

CHAPTER 1

Wine Basics: Fermentation, Grapes, and the Flavor of Wine

Wine rejoices the heart of man and joy is the mother of all virtues.

—JOHANN WOLFGANG VON GOETHE, German author and playwright

When one is beginning to learn about wine, many questions must be answered: What is wine? How is wine made? Why are grapes used to produce wine? Why do certain wines taste the way they do? In this chapter, these important questions will be answered. The topics introduced include:

- A definition of wine.
- The raw materials used to make wine and the process by which it is produced, called alcoholic fermentation.
- *Vitis vinifera*, the wine grape, including its origins, how it has been developed into its modern form, and the characteristics it possesses that make it important to the production of wine.
- The three impacts that shape the flavor of a wine:
 - Grapes
 - Viticulture and *terroir*
 - Viniculture

What Is Wine?

For thousands of years, even predating the beginnings of Western civilization, humans have been converting the juice of grapes into **wine**. Today, wine is more popular than ever, with premium wines being produced and consumed all over the world. Wine can be defined in many ways depending upon how it is used. We use wine to celebrate, to add to the enjoyment of food, and to foster conversation. Some people collect and store wines, waiting for the perfect moment to remove the cork. Others buy wine for its health benefits. Wine has been written about by some of the world's best-known poets, authors, and playwrights. It is mentioned

Wine—A **fermented beverage** produced from the juice of any fruit, usually grapes.

more than any other type of food or beverage in the Bible. Wine is intertwined throughout our history and continues to be an important part of daily life and custom in many parts of the world today. Whatever our reasons for enjoying it, learning to better understand wine—what it is, how it is made, where it comes from, why it tastes the way it does, and how it best matches with foods—can enhance our enjoyment of all types of wines.

Although wine can mean different things depending upon whom you ask, we need to have a working definition of wine to learn more about it. Wine is a fermented beverage produced from the fruit of any fruit, especially grapes. This definition is made up of two parts—understanding the raw material used for its production and the process by which it is produced.

FRUIT: THE RAW MATERIAL OF WINE

The **sugar** found in fruit is the raw material used to produce wine, and technically, wine can be produced from the juice of any fruit that contains sugar, not just grapes. While grapes are synonymous with wine, there are many other types of fruit whose juice is fermented into wine. The most common fruit wines are made from apples (often called hard cider), pears, plums, and berries. That said, the overwhelming majority of wines produced in the world each year are made from grapes, especially one specific species of grape: *Vitis vinifera*, or the “wine grape.” This species has been shaped over the course of thousands of years into the perfect fruit for fermentation.

ALCOHOLIC FERMENTATION: HOW WINE IS PRODUCED

Regardless of the beverage being produced, all alcoholic beverages must at some point go through the process of **alcoholic fermentation**. This process is the only way that humans can create alcohol for consumption. Alcoholic fermentation is a biological process that occurs in nature every day. In fact, it is an initial stage of the spoilage process, as a microorganism breaks compounds down into smaller parts.

Humans have spent hundreds, if not thousands, of years attempting to control and understand this process, but it was not until the 1850s that Louis Pasteur proved that living yeast cells were responsible for converting sugar into alcohol, identifying the action behind alcoholic fermentation.

The Formula for Alcoholic Fermentation

Sugar + Yeast = Ethanol + Carbon Dioxide + Heat

So, when yeast encounters sugar in a liquid solution, it consumes the sugar molecules, breaking them down into two major waste products: ethanol and carbon dioxide. The process also produces heat due to the yeast's metabolic activity.

Almost any source of sugar can be fermented, and for wine, the two fermentable sugars from grapes and other fruits are fructose and glucose. The source of the sugar that goes through fermentation is what determines the type of beverage produced. For example, fruit juice that is fermented produces wine, a mixture of barley and water that is fermented produces beer, and a mixture of rice and water that is fermented produces sake. We describe many wines based on the grape variety or **varietal** used to produce them—the subspecies or type of grape (e.g., Chardonnay, Merlot, Zinfandel). Since the grape is the sugar source, its characteristics are carried over into the finished wine after fermentation.

Yeast is a single-celled fungus that feeds on sugars and simple carbohydrates. A specific species of yeast is used to conduct most alcoholic fermentations, whether one is making a fermented beverage like wine or the base for a distilled beverage like the mash used to produce whiskey. The scientific name for this species is *Saccharomyces cerevisiae*. It is also referred to as budding yeast, brewer's yeast, or baker's yeast (this is also the species of yeast used to make dough rise when baking breads).

