Sparkling Wine and Brandy Production

Wine 3
Introduction to Enology

Sparkling Wine and Brandy

- These are two completely different beverages, but they are similar in that they are both made from wine.
- In both products a simple, clean base wine is first made and then the unique flavors come from the processing after the primary fermentation.

What is sparkling wine?

- Basically its wine (usually white) with bubbles. In the U.S., the legal definition is based on CO₂ content.
  - Still wine < 3.92 g/L
  - Effervescent > 3.92 g/L
  - 1 g/L = 1000 PPM
- Most still wines have 0.5 to 1.5 g/L CO₂

Champagne vs. sparkling wine

- True Champagne is French sparkling wine from the Champagne region of France.
- In the US, Champagne can be used as a generic term for sparkling wine if labeled with region of origin (California champagne).
- You also must have used the term prior to 2006 to be grandfathered in.

Champagne vs. sparkling wine

- Most US producers call it sparkling wine but occasionally even some French-owned California wineries accidentally refer to their product as Champagne.
Types of Sparkling Wine

- French sparkling wine made outside the Champagne region is called **Vins Mousseux** (pronounced Moo-sur).
- Italian sparkling wine is **Spumante**. **Asti** is a sweet sparkling wine made from Muscat. **Prosecco** is a dry sparkling wine made from the Glera (Prosecco) grape.

**Legend** has it that a blind Benedictine monk named Dom Perignon discovered Champagne in Reims France (pronounced Ranss) by opening a bottle of young wine tasting it and shouting “Come quickly I’m drinking stars”. In actual fact, this is a folk tale.

The Champagne region is located in the north of France and is a very cool grape growing region.

**History, Begins in Britain**

- First produced around 1700, sparkling wine was a result of two winemaking innovations of the period.
- The British began using coal to fire their glass making resulting in stronger bottles; they also introduced cork as a stopper.
- These provided for a good seal that could hold pressure for the first time.

**History**

- Sometimes fermentations would occasionally stick when the winter came and the cellar cooled down.
- Young wines from France were imported in barrels and then bottled in Britain. If the wines had a little residual sugar it would ferment in the bottle when the warmer summer months came.
**History**

- Because of the stronger bottle and improved seal, the bottle could hold in the CO$_2$ gas that was produced.
- In Champagne over the next 100 years specialized methods for sparkling wine production were developed in a procedure called **Méthode Champenoise**.

**Sparkling Wine Production**

- There are about 14 million cases of sparkling wine drank annually in the United States, about 5% of wine consumed.
- Since sparkling wine was first developed in France much of the terminology is French.

**Methods of Sparkling Wine Production**

- There are several methods of producing sparkling wine and their tax rate varies. The label must state the method of production.
  - Carbonated wine
  - Charmat process
  - Transfer process
  - Méthode Champenoise

**Artificial Carbonation**

- This is similar to soda pop. It can be bought in kegs for weddings and cheap Sunday brunches. The CO$_2$ is mixed in like a Coca Cola dispenser. Or the wine can be chilled (so CO$_2$ is more soluble) in a pressure tank and the CO$_2$ is slowly bubbled in.

- Most of the production methods for Méthode Champenoise were developed by **Madame Veuve** (widow) **Clicquot** in the early 1800s.

- This is not considered sparkling wine; it is called **carbonated wine**. It doesn’t hold the bubbles very well and has little of the flavor of true sparkling wine. It is also taxed 10¢ less per gallon than true sparkling wine.

- Not much carbonated wine is made because sparkling is considered a prestige product and people would rather pay more to get the real thing.
**Bulk or Charmat Process**

- This method makes up the largest segment of the market (approximately 75%).
- Developed in France in 1907 by Eugene Charmat and introduced to CA. in the 1930's, it's taxed at $3.40/Gal. (higher than still wine)
- Most often finished with a plastic stopper that is oxygen soluble so these wines don't age well. Popular brands are Andre, Totts, and Cooks.

**Transfer Process** (Fermented in bottles)

- This process was perfected in the 1950's in Germany. Almadin, Paul Masson, Taylor all used to do it. This method has died out for the most part because it costs more than Charmat and does not taste as good as Méthode Champenoise.
- It is still used for 375ml bottles and bottles larger than 1.5 L

**Méthode Champenoise** (Traditional Method - fermented in this bottle)

- This is the traditional French method and is considered the best, it is also the fastest growing segment of the market (about 23%). Local producers include Korbel, Mumm Napa, Gloria Ferrar, J, and Domaine Chandon.
- It requires a lot of labor and expensive equipment so there is no point in doing it if you don’t do it right.
Méthode Champenoise

- There are many styles of sparkling wine but the general goal is to produce a cuvée (base wine blend, literally a tubful) that is delicate and clean without defects.
- This blend provides a framework on which to build the flavors of the secondary fermentation and aging.

