Blending and Bottling

Wine 3
Introduction to Enology

Blending and Bottling

Tonight’s Lecture
- What blending does for a wine
- Making bench blends
- Blending in the cellar
- Getting wine ready for bottling
- Final filtration and integrity testing
- Bottling procedures
- Labeling and packaging

Blending

Trying to make good wine taste better

What blending does
- Blending can make a good wine better by adding complexity & balance.
- Complexity by combining different flavor profiles, Ex. Zinfandel with a spicy-peppery aroma with a jammy-fruity Zin.
- Balance by blending wines that complement each other and fill in the gaps, a ripe low-acid wine with a tart wine.

What blending won’t do
- Blending cannot make a bad wine good
- A small amount of a bad wine blended with a larger amount of good wine usually results in a large amount of mediocre wine.
- Wines that have viable spoilage microbes should never be used for blending.

What blending does
- The whole is often more than the sum of the parts.
- A wine blended from two wines will often be scored higher than the mean of the scores of the two base wines.
**Blending Options**

- Blending within or across varietals.
- Blend different vineyards.
- Blend younger and older wines.
- Blend wines with varying treatments, (oak and no oak).
- For home winemakers, use traded or store bought wine to complement your base blend.

**Try it before you buy it**

- **Using lab blends and bench trials:**
  - Before you make the blend in the cellar make a small amount of the proposed blend in the same ratio in the lab.
  - Like making a soup on the stove, taste you wine, think of what kind of flavors might improve it, and then see what you might have available in the cellar to make it better.

**Keep it Legal!**

- Commercial wines have to be made within the boundaries of government regulations and market acceptance. More on this when we talk about labeling.
- Blending for composition (variety, vintage, etc.) or analysis (alcohol).
- Home winemakers make their own rules!

**Tools for Blending Trials**

- Graduated cylinder
- Graduated pipette
- Beaker or bottle
- Calculator or spreadsheet
- When making a blend, be prepared to make a mess.

**The Easiest Way to Start a Winery**

- Négociants buy bulk wine from many growers and wineries to make a blend at a "custom crush" winery and then sell under their own name.
- This is by far the least expensive way to start a "winery".

**Making the Calculations**

- **Calculator**, easy and fast for simple blends.
- **Spread sheet**, good for complex blends or to estimate chemical analysis or composition of a final blend.
- There is an excellent downloadable spreadsheet at [winemakermag.com](http://winemakermag.com)
### Home Winemaking Spreadsheet

<table>
<thead>
<tr>
<th>Component</th>
<th>Gallons</th>
<th>% Blend</th>
<th>pH</th>
<th>TA</th>
<th>SO</th>
<th>RS</th>
<th>Brix</th>
<th>% Alc</th>
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</thead>
<tbody>
<tr>
<td>Wine 1</td>
<td>10.50</td>
<td>70.0%</td>
<td>3.30</td>
<td>7.50</td>
<td>40.0</td>
<td>0.10</td>
<td>24.0</td>
<td>13.20</td>
</tr>
<tr>
<td>Wine 2</td>
<td>0.50</td>
<td>3.3%</td>
<td>3.50</td>
<td>7.00</td>
<td>40.0</td>
<td>0.10</td>
<td>25.80</td>
<td>14.19</td>
</tr>
<tr>
<td>Wine 3</td>
<td>2.50</td>
<td>16.7%</td>
<td>3.72</td>
<td>5.50</td>
<td>55.0</td>
<td>0.20</td>
<td>23.60</td>
<td>12.98</td>
</tr>
<tr>
<td>Wine 4</td>
<td>1.50</td>
<td>10.0%</td>
<td>3.81</td>
<td>5.30</td>
<td>55.0</td>
<td>0.20</td>
<td>25.80</td>
<td>14.19</td>
</tr>
<tr>
<td>Wine 5</td>
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<td>0.0%</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Column</td>
<td>0.00</td>
<td>51.42</td>
<td>103.95</td>
<td>660.00</td>
<td>1.90</td>
<td>362.60</td>
<td>199.43</td>
<td></td>
</tr>
<tr>
<td>Weighted Ave.</td>
<td>15.0</td>
<td>3.39</td>
<td>6.93</td>
<td>44.00</td>
<td>0.13</td>
<td>24.17</td>
<td>13.30</td>
<td></td>
</tr>
</tbody>
</table>

**From Winemaker Magazine**

### Pearson Square

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = Wine @ 15%</td>
<td>B = Wine @ 10%</td>
<td>C = Target 13%</td>
<td>D = 13 - 10 = 3</td>
<td>E = 15 - 13 = 2</td>
</tr>
</tbody>
</table>

Ratio of wine 3/2 wine A/B makes a blend of 13%

### Making the Calculations

- **Pearson square**, a simple way to do the algebra needed to determine the ratio of two wines that needs to be blended together to hit a certain composition.