Ethanol, or ethyl alcohol, is a product of and the type of alcohol found in all alcoholic beverages, from

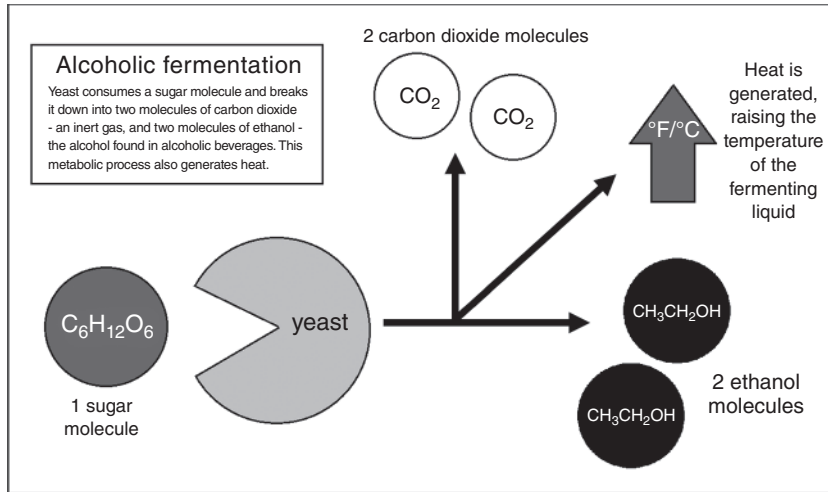


Figure 1.1: Alcoholic fermentation.

beer to vodka. Although it is slightly toxic to humans (which is often felt in the form of a hangover after consuming too much), ethanol is what causes alcoholic beverages to have intoxicating effects. Ethanol plays a role in the flavor profiles and characteristics of wines and other alcoholic beverages, as it has a distinctive, almost perfumed aroma, slightly sweet taste, and produces a mild burning sensation on the palate. The more sugar in a liquid being fermented, the higher the potential ethanol levels can be produced during fermentation.

The other physical product of alcoholic fermentation is **carbon dioxide**, often referred to as CO_2 , which is an inert gas—meaning it does not react with other compounds. As fermentation proceeds, the beverage being fermented will appear like it is boiling, as carbon dioxide bubbles are generated and break the surface of the liquid. For most alcoholic beverages, this gas is either captured for other uses or simply allowed to blow off into the atmosphere and has no impact on the final flavor or characteristics of a product. The exceptions to this are carbonated beverages like Champagne, other sparkling wines, and some beers. For these beverages, a portion of the carbon dioxide produced is captured and allowed to dissolve into the solution. When the container holding that beverage is opened, the carbon dioxide begins to escape and produces the tiny bubbles that make these beverages carbonated.

Why Does Bread Have Holes in It?

The *S. cerevisiae* species of yeast is not only used in the wine, beer, and spirit industries for fermentation; it is also the main yeast used by bakers to make doughs rise. The yeast is added to the dough and begins to feed on sugars found in the flour or added to the dough. While insignificant amounts of ethanol are produced (and subsequently burn off when the bread is baked), substantial amounts of carbon dioxide gas are also produced and trapped in the dough, forcing it to rise and creating the holes found in bread after it is baked.

As a result of this churning and active biochemical reaction, where yeast cells are metabolizing sugars and asexually reproducing as cells split, the temperature of the liquid being fermented is raised. Thus, heat is the final product of alcoholic fermentation. It is not unusual for an uncontrolled fermentation to cause a liquid to rise to over $100^{\circ}F/37.8^{\circ}C$. The warmer a fermentation, the quicker the yeast metabolizes sugar, and in this mad rush, several biochemical products are created by the yeast, which can have a major impact on the flavor of a finished product. Throughout most of history, winemakers could not control this heat because they lacked

technology such as refrigeration. As a result, most alcoholic beverages had foul flavors resulting from the yeast metabolizing sugar too quickly. Today, winemakers ferment wines in temperature-controlled rooms or tanks. This allows them to maintain the exact temperature at which they want their wine to ferment, depending upon the characteristics they wish to bring out in each individual wine.

Why Is Wine Made from Grapes?