Harvesting for Sparkling wine

- To achieve this end grapes are picked at lower maturity than table wines are (17 to 20 °Brix) this is before strong varietal flavors develop.
- Lower sugars produce lower alcohols, important because secondary fermentation raises the alcohol level.
- Crush usually starts a few weeks before still wine harvest.

Press Fractions

- To achieve lower phenolic levels many producers pick into small bins and use whole cluster pressing and try to minimize the maceration of the fruit as much as possible.
- Also, there is great care taken in separating the press fractions.

Press Fractions

- Press Fractions: Yield 180 gallons/ton

<table>
<thead>
<tr>
<th>US</th>
<th>French</th>
<th>Yield</th>
<th>pH</th>
<th>Tannin (PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free run</td>
<td>Cuvée</td>
<td>130 G/T</td>
<td>2.90</td>
<td>170</td>
</tr>
<tr>
<td>Light press</td>
<td>taille (tail)</td>
<td>20 G/T</td>
<td>3.10</td>
<td>280</td>
</tr>
<tr>
<td>Heavy press</td>
<td>taille 2</td>
<td>20 G/T</td>
<td>3.30</td>
<td>400</td>
</tr>
<tr>
<td>D.M.</td>
<td>Rebeche</td>
<td>10 G/T</td>
<td>3.40</td>
<td>450</td>
</tr>
</tbody>
</table>

- These numbers are approximate and not every winery does four fractions.

Cuvée Production cont.

- The press fractions can be treated with fining agents (carbon, PVPP & gelatin) to remove the tannins and color before blending.
- Often, they are sold, used for less expensive wine or as distillation material.
Cuvée Characteristics

- Typical Cuvée numbers:
  - Alcohol 9.5 to 11.5%
  - TA 7.5 g/L or more
  - pH 3.30 or less
  - VA 0.040 g/100ml or less
- Also the wine is low tannin, lightly colored, low aldehyde and low SO$_2$ (less than 10 PPM free 60 PPM total)

Cuvée Production cont.

- **Juice** is generally fermented in stainless steel tanks that are temperature controlled. Some producers ferment a portion of their cuvée in barrels for body and complexity.
- Malolactic ferm. is generally discouraged but some producers use it in small doses.
- After fermentation and racking, it is blended into the assemblage cuvée

Assemblage Cuvée

- May be made from one vintage or several, in France it is usually the current and the previous year, this helps consistency.
- In California if an AVA is used it must be 95% from one year to be vintage dated, non AVA blends must be 85%, unless it is labeled non vintage.
- After the cuvée is blended it is heat and cold stabilized before filtration.

Assemblage Cuvée

- Types of cuvées include
  - **Blanc de Noirs** 100% from red (black) varieties.
  - **Blanc de Blanc** 100% from white varieties.
  - **Rose** (pink) and **Rouge** (red) sparkling wines are less common.
- Tasting cuvées is a specialized skill.

Cuvée Additions

- The secondary fermentation takes place in the bottle where the CO$_2$ is trapped to produce bubbles. So yeast, sugar and a riddling aid to help clarify them is added.
- **Sugar**, this can come from many sources; sucrose, dextrose, sugar syrups (at least 60º Brix). This is one of the few times in California you can add non-grape sugar to wine.
Cuvée Additions

- **Rule of thumb**: 4 g/L sugar = 1 ATM (Atmosphere)
- Since about 6 ATM (90 PSI) pressure is desired so 24 g/L is added before bottling (any residual sugar in the wine should be taken into account).
- **Nutrients**: Yeast foods such as yeast hulls or DAP may be added to cuvée or inoculum.

Bottling the Cuvée, Yeast

- The "Champagne" strains of *Saccharomyces cerevisiae* or *S. bayanus* are used they have the properties of:
  - Pressure, alcohol, cold and SO₂ tolerance
  - Ferment to dryness
  - Flocculates (settles) well
  - Produces no off aromas (magnified by bubbles and can't escape the bottle)

- **Popular strains**:
  - Prise de Mousse/ Première Cuvée (UCD 594) *S. bayanus*
  - Champagne Epernay (UCD 590)
  - Pasture Champagne (UCD 595)
  - California Champagne (UCD 505)
  - Or indigenous mixed strains

Bottling the Cuvée - Yeast

- It is essential that the starter culture be pure and the inoculum size be large, 2 to 5 % of actively growing culture = 1 to 4 million cells/ml.
- The yeast are being asked to ferment under difficult circumstances, (alcohol, CO₂ pressure, etc.) so it is very important that the culture is acclimated to wine and growing vigorously before it is added to the cuvée.