### When to Blend?

- **Field blend**, mixing different varieties in the vineyard and or crushing them together into the same fermentation tank.
  - This gives the wine plenty of time to harmonize but you cannot make a trial blend.
  - Not so bad if you know you will eventually blend the two vineyard blocks together.
  - However both varieties usually do not ripen at the same time.

- **After fermentation** but before ageing, you can taste the wine beforehand but you still are estimating what the taste will eventually be.

- **Mid ageing**, you can taste the wine and it has time to marry the flavors in the barrel.

- **Before bottling**, at then end of aging. Works great but the wine does not have a lot of time for flavors to harmonize.
Blending Complementary Varieties

- Cabernet Sauvignon & Bordeaux blenders
- Zinfandel & Petite Sirah
- Pinot Noir & Syrah (does not take much)
- Chardonnay & Muscat (does not take much)
- Sauvignon Blanc & Sémillon
- Syrah & Grenache, Mourvèdre or Viognier
- Sangiovese & Merlot or Cabernet Sauvignon
- Merlot & Cabernet Sauvignon

Non-varietal blending

- If no grape variety in the blend is more than 75% of the composition it cannot be sold as a varietal wine.
- Non-varietal wines can be sold under a hyphenated name *Cabernet-Merlot*, or a proprietary name such as *Red Truck*.

Blending examples

- Different treatments
- American oak & French oak
- Different levels of ripeness at harvest.
- A small amount of a young wine blended with an older wine can make it taste more youthful & fruity.

Things to be careful of

- Blending can spread spoilage.
- Blending is more successful when you are trying to tweak flavors rather than trying to hide flaws.
- Blending can affect stability (protein, tartrate, microbial), if all of the base wines are stable the blend usually is as well; but test again to be sure.

Final Thoughts on Blending

- There is no trick to blending, make bench blends first and then trust your taste.
- Remember, the primary objective of blending is to add balance and complexity to the final blend.

Bottling - The final step

- Bottling is the last step a winemaker takes when producing a wine.
Bottling - The final step

- It is also one of the most risky steps because mistakes cannot be easily corrected after the wine is bottled, and the bottling process can be very rough on wines.
- Many of the topics we have covered so far in class are reprised in tonight’s lecture.

Stabilization

- Stabilization
  - Heat stabilization with bentonite (white wines).
  - Cold stabilizing 5 days to 3 weeks at 28°F, can be expedited with addition of KHTa seed crystals.

Prebottling

- Steps needed before a wine is ready to bottle:
  - Clarification
  - Stabilization
  - Adjustments - SO₂ & temperature
  - Adjustments - Oxygen & Carbon dioxide
  - Filterability

Sulfur Dioxide

- SO₂ adjustment
  - 0.5 PPM (molecular) for reds to protect from Brettanomyces
  - 0.8 PPM (molecular) for whites at bottling.
  - Remember SO₂ level decreases with bottle aging.

Clarifying

- Clarifying by racking, filtering, or centrifuging, depends on microbial stability and the type and style of the wine being produced.
- The steps of filtration are:
  - Rough → Polish → Sterile → Bottle

Temperature

- Temperature adjustment
  - Wine should be warmed to 60-65°F to prevent condensation on bottles during filling.
  - It is best to warm the wine before polish filtration, if the wine is filtered “warm” there less potential for oxygen pickup and protective colloids are easier to remove.
Oxygen

- **Oxygen**, although oxygen is more soluble at lower temperatures, it is absorbed more slowly.
- Shoot for a dissolved oxygen (DO) level of <1.0 PPM in whites and <2.0PPM in reds.
- Remember:
  1 gram/Liter = 1,000 parts per million (PPM)

Carbon Dioxide

- **Degassing** usually not needed for reds due to long aging.
- Warm wine to 65°F and circulate or sparge with nitrogen to drive out CO₂. With young white wines there is a danger of foaming over the tank.
- This step can be done using a heat exchanger or with hot water dripped over the top of the tank or circulated through the jacket.

Nitrogen Sparging

- Sparging with nitrogen gas lowers the dissolved oxygen level in wine.
- The gas can be introduced during a wine transfer or in the tank using a **sparging stone** to form small bubbles.
- Be careful because excess sparging will reduce a wines aroma.

Filterability Testing

- **Filterability Test** Here a small amount of the wine is lab filtered through the same type of filter that is to be used on the bottling line.
- The flow rate is monitored over time and with the aid of a computer program it is determined if the wine is clean enough for membrane filtration.