Although wine can be produced from the juice of any fruit, more than 95 percent of the wine produced in the world each year is made from one species of grape called *V. vinifera*, or the “wine grape.” There are dozens of distinct species of grapes, but *V. vinifera* has been specifically bred for thousands of years with one purpose in mind: the production of wine. Humans have been manipulating and developing *V. vinifera* for centuries, helping it to evolve into what it is today.

The origin of *V. vinifera* lies in ancient Mesopotamia (modern-day Iran and Iraq) and surrounding areas. The first wines are believed to have been accidentally produced between seven thousand and nine thousand years ago during the Neolithic period by

hunter-gatherers who would have harvested the local *V. vinifera* grapes when they were in season. If there was an abundance of grapes, they would have stockpiled them in clay jars or animal skins to consume later, and if all the grapes could not be consumed quickly, those left over would begin to spoil. Because alcoholic fermentation is one of the initial stages of the spoilage process, the result would be an extremely crude wine full of grape skins, seeds, and pulp. These first wines would not have tasted particularly good, but when consumed, they changed the way the drinker felt and brought on the intoxicating effects of ethanol—a magic potion of sorts. The rest is history.

When one looks at the physical characteristics of the grape, it is not surprising that grapes would have produced the first wines. A grape is a small sack of sugar-rich juice, surrounded by a thin membrane that has wild yeast clinging to it. This makes a grape a kind of fermentation time bomb—it is not a matter of if a grape will start turning into wine, it is more a matter of when.

Nevertheless, wild *V. vinifera* grapes do not have any inherent characteristics that make them better suited for wine production than other grape species. It was only through the domestication and selective breeding of this species that we have such a specialized wine grape today. There were not wild Riesling or Pinot Noir vines growing in Mesopotamia; these are grape varieties that have been developed over time.

The first step in this developmental process was **domestication**, accomplished when agriculture was applied to *V. vinifera* as early cultures began to plant seeds in vineyards instead of relying on wild plants.

Can Wine Be Made from Grapes Bought at the Store?

Table grapes can be grown for wine production, but this is not common. Many table grapes belong to a species of vine called *Vitis labrusca*. *Labrusca* vines are native to North America and include the popular Concord varietal. While *labrusca* grapes make good juice and jelly and taste good eaten raw as a snack, the wines they produce are considered inferior to those made from *vinifera* vines. In fact, wines made from *V. labrusca* grapes are known for a distinctive foxy characteristic—reminiscent of fox urine!

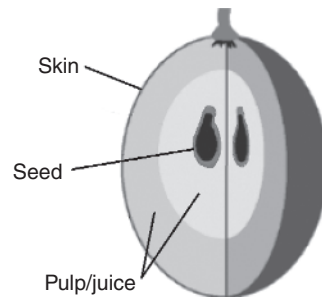


Figure 1.2: Cross section of a *Vitis vinifera* grape.

As grape vines began to be grown in this manner, humans quickly gained control over the species, deciding how it would be grown, which seeds would be planted, and which vines would be allowed to propagate new vines. Once control over *V. vinifera* was established, selective breeding of the wine grape could begin.

For wine grapes, **selective breeding** is when certain vines are selected to produce the next generation of vines due to their characteristics, qualities, and agricultural adaptability. This next generation might then produce subsequent generations of plants, maintaining that set of specific genetic traits. In the case of *vinifera* vines, this began slowly, starting with agricultural decisions made of necessity. If you planted ten vines in a new vineyard, and only one of those vines survived, that would be the vine whose seeds would be planted throughout the rest of the vineyard. Whatever the reason for that one vine's survival, it would be those individual characteristics and that vine's genetic line that would be allowed to perpetuate over time.

Selective breeding is not something that occurs overnight, and it took hundreds if not thousands of years to produce today's grape varieties. Some were the result of isolating and continuing traits in a vine, as discussed above. However, many were simply the result of taking advantage of lucky mistakes and quirks in nature. Several of the popular grape varieties we know today originated as genetic mutations.

Consider wine grapes with no pigment in their skin. With few exceptions, the skins of wild *vinifera* vines are pigmented and appear anywhere from red to dark purple in color. White-skinned grapes have no pigments in their skins, the equivalent of albino grapes, and the result of a genetic mutation. The white-skinned Pinot Blanc grape is a varietal that resulted from a mutation of red-skinned Pinot Noir vines. In nature, these grapes without pigment would often be weaker genetically and would therefore have a challenging time propagating to continue their genetic line. However, if a farmer oversees a vineyard, they are in control of the plants in that vineyard and could make the decision to plant only seeds from a vine that produced grapes without pigment in their skins. Over the course of subsequent generations, that trait would become inherent in that grower's vines.

