



BEGINNER FORTIFIED WINE PRODUCTION



Material contained in this document applies to multiple course levels. Reference your syllabus to determine specific areas of study.

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Wine was originally fortified, or strengthened, to better sustain itself during the journey to those importing it. The addition of brandy or neutral grape spirit would kill off the yeasts, which are constantly in the process of converting sugars to alcohol. Once the alcohol by volume reaches 16-18%, yeasts die. The remaining sugars are never converted into alcohol, and the natural sugars of the wine persist. Wines can be fortified at various stages in their fermentation, sweetened or colored with a variety of techniques. Different grape varieties can be used. Grapes can be dried. Wines can be boiled and reduced, cooked, aged in a solera, or aged in a boat that travels halfway across the world and back. They can be enjoyed immediately or aged for over 200 years.

Port, Sherry, Madeira, Marsala, Malaga, Montilla-Moriles, and Vin Doux Naturels (VDN's) are all Fortified Wines.

Most people think of stuffy British old men drinking out of little glasses in a mahogany library with their pinkies out when they think of Sherry- if they think of Sherry. While that image may have relegated Sherry, as an old-fashioned wine, to the back of the cool class, that is only part of the picture. Both Christopher Columbus and Ferdinand Magellan filled their ships with Sherry when they set sail to discover the New World. Jackie Kennedy drank Sherry- and so did James Bond. The Beatles enjoyed Sherry and even traveled to Jerez and autographed some large casks. Tom Waits always enjoys his Sherry. Every top chef, including Feran Adria, Thomas Keller, Grant Achatz, Jose Andres, and Wylie Dufresne, touts the taste and pairing ability of Sherry. People in Spain drink Sherry with their meals, and chug it in celebration after winning a soccer match! But if you don't like Sherry, and think it is a drink for your grandma, that just means more delicious Sherry for the rest of us to enjoy.

Today Sherry is lauded by a small group from the culinary curious to expert epicurean leaders. Sherry is made in a wide variety of styles, sweetness levels, and alcohol strength. It is the least acidic and most aldehydic wine in the world! An Aldehyde is an oxidized alcohol and adds aromas of roasted nuts, caramel, and straw.

This legendary fortified wine is made in Jerez de la Frontera, Sanlucar de Barrameda, and Puerto Santa Maria in the Andalusia region of Southwest Spain. Palomino, Pedro Ximenez, and Muscat of Alexandria are the only three authorized grapes in the region. Palomino is the primary varietal and accounts for 95% of all vineyard plantings. The Jerez DO (Denominacion de Origen) is distinguished by its chalky porous Albariza soils. There are two main types of Sherry: Fino and Oloroso.

“ Sherry
“Oh I must've been a dreamer
And I must've been someone else
And we should've been over
Oh Sherry, our love
Holds on, holds on...”
'Oh Sherry' by Steve Perry ”

“ Both Christopher Columbus and Ferdinand Magellan filled their ships with Sherry when they set sail to discover the New World. ”

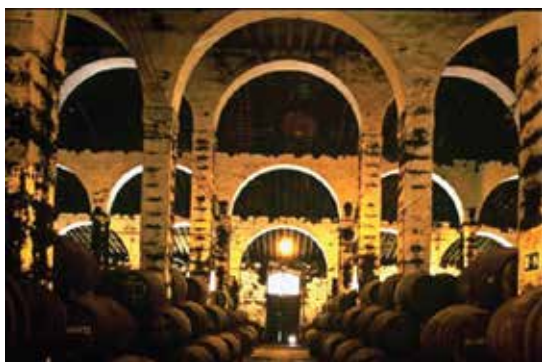
BEGINNER FORTIFIED WINE PRODUCTION

Fino has a final alcohol of 15.5%, is the finest quality, and ages biologically (in contact with the film of yeasts called flor).

Oloroso has a final alcohol of 18%, is lesser quality, and ages physiochemically (in direct contact with air).

Let's make some Sherry!

