zinfandel must from 5 to 6 g/L, 38 g (1.33 oz) tartaric acid are required for each 10 gal of must. Metric units, such as grams, are readily converted to other units of measure using the adjacent Conversion Factors chart (table 3).

Table 2. Amounts of tartaric acid required to increase acidity

Present acid content	To obtain 6.0 g/L add to each gal:	To obtain 8.0 g/L add to each gal:
(g/L*)	(g)	(g)
3.0	11.3	18.9
3.5	9.4	17.0
4.0	7.5	15.2
4.5	5.6	13.2
5.0	3.8	11.4
5.5	1.9	9.5
6.0		7.5
6.5		5.6
7.0		3.8
7.5		1.9

*Titratable acidity as tartaric acid.

Table 3. Conversion factors

To convert from	To	Multiply by
Acres	hectares	0.4047
Cups	ounces	8.0
Cups	milliliters	236.6
Drams	milliliters	3.7
Gallons	liters	3.79
Grams	milligrams	1000
Grams	ounces	0.035
Grams/liter	pounds/gal	8.345×10^{-3}
Hectares	acres	2.47
Hectoliters	liters	100
Kilograms	grams	1000
Kilograms	ounces	35.27
Kilograms	pounds	2.2
Liters	gallons	0.264
Liters	ounces	33.8
Liters	pints	2.11
Liters	quarts	1.06
Milligrams	grams	0.001
Milligrams	ounces	3.5×10^{-5}
Milligrams	pounds	2.2×10^{-6}
Milliliters	liters	0.001
Milliliters	ounces	0.034
Ounces	grams	28.3
Ounces	milliliters	29.57
Pints	gallon	0.125
Pints	ounces	16
Pounds	grams	453.6
Quarts	liters	0.946
Tablespoons	teaspoons	3
Tablespoons	ounces	0.5
Tablespoons	milliliters	15
Teaspoons	milliliters	5
Teaspoons	tablespoons	3

Following adjustments in sugar and/or acid content, the °Brix and/or TA should be determined again to verify that the desired adjustment has been achieved.