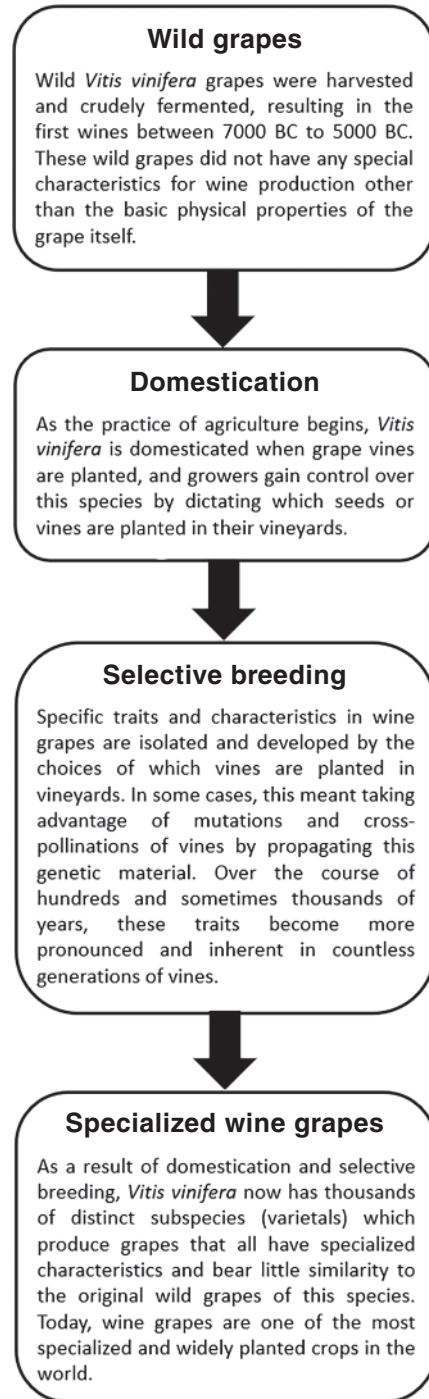


Figure 1.3: The evolution of the wine grape.

Crosses, or a pollination of one varietal plant by a different varietal, have also added to the abundance of wine grapes we have today. These can happen either on purpose through controlled plant science or by accident out in a vineyard. It is believed that Cabernet Sauvignon is the result of the accidental cross-pollination of the Cabernet Franc varietal and Sauvignon Blanc (hence, Cabernet Sauvignon). Pinotage is a South African grape varietal that was developed by a plant scientist in the 1920s when he crossed the Pinot Noir varietal with a grape variety called Cinsaut.

Regardless of how selective breeding has occurred, the result is more than 3,000 different varieties of *V. vinifera* (although some estimates reach as high as 10,000!). Each distinct from one another and different from the original wild vines from which they descended. In addition to the number of varieties produced, important characteristics were also developed into the *V. vinifera* species to make it ideal to produce wine. This is the reason that wine today is synonymous with the wine grape.

How Many Grapes Are in a Bottle of Wine?

As far as how many wine grapes it takes to produce one bottle of wine, the answer can vary depending upon the style of wine being made and the varietal or blend of varieties that is being used. For most dry wines, it will take approximately 3 pounds of grapes to produce a full 750-milliliter bottle of wine, which works out to 600–800 wine grapes. Some sweet desert wines are made from shriveled, concentrated grapes, and these wines can use well more than twice the normal amount.

Characteristics of the Wine Grape

While the multitude of wine grape varieties means we have almost countless traits within the species, there are certain characteristics that all wine grapes

share. These are what make wine grapes ideal for wine production and include high **sugar** content, elevated levels of **acidity**, large concentrations of **tannins**, a built-in supply of yeast for easy fermentation, and the fact that grapes are biochemically complex, leading to a complexity of flavor.