Palomino grapes, and occasionally others, are pressed. This occurs most frequently with a bladder press. Acidification takes place if necessary, and then the wine is racked. Fermentation lasts three to seven days and takes place at 75-84°F/24-29°C. Wild yeast ferments the wine, as opposed to selected yeast strains being inoculated into the wine. (Wild yeast fermentation results in a wine with more rose/floral/honey aromas, a wild rustic nature, and maderized/sherry aromas.) Malolactic fermentation occurs, and the whole process takes place mostly in stainless steel tanks. Now that the base wine is made, it is classified into Fino or Oloroso. Fino is the palest, clearest, and best and tends to come from the highest percentage of Albariza soils, free run juice, older vines, and delicately handled fruit. A base wine is classified as Oloroso when it is not the palest and clearest. Color, clarity, aroma, and flavor are all analyzed to determine what category of Sherry it will be. If it is not clearly one type or the other the wine can be classified as mosto sobretablas, or undecided.



“ Sherry is made in a wide variety of styles, sweetness levels, and alcohol strength. It is the least acidic and most aldehydic wine in the world! An Aldehyde is an oxidized alcohol and adds aromas of roasted nuts, caramel, and straw. ”

FINO has a final alcohol of 15.5%, is the finest quality, and ages biologically (in contact with the film of yeasts called flor).

OLOROSO has a final alcohol of 18%, is lesser quality, and ages physiochemically (in direct contact with air).

Now for the fortification. For Fino, a half neutral grape spirit half sherry mixture is added, which brings the alcohol level up to 15-15.5%. Olorosos are increased to 18% alcohol by volume with the addition of neutral grape spirits. The aging process comes next, and this is one of the unique features of Sherry. In the Fino casks, a flor develops. This is a yeast in the same family of the yeasts that turn grape juice to wine, but a different strain (*Saccharomyces Cerevisiae Beticus*). This film of yeasts can only develop in a humid aerobic environment. Development is encouraged by seasoned barrels, absence of residual sugar, less than 16% alcohol, and a high acid wine. Flor ages the Sherry biochemically. It basically eats the acids and ethanol and converts them into aldehydes and fusel oils. The barrel is then aged within the solera system. This is a tiered system of stacked barrels with the youngest vintage put in barrels at the top. The last tier is actually called solera and all the younger tiers are called criaderas (nurseries). A simple solera can be composed of three or four rows of criaderas and a complex solera can contain as many as 14. Once the wine from the solera (oldest wine on the bottom row in this case) is drawn off (usually just 10-15% of the barrel) and bottled, it is replaced with wine from the first row above and then everything is moved down. The very top is filled up with the newest, youngest wine. At bottling, anywhere from 5-34% of the oldest wine can be bottled- but never more than 35%. Bottling too much would weaken or dilute the whole solera.

Before bottling, the Sherry can be sweetened, color added, and/or alcohol added depending on the style

“ Wild yeast fermentation results in a wine with more rose/floral/honey aromas, a wild rustic nature, and maderized/sherry aromas. ”

desired. Pedro Ximenez grapes are used in creating sweetening agents and Moscatel adds the coloring. Vino de Color is Moscatel grape juice reduced to 1/3 to 1/2 its original volume. This is typically used to make East Indian and Brown Sherries. Vino Dulce is raisinated Pedro Ximenez or Palomino grapes. Dulce Apadago is unfermented grape must with grape spirits added or sweet wine with fermentation arrested by adding grape spirits. Dulce Alimbar is a sweet mixture of half glucose and half fructose.