Carbon Dioxide

- **Carbon Dioxide level adjustment**
  - CO₂ is soluble in wine to 1.65 g/ L at 1 ATM pressure; the threshold for taste is at 1.3 g/ L
  - CO₂ affects taste and can be desirable in young fruity wines (White Zin, G ewurtz)
  - Dry red or white .5 to .9 g/ L
  - Off dry style  1.0 to 1.3 g/ L

Filterability Testing

- Filterability testing is not absolutely necessary, but if the wine is to be sterile filtered at bottling it insures that the wine is clean enough pass through membrane filters without clogging.
- Membrane filters are very expensive so you can pay for the cost of the lab equipment the first time you prevent a set of membrane filters from plugging.
Filterability Testing

- **Turbidity**, Some wineries prefer to measure turbidity to see if a wine is ready to bottle.
- Turbidity is measured using a nephelometer and expressed in NTUs (Nephelometric Turbidity Units).
- Wine should be < 1.0 NTU for membrane filtration.

![Image of Filterability Testing](image)

Final Filtration

- Four common grades of tightness:
  - 0.45 micron screens out bacteria.
  - 0.65 micron screens out yeast.
  - 0.80 micron good prefilter, gets out larger yeast
  - 5.0 to 20 microns (fly catcher)

1 micron (μm) = 1/1,000,000 meter

Integrity testing (Bubble Point)

- Integrity testing, it takes a certain amount of pressure for a gas to break the surface tension of water on the pores of a membrane and pass through the filter.
- Using this property it is possible to determine the maximum pore size by measuring the amount of pressure needed to break the surface tension and allow gas through.

Integrity testing

- Only nitrogen gas and water should be used for the bubble point test. Both alcohol content of the liquid the membrane was stored in as well as temperature of the membrane has an effect on the bubble point.
Integrity testing

- 22 PSI for 0.45 μm @ 20 ºC (68 ºF) with N\textsubscript{2} gas
- 13 PSI for 0.65 μm @ 20 ºC (68 ºF) with N\textsubscript{2} gas

Sterile bottling

- Using membranes the bottling line can be sterilized with hot water (180 ºF for 30 minutes, this is measured at the coldest part of the line and the timer starts when it is up to 180 ºF).
- After its sterilized the membranes keep microorganisms out as wine flows into filler so the wine is bottled sterile.

Integrity testing

Before starting purge system with water and then close inlet and outlet valves

Sterile bottling

- Live steam for 15 minutes will also sterilize a filler.

Integrity testing

- Pressure hold test, similar to a bubble point test but the nitrogen pressure is brought to just below the bubble point and then the gas supply is turned off.
- The pressure is monitored for several minutes to see if it holds. This method takes more time but is more accurate.

Sterile bottling

- Bottling lines can also be sterilized with ozone. The filler is filled up with ozoneated water and soaked overnight. Draining it in the morning and you are ready to go.
- However, ozone degrades membrane filters so it cannot be used for sanitizing final filters.
Sterile bottling

- This is most important for sweet wine or wines that have not gone through malolactic fermentation, for dry reds that are finished with MLF it can be skipped.
- A 0.80 μm is fine for wines that will not be aged for too long but be sure to use a 0.65 μm when a red wine has a risk of Brettanomyces.

Sterile bottling

- If your membrane filters get plugged up quickly after starting on a new wine, do not just put in new ones and start again because they are likely to plug as well (and you will be out another $300/ filter!)

Sterile bottling

- If you cannot sterile bottle and your wine is microbially unstable you can use additives to prevent microbial growth in the bottle.
  - Sulfur dioxide
  - Sorbic acid (yeast)
  - Fumaric acid (malolactic bacteria)

Wine in Kegs

- Wine sold “on tap” in restaurants. Usually sold in 3 to 7 gallon sizes. The kegs are pressurized with inert gas and preserve the wine for several weeks after the keg is tapped.
- Reusable kegs lower packaging costs but is offset by increased transportation costs.
Bottles

Bottles arrive in bulk or in cases, are loaded on to line and go through a bottle cleaner that blows or rinses out the cardboard dust and sparges with N\textsubscript{2} or CO\textsubscript{2} before they are filled.

Filler

Wine comes from the bottling tank by gravity or a gentle pump, goes through the filters and into filler bowl, most wine fillers fill the bottles by gravity and pull out foam and overfill with vacuum.

Filler

- Fill height should be set to the volume listed on the bottle using weight & density. This is because volume can change with temperature. 10\textdegree F change in temp can change fill height by about 1/8 inch.
- TTB regulations require that you measure for fill heights for accuracy and record the results at least every day.
**Corker**

- The corker first pulls a vacuum on the bottle, then jaws squeeze cork and plunger pushes cork into bottle, this reduces $O_2$ and eliminates wine leaking through cork.
- When hand (non-vacuum) filling it is necessary to leave the bottle cork up for about 10 days to equalize the pressure in the bottle and keep the bottle from leaking.