SUGAR

Wine is a fermented beverage, and sugar is the basic building block needed for an alcoholic fermentation. It makes sense that wine grapes, being bred only for the purpose of producing wines, would have substantial amounts of sugar in their juice. Not surprisingly, *V. vinifera* grapes have the potential for extremely high levels of sugar; in fact, ounce for ounce, grape juice is the sweetest juice of any fruit. The more sugar a liquid contains, the more ethanol can be produced. While most fruits would produce wines that top out at roughly 10 percent alcohol by volume, wines made from wine grapes can sometimes reach as high as 20 percent alcohol by volume.

ACIDITY

While sugar is important to fermentation and wine, if that sugar has nothing to balance out its sweetness, the resulting wine will taste overly or sickly sweet. Imagine eating a bowl of sugar or drinking a glass of simple syrup (concentrated sugar water). Even if you have a sweet tooth, this should sound unappetizing or like a stomachache waiting to happen. Is there a way to balance all that sweetness? For wines, and a large variety of other products, from candies to soft drinks, this balance comes in the form of acid.

How Acidic Is Wine?

Acidity is often measured using the pH scale, where the lower the pH of a substance, the higher the concentration of acidity. The pH of most wines ranges from 2.9 to 3.8, making wine an extremely acidic beverage. Compare that to the pH of lemon juice, which is 2.4.

In the same way that the sweetness of sugar needs to be balanced, so too does the sour flavor of acid. While you would not want to drink a glass of simple syrup, a glass of lemon juice would also be unappealing. If you were to mix the two together, however, you would have lemonade. The elevated level of acidity found in the juice of wine grapes is therefore the next important characteristic for making wine.

Not only do wine grapes have significant levels of acidity, they also contain an array of distinct types of acids. The three main acids found in wine grapes are tartaric, citric, and malic. This acidity helps balance out the inherent sweetness of *vinifera* juice and is also one of the most important reasons that wine is such a good match for food.

TANNINS

The skins, seeds, and stems of wine grapes contain unusually high concentrations of **tannins**. Tannins are long-chain phenols found in all plant life, but very rarely do you find significant quantities in fruits. All grapes have tannins in their skins, whether they are wine grapes or table grapes, but wine grapes tend to have very high concentrations. The main reason that wine grapes are so tannic is their size; wine grapes are much smaller than most table grapes, and that means that they have a larger skin-to-juice ratio. Tannins are also found in large concentrations in tea leaves and the wood of trees.

These tannins are not something that you taste when you drink wine, but rather something you feel—a sensation of **astringency**. Astringency is best described as a drying out of the palate. Wines with high tannins might make you feel like your tongue is fuzzy or like your teeth have socks on them. Imagine chewing on table grapes until the juice and sweetness are gone, and all you are left with is the skins on the palate. As you continue chewing these grape skins, you will feel the astringency of the tannins found within them. While this may sound like a strange sensation, it is tannins that give a red wine its structure (tannins are not easy to detect in white wines because of how they are made), and they add

a degree of complexity to wines made from wine grapes that is not found in wines made from other kinds of fruit.

EASY FERMENTATION

When you buy grapes at the store, very rarely are they shiny; instead, they are coated with a powdery residue. Wine grapes are no different, and when they are harvested, this powdery residue—called a bloom—clings to their skins. This bloom is composed mostly of wild yeast cells that have attached themselves to the skin of the grape. Yeast is a single-celled organism and thus does not have a brain, but it is not stupid. These yeast cells cling to the grapes in a dormant state, knowing that at some point the grape will be separated from the vine, and when its skins are damaged or begin to break down, sugar will be exposed. This will allow the yeast cells to start fermentation and asexual reproduction, fulfilling their biological drive to produce more yeast cells. By their very nature, wine grapes are extremely easy to ferment. All you must do to make wine is take some grapes and either crush them to extract their juice or allow them to sit until spoilage begins to split the skins of the grapes. This ease in starting fermentation is one of the main reasons why the grape was the focus of winemaking efforts early on in history.

BIOCHEMICAL COMPLEXITY = COMPLEXITY OF FLAVOR

With all the genetic manipulation *V. vinifera* has gone through over the course of thousands of years of selective breeding, it is safe to assume that the juice of these grapes is biochemically complex. Not only were physical characteristics such as sugar content and acidity magnified, so too were chemical components that make up the flavor and aroma compounds found in these grapes.

Certain varieties were developed because of the aromas and flavors they contribute to a wine. If you could grow grapes that were reminiscent of apricots or peaches, your wine would be unique, gaining you

a competitive advantage. The more of these flavor compounds wine grapes contained, the more complex the wines made from them became; and, as in most things involving food and beverages, the more complex the flavors of a product, the more high quality it is considered.