SHERRY Job Aid



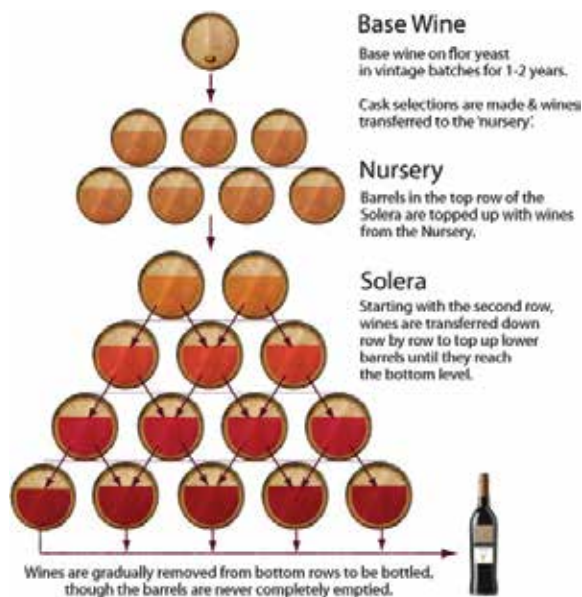
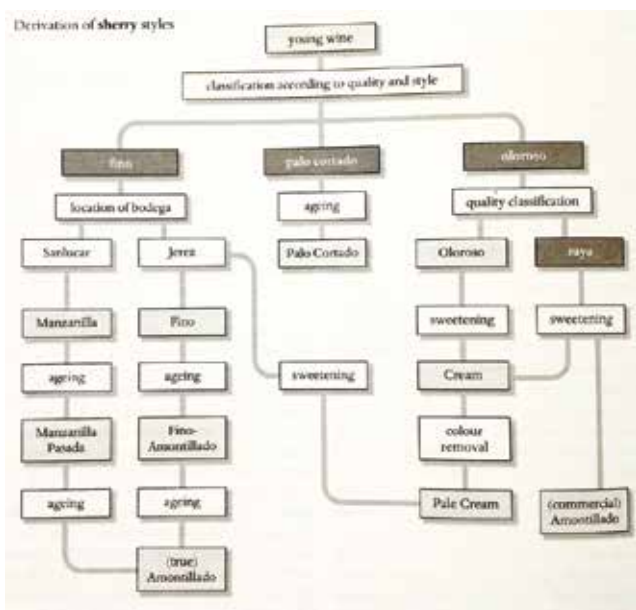
Sherry	Description	Variations
Fino Sherry	Fino Sherry is made from the Palomino grape alone. Its unique flavor and aroma is derived from the biological action of flor and controlled oxidation. It is one of the least acidic and most aldehydic wines in the world with a taste that is very similar to roasted almonds.	<ul style="list-style-type: none"> • Palma: the most delicate of Finos • Entre-Fino: a Fino lacking in delicacy • Palma Cortada: a more robust Fino, leaning toward Amontillado in style • Pale Cream Sherry: a Fino sweetened with dulce de almibar • Fino-Amontillado/ Amontillado-Fino: as the flor thins and dies, the wine picks up body, a richer, nuttier nose, and more intense flavors, morphing from Fino-Amontillado into Amontillado-Fino
Manzanilla Sherry	<p>A Manzanilla Sherry is a type of Fino that has biologically aged in contact with flor. It is particularly aromatic due to the predominance of the yeast <i>S. Beticus</i> in the velo.</p> <p><i>S. Beticus</i> characteristically thrives in the cooler, more humid, maritime climate of Sanlúcar de Barrameda; thus, Manzanilla Sherries can only be made from butts aged in this town. It tastes like salted, roasted almonds.</p>	<ul style="list-style-type: none"> • Manzanilla Pasada: a Manzanilla that has lost its flor and matures in direct contact with the air for a short to moderate period of time • Manzanilla Amontillado: a Manzanilla that has lost its flor and matures for a prolonged time in direct contact with air

BEGINNER FORTIFIED WINE PRODUCTION

SHERRY Job Aid

<p>Amontillado Sherry</p>	<p>An Amontillado sherry begins its life as a Fino. After the flor dies, this Sherry spends considerable time aging in direct contact with the air deepening in color, filling out in body and picking up more pronounced maderized aromas and flavors. Its flavor profile is often likened to roasted hazelnuts.</p> <p>You will note that the only difference between an Amontillado and a Manzanilla-Amontillado is that the Manzanillas are aged in Sanlúcar de Barrameda. Otherwise, the process is the same.</p>	<ul style="list-style-type: none"> • Pale Cream Sherry: an Amontillado sweetened with vino dulce or dulce de almibar • Medium Sherry: an Amontillado sweetened with vino dulce
<p>Palo-Cortado is an extremely rare Sherry. The aging is all physiochemical—no flor. It has the aroma of an Amontillado, without having had any contact with film yeast, yet the flavor and color of an Oloroso. Few soleras of Palo Cortado have been maintainable since the phylloxera epidemic, and it is uncertain as to why. Palo Cortado tends to lose its ability to straddle the gustatory middle-road between the two Sherry styles and degenerates into a full-blown Oloroso, now that the vines are grafted onto American rootstocks.</p>		
<p>Oloroso Sherry</p>	<p>Oloroso Sherry is aged through the pure physiochemical process of oxidation. An Oloroso changes in color from light to dark brown as it ages, increasing in body, alcohol and aroma. Glycerin gives a perception of sweetness to an otherwise dry wine. Olorosos taste like toasted pecans.</p>	<p>(all sweetened)</p> <ul style="list-style-type: none"> • Cream/Milk Sherry: A British favorite, originating in the town of Bristol • Brown Sherry: a very dark, sweet Sherry; a blend of Raya, Oloroso, vino de color and vino dulce • Pajarete: an extremely sweet form of Brown Sherry • East India Sherry: a form of Sherry whose flavor profile simulates that created by the bygone practice of placing Sherry into the holds of sailing ships as they traversed the tropics. The heat and the movement of the ship concentrated flavors and matured the wines more quickly.
<p>Raya Sherry</p>	<p>Rayas are aged through the pure physiochemical process of oxidation. They are similar to Olorosos in flavor, but have less delicate aromas.</p>	<ul style="list-style-type: none"> • Rayas Olorosos: a better, less coarse Raya • Rayas Finas: a lighter-styled Raya