**Bottle Closures**

- Corks have been the most popular seal for fine wine for more than 300 years, but they are now being replaced by many wineries.
- Cork is a natural product made from the bark of the cork oak tree.
- Harvesting the bark does not kill the tree.
Corks

- Cork is cut from the bark of the Cork Oak (Quercus suber) tree native to Spain and Portugal.

Grading Corks

- Corks are graded by quality, size and are coated with silicon or paraffin to ease insertion.

Cork Alternatives

- Natural Cork
- Stelvin
- Noma Cork
- Neo Cork
- Supreme Cork
- Altec
- 3+1

Screw Caps

- Also called ROPPs (Roll On Pilfer Proof), quickly becoming the closure of choice for white wines.
- Different types of liners available.
- Stelvin brand most popular.
- Reduction (sulfides) after bottling may be a problem.

Stelvin Diagram

- Stelvin Definitions
  - (PET) Polyethylene terephthalate
  - EPE (Expanded Polyethylene)
  - PE (Polyethylene)
  - oriented polyamide (OPA)
  - Polyvinylidene chloride (PVDC) Saran Wrap
  - SiOx (silicon oxide) coating that protects against moisture, gas, and aromas.
  - OTR (Oxygen Transmission Rate)
Screw Cap Test with Semillon

Capsule Test

Applying capsules

Capsule Spinner

Screw Cap Machine

Screw Cap Machine

Capsuling

Capsules

There are many different kinds:

- Lead, Worked great but it was banned in the 80s
- Tin, Looks great but expensive
- Poly-Lam, Plastic & Aluminum, cheap but looks good
- PVC, Inexpensive (heat shrinks) looks cheap
- Polyurethane, Inexpensive (push on) looks cheap
- Wax sealing, Labor intensive, can't do graphics
- No Capsule, Some wineries use just a tamper seal

Capsules

Applying capsules

Capsule Spinner

Type of Capsules

Wax Dipped

PVC (Heat Shrink)

Plastic (Push On)

Tin (Spin On)
**Labeling - governed by marketing & TTB**

- Basic Regulations:
- Labeled California must be 100% California.
- Labeled Vintage, must also list appellation. For AVA Wines must be 95% from a single vintage. For non-AVA wines must be 85% vintage.
- Labeled Estate must be 95% from Estate Vineyards and in the same appellation as the winery.

**Types of labels**

- Silk Screened
- Pressure sensitive, pre-glued labels that peel & stick, good for intricate designs and quick clean up, but more expensive per label.
- Paper, these are the least expensive type, glue is applied by the labeler and then they are applied to the bottle.

**Labeling - governed by marketing & TTB**

- Labeled with American Viticultural Appellation (Sonoma Valley) must be 85% AVA.
- Labeled with political region (Sonoma Co) must be 75%.
- Labeled Variety must be 75% Varietal.
- Labeled Produced and Bottled must be 75% fermented at the winery.
- More information the lecture on wine law

**Types of labels**

- Silk Screened
- Pressure sensitive labeler

**Labeling**

- After labeling the bottles are loaded into cases and palletized for warehousing and bottle aging.
- Some wineries do not label their wines until after bottle aging is finished and they are just about to sell. This gives better quality control, and the bottle storage takes up considerably less space, but it is much more labor intensive.
Bottle Ageing

- It is best to bottle age wine before it is released to the consumer. The roughest treatment a wine gets is when it is bottled so it takes some time to come together (harmonize the flavors) after bottling.
- This awkward phase is referred to as **bottle shock**. *(But it's not like in the movie)*

Bottling Checklist ~ Wine

- Wine stability
- Wine clarity
- SO₂ and additive adjustments
- Temperature adjusted
- Degassed
- Is wine composition legal for labels

Bottling Checklist ~ Materials

- Is bottling line ready
- Membrane filters
- Packaging materials ready
  - Corks, Caps, bottles, labels, cases, etc.
- Labor available
- Trucking/warehousing set up
- Cold beer in refrigerator for after work

Mobile Bottling Lines

- For smaller wineries bottling lines are an expensive investment for equipment that is infrequently used. Several companies lease bottling lines on trucks that wineries can rent for their bottling.
Mobile Bottling Lines

- **Advantages:** Less cost up front, do not have to hire extra staff.
- **Disadvantages:** Inflexible schedule and costs more per bottle.

Next week

- Review second exam
- **Wine defects** (and how to prevent and cure them)