The result is a complexity of flavors in wines made from wine grapes that you will not find in wines made from other fruits. A hard cider is a type of wine made from apples, and the dominant flavor of hard cider will be apples. Wines made from raspberries or blackberries will taste like raspberries and blackberries, respectively. Even wines made from other species of grapes (such as Concord grapes) taste like grapes.

Wines made from wine grapes will have many flavors, from apples and pears to lemons, limes, grapefruit, tropical fruits, berries, dried fruits, herbs, and more. The one flavor rarely found in wines made from wine grapes, however, is the flavor of grapes. Those flavors have been bred out of wine grapes. If you taste a Sauvignon Blanc-based wine and smell and taste grapefruit, it is not because the winemaker added grapefruit to the wine. It is because the same biochemicals that make a grapefruit taste and smell like a grapefruit are also found in that specialized *vinifera* varietal. It was bred to taste that way.



Figure 1.4: These wine bottles are labeled by the name of the main grape varietal used in their production, a widespread practice in most wine-producing regions outside of Europe.

Although it is not necessary or important for a wine enthusiast to understand the science behind the development of this biochemical complexity, it is key to understand that wine grapes are complex. This complex biochemistry is what leads to a complexity of flavor in wines made from wine grapes and is the principal characteristic making *V. vinifera* the most important fruit for wine production.

Why Does My Wine Taste Like This?

When tasting and discussing wine, it is important to be able to identify and describe what you taste. Far more significant, however, is understanding why that wine tastes the way it does. This may be the most important thing you ever learn about wine, and I cannot emphasize this point enough—even though wine is an extremely complex beverage, the influences that shape the flavors found in any wine can be broken down into just three parts:

- The grapes used to make the wine.
- **Viticulture** and **terroir**, or the agricultural decisions made while the grapes were growing and the specific environment in which those grapes were grown.
- **Viniculture**, or the winemaking practices and procedures used to produce the wine.

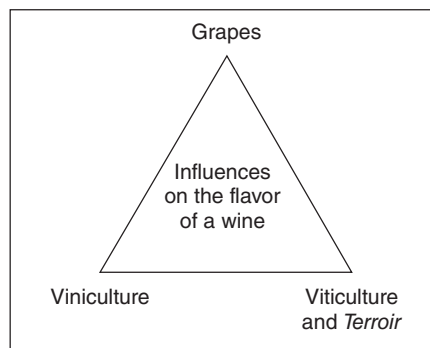


Figure 1.5: The three influences on the flavor of a wine.

GRAPES

The grape varietal or the blend of varietals used to produce a wine will have the largest influence on the flavor of most wines. Since grape juice is the basic building block used to make wine, it follows that the flavors and characteristics of the juice from varietals of grapes or blends of grapes will be retained in the finished product. For instance, a wine made from Pinot Noir grapes will often display flavors of cherries, cranberries, and earthiness because those are flavors that the Pinot Noir grape inherently imparts. Sauvignon Blanc grapes, on the other hand, will produce a wine that has flavors of grapefruit, tropical fruit, and freshly mowed grass because those are flavors found in the juice of Sauvignon Blanc grapes. Important wine grape varietals and the characteristics they impart will be discussed in Chapter 5.

VITICULTURE AND TERROIR

The art and science of growing grapes is referred to as viticulture, and grape growers have an influence on the quality and characteristics of the fruit they grow based on agricultural decisions they make in their vineyards. Vines can be trained to maximize the exposure of their leaves to the sun, speeding up photosynthesis. When irrigated, vines are allowed more access to water. Regardless of which procedures are applied, how particular vines are grown can determine some of the flavors and characteristics that these grapes will impart to a finished wine.

It is not just the processes and procedures that grape farmers utilize in their vineyards that can affect wine grapes but also the influence of the vineyard itself on the vines. There is an important reason that wines made in two separate places from the same grapes can taste quite different from one another, even if the winemaking practices used to produce them are identical. This difference can be summed up by the French term *terroir*, which describes the unique “taste” of a specific place.