BEGINNER FORTIFIED WINE PRODUCTION



Sherry - Styles & Solera

PORT

"Sip your spirits and cure your cold, but I will take Port that will cure all things, even a bad character. For there was never a port drinker who lacked friends to speak for him" –William Thackeray

Port was created because the English hated the French. At times, French wine was prohibited to be imported into England, and at other times high punitive taxes were levied on French goods. While the English had long been a fan of the great wines of Bordeaux (it was the closest wine region to England and easiest to ship), they explored other options to get their wine fix on. The deep, rich, tannic wines of Portugal's Douro were discovered. To ensure safe travel on the ship back to England brandy was added to stabilize and protect the wine.

Port comes from the Oporto region in Northern Portugal in the Douro Valley (its name meaning 'River of Gold'). Within the Douro Valley there are three sub regions: Baixo Corgo, Cima Corgo, and Douro Superior. The soil here is comprised of schist, granite, sand, clay, and quartz. A vineyard ranking system has been established to identify the best land. Created by the Cadastro, this system evaluates soil composition, production/yields, slope, stoniness, locality, altitude, shelter, sun exposure/aspect, grape varieties, training method, age of vines, and density. Scored on each category the highest score possible is 2,031 points- but any property with over 1,200 points gets an A rating. To receive an F, or failing grade, a vineyard must score fewer than 200 points. The Instituto do Vinho do Porto (IVP) controls overall Port production, can inspect a port house anytime, and calculates how much Port can be produced each vintage. The production permitted is based on the Cadastro rankings and point system. Poor F ranked vineyards rarely get to make any Port- but no real loss as who wants to drink a failing Port? The Casa do Douro is the governing body that represents growers and the Comissao Interprofissional da Regiao Demarcada do Douro (CIRDD) represents both growers and shippers. Port is traditionally made in Douro in Northern Portugal and shipped down the Douro River to Villa Nova de Gaia. Along with Istanbul, Villa Nova de Gaia is the most humid city in Europe. High humidity supports the aging process with low evaporation. While Port no longer has to be aged in Villa Nova de Gaia, it usually still is. When aged in the hot Douro, there is a noticeable caramelization of flavors commonly referred to as Douro Bake.

“ The Douro is one of the oldest delimited wine regions, being demarcated as an official production zone in 1756. While there are 80 grape varieties allowed in Port, only eight are recommended. ”

BEGINNER FORTIFIED WINE PRODUCTION

“ Port has a residual sugar of 8-12% (but legally it can range from less than 4% to more than 13%). This puts port in the sugar range of soda (Coke= 10.8%, Pepsi=11.55%, Mountain Dew=12.4%, and Red Bull =10.8%) but port is typically served in 2-3 ounce portions. ”



Transporting barrels of Port

The Douro is one of the oldest delimited wine regions, being demarcated as an official production zone in 1756. While there are 80 grape varieties allowed in Port, only eight are recommended:

