Chapter 7
Common Elements in Winemaking and Maturation

Vinspiration

Different Winemaking Approaches

Yeast -> converts sugar in grape juice to alcohol.

Natural wines = least human intervention as possible.

Common Elements in Winemaking and Maturation

Oxygen (oxidation)

- Gas reacts to grape juice
- Some positive/negative affects

Oxygen in winemaking

- **Anaerobic winemaking = min/no oxygen influence**
  - Used for wines with primary fruit characteristics
  - Grapes picked at night/chilled/airtight winery equipment (nitrogen/CO2)

Oxygen in maturation

- If anaerobic -> airtight stainless steel/cement lined with epoxy resin vessel - full to the brim (no oxygen influence)
- **Aerobic maturation = wooden, oak vessels**
  - Soften tannins/develop tertiary characteristics/change in colour (red, paler/white, golden)
- Small vessels (225-litre barriques) - more oxidising as greater proportional surface area exposed. No more than 2 years in barrique.
- Larger vessels - longer maturation potential
- If container not completely full = more oxygen/effect enhances (ie Oloroso Sherry) - caramel/toffee
- Too much oxygen - no fruit/stale - not fit for sale

Sulfur dioxide

- **Antioxidant** and **antiseptic** (indispensable/must be used)
- Upper levels of SO2 controlled - too much is toxic
- SO2 produced naturally in fermentation
- SO2 kept low = too much and wine is harsh/lacks fruit

Antioxidant effects

SO2 protects grapes from oxygen - becomes 'bound' - must be replenished/monitored

Antiseptic

SO2 can be toxic to yeast/bacteria (unwanted flavours) - main yeast in winemaking can tolerate levels of SO2 toxic to other species.

Oak vessels

- Fermentation and maturation
- Tannin from oak - adds structure + textural complexity (toast/vanilla/smoke/cloves)
- Hygiene essential (no yeast/mold/bacteria)

Four factors to consider:

Species and origin of oak

European vs. American (France considered finest)

Size

Small vessels - larger surface area - greater effect (225-litre *barriques*/228-litre *piece*)

Production of oak barrels

Toasting (staves heated to bend) transforms tannins/flavour compounds (sweet spice/toast)

Age

Toasting diminishes after each use - cask with 4+ uses has no more flavour/tannin to impart

Oak alternatives

- Oak chips/staves = cheaper
- Oxidative effects - can add small, controlled amount of oxygen

Inert Winery Vessels

Stainless steel

- Stainless steel/concrete
- Fermentation (can be used also as storage)

Concrete vessels

- Lined with inert epoxy resin (waterproof)
- Harder to clean
- Keeps temp consistent during fermentation without cost of additional equipment

(Glass bottles also inert vessels - storage + maturation)

Grape Processing

Grapes get first dose of SO2 upon arrival at winery

Sorted by hand (individual grapes) if premium - (not used for high-volume).

Destemming and crushing

- Machine harvested = no stems
- Stems removed by machine that can also crush
- **Crushing** = **breaks skin from juice (free run juice)**
- **Avoid seed damage** (bitter oil/tannin)

Pressing

- **Pressing** = **separating liquid and solid constituents of grape**
- White grapes - pressing before fermentation / black grapes - pressing after fermentation
- Gentle pressing to keep seeds undamaged
- Vertical 'basket' presses (old method) - vertical press using a plate was raised/lowered by level (still happens in Champagne)
- **Pneumatic press** (newer method) - **inflatable rubber tube with a perforated, horizontal stainless steel cylinder** - larger area/more controlled. Closed tank to minimise oxygen.
- Fractions = separate liquid into different, individual pressings.

Adjustments

Made before/during/after fermentation

Grape juice = **must**

Sugar and alcohol

- **Enrichment** = **RCGM (rectified concentrated grape must) added to the must (before or during fermentation)** - **more sugar for yeast to convert to heighten alcohol.**
- **Chaptalisation** = **sugar (not from grapes, ie sugar beet) added to must.**
- Remove water - concentrates sugars - wine higher in alcohol/ also concentrates faults and reduces wine volume

Acid

- **Acidification** = **addition of tartaric acid in powder form** (used in hot climates)
- **Deacidification** = **acid neutralised by addition of alkali** (used in cool climates)

Fermentations

Alcoholic fermentation

- Yeast + sugar = alcohol + CO2 (+ heat/flavours)
- **Saccharomyces cerevisiae** = **common winemaking yeast**
  - Tolerates high alcohol/SO2
- Alcohol fermentation will not start is temp below 5°c - will continue until all sugar consumed
- Alcoholic fermentation stops before all sugar consumed if (a) no nutrients left (besides sugar) and (b) temp above 35°c
- If sugar too high = yeast may struggle to start fermentation process
- If WM wants to keep some sugar - fermentation stopped by killing/removing yeast
- Yeast removed by filtration - after fermentation is halted by chiling to below 5°c.
- Control fermentation = choice of yeast/temperature management (more below)