Bottling the Cuvée - Riddling Aids

- These are fining agents that help to settle yeast during riddling, usually bentonite (100 to 250 g/1000 gal mixed up very fine) sometimes in conjunction with other fining agents.
- Bentonite is a very necessary ingredient for clear wines, and the wines must be clean of particles to avoid gushing.

Bottling the Cuvée - Riddling Aids

- Bubbles form at nucleation points (rough surface of solids or particles in the wine), if there are a lot of them in the wine all of the bubbles will form at once and cause the bottle to "gush".
- The combination of all these ingredients is called the **Liqueur de tirage**.
Bottling

- The cuvée is then bottled with crown cap and a **bidule**. It is very important to keep the cuvée and the liqueur de tirage well mixed during the bottling because the yeast and sugar tend to settle out and this would lead to bottle variation.

Secondary Fermentation

- Bottles are stored:
  - Stacking on floor, (high amount of storage per area but labor intensive).
  - In bins, about 600 bottles/ bin easy to store and transport.
  - In cases, (convenient but the cases look bad after time).

Secondary Fermentation

In Warehouse

In Caves

Storage Conditions

- **Rate of secondary fermentation** is a function of storage temperature, yeast strain, inoculum size, cuvée chemistry, generally a cooler fermentation is preferred (48 - 55 °F).
- Goes slow due to conditions (pressure alcohol etc.) and takes 1 to 2 months, it can stick if too much SO₂ or low nutrients.

Storage Conditions

- Minimum temperature fluctuation and minimum lighting.
- Champagne is highly susceptible to becoming “light struck” green glass (champagne green) helps to filter out UV.
- Caves provide ideal storage conditions.

Tirage

- **Tirage** is the aging done to Méthode Champenoise sparkling wine. Usually it is from one to four years and this is the point that method Champenoise sparkling wine gets its distinctive character.
- A **Sparkling wines aroma** is a function of yeast autolysis and aging. Yeast autolysis begins to occur 6 to 12 months after the end of fermentation.
**Tirage**

- **Autolysis** (self-lysis or breakdown) refers to the actions of proteolytic enzymes that breakdown the yeast cells and result in an increase in amino acids, esters, fatty acids, and other sensory compounds.
- After four years the wine can have up to 25 times the amount of the base cuvées amino acids.

**Bubble Retention**

- In France the minimum amount of time for tirage is 9 months and can be as long as 5 years, in the U S it averages about 2 years with reserves aging a bit longer.
- The nature of the bubbles is an important (if poorly understood) characteristic of fine champagne. Desirable characteristics are small bubbles that are slow to form.

**Bubble Retention**

- Bubble retention is influenced by yeast strain, length of time under pressure, and the amount of amino acids and proteins, (the more amino acids the finer the bubbles).
- The bubble retention also depends on the way it is served.
- Cold, 40 °F is optimal in a tall clean glass with few nucleation points.

**Riddling or Remuage**

- **Hand Riddling**
  Bottles are mixed after tirage and placed in wooden racks then the bottles are lifted, shaken left and right, and turned a 1/4 turn and replaced at a slightly steeper angle.
- This is repeated every 1-2 days and takes from 3 - 6 weeks. A good riddler can do as much as 25,000 bottles in a day (wear eye protection!).
Riddling or Remuage

- Riddling by hand has been replaced at most wineries by **automatic riddling**.
- Gyropallet baskets on a pallet that hold 500 to 3000 bottles that can move in all directions and can be controlled by computer.

Disgorging

- Removal of sediment from the bottle done by hand or machine. Before disgorging the bottles are chilled (the cooler the wine the less the amount of CO$_2$ that will be lost).
- Immediately prior to disgorging, the ends of the necks are placed in brine or glycol solution chilled to 20° below zero.
- Home winemakers can accomplish this with dry ice & alcohol (wear eye protection!)

Disgorging

- This forms an ice plug trapping the sediment in the end of the bottle. When the cap is removed, the pressure pushes out the ice plug, bidule, and the solids.

Dosage

- After the disgorging, the dosage is added to bring the volume to the proper fill level and to adjust the sweetness and flavor slightly. The dosage determines the amount of sweetness in the champagne.