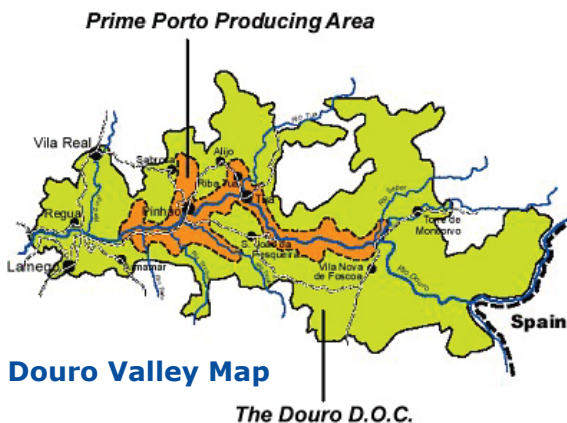
Red varieties: Touriga Nacional, Touriga Franca, Tinta Barroca, Tinta Roriz (also known as Tempranillo), and Tinta Cao

White varieties: Gouveio (also known as Verdelho), Malvasia Fina, and Viosinho

Let's make some Port!

To make Port the fermentation is arrested by adding grape spirits, which stops the fermentation (conversion of sugars to alcohol) that results in a sweet wine. The shorter fermentation time could mean less color and tannin extraction. To concentrate the pigment and tannins an aggressive pressing and maceration take place. The grapes were traditionally pressed by vineyard workers feet (feet are strong enough to crush the skin and pulp while keeping the bitter pip intact) in large shallow lagares. Wild yeasts begin the fermentation, fermentation gets hotter, and more pigment and tannins are extracted. After 24-36 hours, the fermenting grape juice is about half converted to wine, initial sugar measurement of 12-13 Baume has been half converted to alcohol leaving 6-8 Baume. The juice/wine is transferred from the large square lagares where it is pressed into giant vats. A neutral grape spirit, Aguardente, is added that is about 77% alcohol by volume. Geropiga, or extra sweet Port, can be added to the blend to increase sugar if necessary. Once the alcohol is added, it reaches 18-20% ABV and all ambient yeasts are killed. The alcohol level is too high for yeasts to live and continue converting sugar to alcohol so the fermentation process is completed. The resulting Port has a residual sugar of 8-12% (but legally it can range from less than 4% to more than 13%). This puts port in the sugar range of soda (Coke= 10.8%, Pepsi=11.55%, Mountain Dew=12.4%, and Red Bull =10.8%), but port is typically served in 2-3 ounce portions.

Sidenote: The high sugar content of Port wine does not make it ideal for volume consumption. If you ever find yourself in Portugal drinking Port all night chances are high you will wake up with a serious hangover!



There are several types of Port and they fall into two categories:

Bottle Aged - Vintage and Single Quinta Ports- the reductive aging process means the wine will deteriorate faster once the bottle is opened.

Barrel Aged - all other Ports - the oxidative aging process means the wine will hold flavor for longer periods once the bottle is opened.

-Small barrel aging is used to make Tawny Port in a controlled oxidative process.

-Large barrel aging is used to make Ruby Port to retain its color.

BEGINNER FORTIFIED WINE PRODUCTION

PORT Job Aid

Bottle-Aged Port

Port Type:	Blend of:	Filtered/ Fined?	Aging Regimen	Of Note:
Vintage (ruby)	Grapes Vineyards	No; it will throw a crust.	2 yrs in cask	Takes 10 yrs or more to mature.
Single Quinta Vintage (ruby)	Grapes	No; it will throw a crust.	2 yrs in cask	Takes 10 yrs or more to mature.

Wood-Aged Port

Port Type:	Blend of:	Filtered/ Fined?	Aging Regimen	Of Note:
Simple Ruby	Grapes Vineyards Vintages	Yes; no Crust	3 yrs in cask	
Simple Tawny	Grapes Vineyards Vintages	Yes; no crust	3 yrs in cask	
Late-Bottled Vintage (LBV) (ruby)	Grapes Vineyards	Optional	4-6 yrs in cask	Filtered LBVs receive a T-cork; unfiltered LBVs receive a driven cork. This is a single vintage port, bottled late.
Vintage- Character (ruby)	Grapes Vineyards Vintages	Yes; no crust	4-6 yrs in cask	This is NOT a vintage port. It is a blend of several.
Old Tawnies	Grapes Vineyards Vintages	Yes; no crust	10-40 yrs in cask	
Colheita (tawny)	Grapes Vineyards	Yes; no crust	7 yrs minimum in cask, can stay up to 10-50 yrs in wood	This single-vintage tawny is the rarest of all port.
White	Grapes Vineyards Vintages	Yes; no crust	3-4 yrs in cask	There are two styles: Dry: 3% RS Normal: 6% RS

BEGINNER FORTIFIED WINE PRODUCTION

MADEIRA

Madeira is delicious, adventurous, and the longest lived fortified wine. Bottles of Madeira from 1795 have recently been poured by the glass at a few top restaurants. Imagine drinking a bottle of wine that was made during the presidency of George Washington!