Terroir encompasses all the environmental impacts on a grapevine as it produces fruit each year—from climate to soil conditions and chemistry to the geography of the vineyard. These environmental

factors make the flavor of the fruit grown in each individual vineyard site unique. For example, a Cabernet Sauvignon-based wine from California’s Napa Valley will tend to be higher in alcohol, fuller bodied, and have more powerful fruit flavors than a Cabernet Sauvignon-based wine from the French region of Bordeaux. This is due to the *terroir* of Napa Valley; the climate there is warmer than the climate of Bordeaux. A warmer climate causes the grapes to ripen more, which produces these characteristics in the resulting wine. The two wines would be made from the

Terroir Directly translated, the French word *terroir* means “dirt” or “earth.” When applied to wine, however, *terroir* is short for the French term *goût de terroir* (taste of the earth). This term describes the impact of the environment on a particular wine—the flavors that the vineyard itself contributes to a wine.



Figure 1.6: The conditions under which grape vines are grown can have a large impact on the quality of the resulting wine.

exact same grapes, could be treated the same in the winery, and would still end up tasting quite different. The role of *terroir* and viticulture will be discussed in detail in Chapter 3.

WINEMAKING

While viticulture is the art and science of growing grapes, viniculture is the art and science of making wine. The decisions and practices that a winemaker uses when producing a wine can have a significant impact on the flavors found in that finished wine. As the science of winemaking is better understood, winemakers can have a greater influence and control on the flavors and characteristics found in their wines.

Have you ever tried a California Chardonnay that tasted buttery? That flavor does not come from the Chardonnay grape, nor is it a flavor that is imparted from the vineyard in which the grapes grew; rather, it is a flavor produced by a winemaking procedure that happens after a wine has been fermented. If you store wine in an oak barrel for twelve months, the flavor of the wine will change. A winemaker must decide how to complement or manipulate both the flavors that come from the grapes they are using and the flavors that result from how and where those grapes were grown. The role of winemaking and viniculture will be discussed in Chapter 4.

Summary

Wine is one of the world's most important beverages and has been a part of Western culture for thousands of years. Although the topic of wine may seem daunting at times, it really is a simple product. Regardless of price, pedigree, or hype, all wine is nothing more than the fermented juice of fruit. The fruit used to produce most wines is the wine grape, *V. vinifera*, which has been developed for thousands of years to possess the important characteristics needed for wine production. Finally, the flavors

found in every wine you will ever taste are a result of only three influences: grapes, viticulture and *terroir*, and viniculture. With that in mind, you now possess a solid foundation for understanding wine. In the chapters that follow, you will gain information that will build on that knowledge.

Review Questions

1. Wine can be produced from any fruit, not just grapes.
 - A. True
 - B. False
2. The correct formula for fermentation is:
 - A. Sugar + Yeast = Methanol + Carbon Dioxide + Heat
 - B. Sugar + Yeast = Methanol + Sulfur Dioxide + Heat
 - C. Sugar + Yeast = Ethanol + Sulfur Dioxide + Heat
 - D. Sugar + Yeast = Ethanol + Carbon Dioxide + Heat
3. The scientific name for the yeast used in wine fermentation is:
 - A. *Vitis vinifera*
 - B. *Saccharomyces vinifera*
 - C. *Saccharomyces cerevisiae*
 - D. *Vitis cerevisiae*
4. The specific type of alcohol found in wine, beer, and spirits is:
 - A. Ethanol
 - B. Methanol
 - C. Isopropyl
 - D. Butanol
5. The warmer a fermentation, the faster the yeast ferments.
 - A. True
 - B. False
6. The scientific name for the wine grape is *Vitis vinifera*.
 - A. True
 - B. False
7. Which of the following is not a specific characteristic of wine grapes?
 - A. High sugar levels
 - B. High acid levels
 - C. Pest resistance
 - D. Biochemical complexity

8. The juice of wine grapes is sweeter than the juice of any other fruit.

 - A. True
 - B. False
9. The tannins found in wine grapes serve to balance out the sugar in resulting wines.

 - A. True
 - B. False
10. Which of the following does not have an impact on the flavor of wine?

 - A. Grapes
 - B. Price
 - C. Winemaking
 - D. *Terroir* and viticulture

Key Terms

wine	yeast	domestication	viticulture
sugar	ethanol	selective breeding	<i>terroir</i>
<i>Vitis vinifera</i>	carbon dioxide	acidity	viniculture
fermented beverage	varietal	tannins	
alcoholic fermentation	<i>Saccharomyces cerevisiae</i>	astringency	