Dosage

- Because the base cuvée is quite tart and CO$_2$ is perceived as acidity, a small amount of sugar is usually added to achieve balance. Sugar levels vary by winery and style.
- Other components of the dosage can include brandy, tannins, water, or still wine. Whatever combination that will tweak the flavors to make a better tasting sparkling wine.
Dosage

- Here are some of the classical definitions of sweetness: Not all wineries use these definitions similarly.

<table>
<thead>
<tr>
<th>French</th>
<th>English</th>
<th>Sugar level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
<td>Natural</td>
<td>no dosage (dry)</td>
</tr>
<tr>
<td>Brut</td>
<td>up to 1.5% R.S.</td>
<td>(most .8 to 1.2%)</td>
</tr>
<tr>
<td>Extra Sec</td>
<td>1.2 to 2.0%</td>
<td>(extra dry)</td>
</tr>
<tr>
<td>Sec</td>
<td>1.7 to 3.5%</td>
<td>(Dry)</td>
</tr>
<tr>
<td>Demi Sec</td>
<td>3.5 to 5.0%</td>
<td>(Semi Dry)</td>
</tr>
<tr>
<td>Doux/ Cremant</td>
<td>&gt;5%</td>
<td>(Sweet)</td>
</tr>
</tbody>
</table>

Packaging Considerations

- Bottles must be strong to withstand up to 120 PSI. They weigh 35oz compared to 17oz for regular bottles. They traditionally have a punt and are dark green to protect from UV light.
- Corks have an amalgamated upper part and a natural disk lower part that is in contact with the wine, many winemakers would prefer to use crown caps.

How to Open a Bottle of Sparkling Wine

- Make sure the bottle is cold. Sparkling wine tastes best when chilled to 40 to 45 ºF.
- Remove the foil covering the cork. Bottles usually have a tear tab for this purpose.
- Place your thumb over the Cork and untwist the tab and loosen the wire hood so that it does not catch on the lip of the bottle. However, do not let go of the cork.

How to Open a Bottle of Sparkling Wine

- Place a folded cloth napkin over the cork. Grasp the cork and neck of the bottle through the napkin. Tilt the bottle away from yourself and others at a 45-degree angle.
- Still grasping the cork and wire hood through the cloth napkin, slowly twist the tilted bottle - not the cork.

How to Open a Bottle of Sparkling Wine

- As you turn the bottle, the pressure of the bubbles will push the cork out. Keep a firm grip on the cork and gently let it ease itself out of the bottle.
- Try tilting the edge of the cork closest to you to allow the gas to escape slowly off the side. The cork should come out with a whisper, not a loud pop.
**Serving Sparkling Wine**
- Tall slender glasses called flutes are preferred to prolong the effervescence.
- When pouring fill the glass 1/3 let the foam (mousse) die down and then fill to 2/3 full.

**Brandy Production**
- Brandy is distilled wine and it a completely different product to make & sell. Considered to be a mixer or hard alcohol.
- Much is what is covered tonight applies to other distilled beverages.

**Distillation**
- Distillation in the concentration of alcohol by boiling.
- Alcohol boils at a lower temperature than water (more volatile) when wine is heated the ethanol comes off in a higher concentration in the steam first and then diminishes as the wine is boiled.

**Historically wool was placed over a kettle of boiling wine. The alcohol has collected in the wool and then rung out.**
- The name brandy comes from the Dutch word *brandewijn,* meaning "burnt wine."

**Distilled Spirits**
- Distilled spirits are categorized by the source of the base alcohol, flavorings that are used, and how they are distilled and aged.
- Whisky - grains (corn, wheat, rye)
- Rum - molasses (sugar cane)
- Gin - grains
- Vodka - grains, potatoes
- Tequila - agave

**Distilled Sprits Sales Growing**
- Sales of spirits, particularly high-end artisan brands, have grown steadily in the last decade.
Winemaking for Brandy

- Winemaking for brandy is very simple. Like champagne, a fairly neutral base wine is ideal because the flavor comes from aging.
- The wine should be clean, low SO₂, low VA and at about 10% alcohol.
- It takes about 7 gallons of wine to produce 1 gallon of brandy so inexpensive grapes are usually used.

Measurement of alcohol

- One percent alcohol is equal to 2 degrees proof so 200 proof is one hundred percent alcohol. However, alcohol and water form an azeotrope at 96% so it cannot be concentrated beyond 96% by distillation.
- British sailors knew a 50/50 mix of water & alcohol will combust so at 100 “proof” they knew they were getting their fair ration of Rum.