In Shakespeare's *Henry IV*, the Prince of Wales is accused of selling his soul for a glass of Malmsey (Madeira) and a chicken leg. Thomas Jefferson, George Washington, John Adams, and Benjamin Franklin all enjoyed Madeira. The inauguration of George Washington as President, Washington chosen as the capital city, and the writing on the Declaration of Independence were all historic moments marked with a glass of Madeira.

The island of Madeira, where the fine fortified wine is made, was discovered by Joao Goncalves Zarco 'the one eye' or 'the squinter.' Yep, a rugged old warrior pirate of a man discovered the island that makes the refined and posh Maderia. When his ship neared the island he described "there hung over the sea a thick impenetrable darkness, which was guarded by a strange noise." They believed they had found the gates to Hell.

Good old Zarco populated the island with prisoners and grape vines. Madeira takes its name from the Portuguese word for wood, as the island was covered with ancient trees. Legend has it that he accidentally set the island on fire and that it burned for seven years. All the charred tree ashes helped to create the rich fertile soil of Madeira. The island's location well off the Southern Portuguese coast in the Atlantic Ocean made it an ideal stopping point for travel to the West Indies, the New World, England, and many other destinations. Originally an unfortified table wine, the wines of Madeira frequently traveled on Dutch East India Company boats to India. The long hot voyage transformed the wines into something even more spectacular. Vinho da Roda was a type of early Madeira that aged on a ship for a round trip to India and back. By the 1800's estufas, or hot rooms, were created to simulate this voyage and transform the wine of Madeira into Madeira. Alcohol was added to protect the wine from breaking down, and this practice was standard by the 1750's.

There are five main grapes used in Madeira production and each has its own unique style and classification. Sercial and Verdelho are fermented until almost dry and then fortified. Bual and Malmsey are fortified earlier in fermentation.

- Sercial- this is the driest and tastes of almonds (.5-1.5% RS)
- Verdelho- moderately sweet and smokey (1.5-2.5% RS)
- Bual- Sweet and raisiny (2.5-3.5% RS)
- Malmsey- The sweetest with nutty and grapey flavors (3.5-6.5% RS)
- Tinta Negra Mole- the most widely planted grape on the island, but only used in the production of bulk Madeira. It is fermented dry and then fortified.



Madeira Zarco



“ There are five main grapes used in Madeira production and each has its own unique style and classification: Sercial and Verdelho are fermented until almost dry and then fortified. Bual and Malmsey are fortified earlier in fermentation. ”

BEGINNER FORTIFIED WINE PRODUCTION

Madeira can be made in three ways:

- Wine is in a concrete vat, and hot water (as hot as 122F/50C) circulates through a coil submerged in the vat. The maderization process takes 3 months, and then it is sweetened and fortified. This is the cheapest and fastest method.
- Wine is in a cask, and fortified prior to heating for a more integral flavor. An estufa (or oven at 85-105F/30-40C) heats a hot room, called a Armazens de color, for 6 to 12 months.
- Fortified wine is aged in a cask in a non-temperature controlled warehouse. This process takes several years, and is an expensive lengthy process.

The resulting wine should be 17-18% ABV.