Distillation

- After ageing the brandy is diluted (cut) with water to 80º proof (40% alcohol).
- Brandy is aged at a higher proof then diluted with water before bottling to save money on barrels and to save space.

Winemaking for Brandy

- Wine for brandy must have no unpleasant aromas because they would be concentrated along with the alcohol.
- You get a more efficient concentration if you start with low alcohol wine.

Distillation

The horizontal lines illustrate how much the alcohol can be concentrated per distillation.

Graph of % Ethanol vs. boiling point

Finishing

- Most of the flavor in brandy comes from barrel ageing but often small amounts of “rectifying agents” (sugar, caramel coloring, fortified wines and other flavorings) added before bottling.
- In California rectifying agents must be less than 2.5% of the blend.
- In the U.S. Brandy must be aged in barrels for two years or be labeled “Substandard Brandy”.
Types of Stills

- **Batch process**, also called pot or Alembic stills (Alembic is from the Arabic word for still)
- **Column Stills**, also called continuous stills.

Cognac

- **Alembic** or pot stills are used in the Cognac region of France and in some premium distilleries in the US. They are 600 to 800 gallons in size and the distillation is done twice to concentrate the alcohol to 70%.

Cognac Terminology

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.S. (Very Superior) or Three Star</td>
<td>30 month minimum aging</td>
</tr>
<tr>
<td>V.S.O.P (Very Superior Old Pale)</td>
<td>54 month minimum aging</td>
</tr>
<tr>
<td>V.O. (Very Old) or Réserve</td>
<td>54 month minimum aging</td>
</tr>
<tr>
<td>X.O. (Extra Old) Extra, Napoleon, Vieille Réserve or Hors d'Age</td>
<td>72 month minimum aging</td>
</tr>
</tbody>
</table>

Scotch and Irish whiskey

- Scotch and Irish whiskey are made with Alembic (pot stills) using fermented malt. (Irish Whiskey is distilled three times).
- The batch process has more impurities and more flavor.

Column Stills

- Also called continuous stills, they are the typical type used in the US. They have 30 to 50 plates. Each plate is a separate distillation. The lower the plate the lower the proof.
Column Still

Column stills are usually made of stainless steel with copper plates, copper is a good conductor of heat and helps to remove sulfides during the distillation. Pot stills are often completely made from copper.

Inside a Column Still

- Column Still bubble cap

Armagnac Stills

- Are used in the Armagnac region of France they are a hybrid of column and pot stills, they concentrate to 53% alcohol in one batch distillation.
- 1/10 as much produced as Cognac

Fusel Oils

- Fusel Oils are higher alcohols that have more carbons than ethanol that are concentrated with the distillation and have sensory effects.
- Propanol, butanol, amyl alcohol and furfural.
- Grappa (or marc brandy) is steam-distilled brandy made from fermented grape skins (pumice) Usually not oak aged, it’s an acquired taste.
- What is marc?

Brandy vs. Liqueurs

- Brandy can be made from any fermentable fruit.
- Brandies are distilled from fermented fruit. Un aged fruit brandies are also called eau de vie (water of life).
- Liqueurs, such as Schnapps or Aquavit, are made by adding fruit as a flavoring to neutral spirits (usually made from fermented potatoes or malted grains).
Other Brandies
- **Metaxa** (Greece) – from sun-dried grapes
- **Pisco** (South America) – from Muscat grapes
- **Applejack** (US), **Calvados** (France) – apples
- **Slivovitz** (Serbia, Bosnia) – from plums
- **Eau de Vie** (France, elsewhere) un-aged fruit brandy, **Fraise** (strawberry); **Framboise** (raspberry); **Mûre** (blackberry); **Kirsch** (cherry)
- **Grappa** (Italy), **Marc** (France) – from pomace

Proof Gallons
- The Federal tax on distilled spirits (including brandy) is $13.50/PG (Proof gallon) records are kept in PG for tax purposes.
- 1 PG = 1 wine gallon at 100 proof (50% alcohol)
- 100 wine gallons at 140 proof = 140 PG
- Federal tax on a 750 ml Bottle of 80 proof brandy is $2.85, state taxes add even more.

Safety
- It is important to remember brandy is Flammable, and requires specialized (explosion proof) equipment for handling. Treat it with respect.
- Vapor
- “Explosion proof” equipment.
- Treat it like you are working with gasoline.

Next week
- **Dessert Wines**
- Don’t forget to email me your choice for a final project wine by next week.