MADEIRA Job Aid

Types Of Madeira

Type of Madeira	Sugar Level	Flavor Characteristics
Sercial	Dry; .5-1.5% RS	Almonds
Verdelho	Semi-Sweet; 1.5-2.5 % RS	Smoky
Bual	Sweet; 2.5-3.5 % RS	Raisin-like
Malmsey	Very Sweet; 3.5-6.5% RS	Nutty grapiness

Madeira Classifications

Type of Madeira	Age	Type of Estufa	Type of Aging	Bottle age?	Grape Varieties	Of Note:
Granel	18 mo	Tank	Bulk	None	Tinta Negra Mole	Represents 40% of the island's production
Finest	3-yrs	Tank	Bulk	None	Tinta Negra Mole	
Reserve	5-yrs	Tank	Bulk	None	Tinta Negra Mole	Some of the wine may have spent time in cask
Special Reserve	10-yrs	Cask	Cask	None	Noble Grape Varieties	
Extra Reserve	15-yrs	Cask	Cask	None	Noble Grape Varieties	
Vintage	20-yrs	Cask	Cask	2-yrs	Noble Grape Varieties	Made from one vintage

MARSALA

Marsala is made on the Italian island of Sicily in both sweet and dry styles. Catarratto, Grillo, and Inzolia are the grape varieties used and the blend is fortified during fermentation. Marsala production began in Sicily when a British lover of Sherry, Port, and Madeira named John Woodhouse noticed that Sicily had a good climate for fortified wine production. Marsala can be fortified in two different ways: Grape spirit can be added or late picked must mixed with alcohol (sifone) can be added. Marsala can also fall into three color categories: Oro (golden) Ambra (amber- sweetened by mosto cotto or concentrated must), and Rubino (ruby).

BEGINNER FORTIFIED WINE PRODUCTION

Marsala is categorized into sweetness level in the following way:

Secco (dry)- 4% RS

Semisecco (semidry)- 4-10% RS

Sweet- more than 10% RS

Marsala is categorized according to aging regimen:

Marsala Fine- minimum 1 year aging

Marsala Superiore- minimum 2 years aging

Marsala Superiore Riserva- minimum 3 years aging

Marsala Vergine/Marsala Solera- minimum 5 years aging- cask solera system

Marsala Vergine Stravecchio Riserva- minimum 10 years aging- cask solera system



MALAGA

Continuing our tour of fortified wines, we return to Andalusia, Spain (home of Sherry) where Malaga is made. Malaga was incredibly popular in the 17th century, and by the mid-19th century, vine plantings here were so extensive as to be Spain's second largest wine region. Remember that Spain's La Mancha region is not only Spain's largest, but the largest region in all of Europe. The double defeat of powdery mildew and phylloxera devastated the region and it never quite recovered. There are now about 14 bodegas making Malaga today, where there were well over 100 at the height of its popularity. Pedro Ximenez, Airen, and Moscatel de Alejandria are the grapes used to create Malaga wine. Grapes were dried on straw mats, which reduced the water content and concentrates the flavors. Malaga can still be made in this way. These wines are aged in a solera system within the city of Malaga. They can range from 15-23% ABV and can be finished either dry or sweet.

BEGINNER FORTIFIED WINE PRODUCTION

MONTILLA-MORILES

Montilla-Moriles is very similar to Sherry. It is also a region in Andalusia, Spain located just north of Malaga. It is made in Fino and Oloroso styles- the first with flor and the second without. Added complexity and integration of flavors that the solera system provides in Sherry is utilized here too. Fortification takes place after fermentation. The main point of differentiation is that Pedro Ximenez, Airen, and Moscatel Alejandria are the main varietals used in Montilla-Moriles production. Pedro Ximenez is the dominant grape planted here, and can reach 14-16% ABV without fortification.

VIN DOUX NATURELS

This is a broad term to describe a French wine whose fermentation is arrested by the addition of neutral grape spirit. Typically, they are made from the Muscat family of grapes or Grenache. This technique of arresting fermentation with neutral grape spirits to kill off the remaining yeasts that results in a wine with high alcohol and residual sugar may sound familiar. This is the same fortification process for Port, Madeira, Marsala, and Malaga. This process was originally mastered 400 years before Port was ever produced by Arnaldus Villanova in 1299 at Montpellier University's Medical School. The neutral spirit added to make VDN's is a higher percentage (95% ABV compared to Port's 77% ABV neutral spirit) but less is added and the resulting wine is around 15% ABV.

In the Languedoc, the VDN's made are Muscat de Frontignan, Muscat de Lunel, Muscat de Mireval, Muscat de St.-Jean-de-Minervois. In the Rousillon Muscat de Rivesaltes, which is Muscat based as the name suggests, and Grenache based VDN's Banyuls and Maury. Muscat de Beaumes de Venise and Grenache based Rasteau are the VDN's of the Rhone.