Yeast

Ambient yeast (in grape bloom/in winery)	**Cultured yeast** (individual strains of S. Cerevisiae)
• Complex flavours • Cannot control which yeasts • Variation between batches • Unsuitable for high volume	• Performs well • Attractive flavours • Limits potential complexity of the wine

Temperature

- Too hot = yeast killed
- Fermentation temperature low - keep aromatic flavours (white)
- Fermentation temperature higher - extract colour/tanning (red)

- Excess heat removed by pumping over

Malolactic fermentation (MLF)

- **Malic acid → lactic acid**
- Reduces acidity/adds buttery flavours + CO_2
- **MLF encouraged by raising temperature and not adding SO_2 after fermentation**
- Avoided by cool temp/SO_2 use/filtering out bacteria

Pre-bottling maturation and bleeding

Lees

- Cloudy - dead yeast cells/grape fragments
- Over hours, these falls to bottom of the vessel
- **Gross lees** = **unpleasant aromas/flavours**
- **Fines lees** = **(smaller particles) removed gradually**
  - In contact for extra flavour/rich texture

Pre-bottling maturation

- Primary fruit flavours - bottled after a few months (stored in stainless/inert)
- Tannin/alcohol/acidity/flavour benefit all needed for longer aging potential
- If aging/maturing - vessel flavours (oak/oxidation) + sediment depositing - all potential.

Blending

- Applicable to single variety + blend
- Usually after or during fermentation
- Potential for local winemaking constraints

Balance

- Adjust balance to enhance quality (ie, red wine - free run wine + press wine = higher tannin).

Consistency

- Consistency amongst bottles vital
- **Small barrel wine** - **less consistent** - can be moved to a large vat to smooth/blend
- Blending required if variations in fruit (different vineyards/harvesting) + slight inconsistencies

Style

- Blend to a consistent, yearly 'house' style - ie, press fractions/ fermentation or maturation in different vessels/ only portion of wine MLF.
- Different grape varieties/vintage/vineyard to achieve their own style.

Clarification

Fining

Fining agent added to cause constituents to clump into larger forms - removed by filtering. Widely used - although some winemakers believes effects flavour/texture.

Sedimentation

Racking = **wine pumped into different vessels to remove gross lees.** Repeated racking to remove sediment. (**Centrifuge** - **machine to speed up racking process** - expensive.)

Filtration

Process of removing gross + **fine lees** (after fermentation/during maturation).

- Depth filtration: thick layer of material - suitable for filtering gross lees.
- Surface filtration: fine sieves - expensive + clog up easily. Used after depth filtration.
- Sterile filtration: also removes yeast/bacteria with pores small enough to still be present in wine.

Stabilisation

Change in slow, predictable manner (ie, Port 50-60 years of aging)

Fining - adds clarity - seen as stabilisation technique

Other important areas that require stabilisation:

- Tartrate Stability
  - Tartaric acid less soluble in wine than grape juice
  - Forms crystals called **tartrates** - coloured by wine/harmless/flavourless - ruin look.
  - Develop with long maturation in cellar / cool temperatures
  - To remove, **WM chill wine to 0°c** + **filter out**
- Microbiological Stability
  - Yeast/bacteria can spoil a wine - equipment must be kept clean.
  - Fortified wines (high alcohol) and MLF (alcohol, acid, lack of nutrients) - resistant to microbiological spoilage.
  - **No MLF/low-med alcohol/low acid/little residual sugar - at risk of spoilage**
  - **SO2 and sterile filtration to avoid.**
- Oxygen stability
  - Oxygen dissolved in wine/enters through packaging

- **Keep SO2 topped up to avoid**
- Bottles finished with CO2 or nitrogen before filling to eliminate oxygen.

Packaging

Bottles and alternatives

Glass bottles	**Plastic bottles**	**Bag-in-box**
• Portable/cheap to produce/strong/air tight • Rigid/heavy/weight adds to transport costs • To lower cost - some producers pack wine in the country which it's sold. • After open - vulnerable to oxygen.	• Lighter • Not airtight - air through plastic	• Bag collapses to prevent air entering • Some air - wall of bag - consumed in 18 months.

Closures

- Protect wine from harm until consumed
- Must consider - ease of use/bottling/manufacturing line
- Small oxygen - positive tertiary flavours
  - **Cork**
    - Popular, original wine closure, balance of small oxygen for tertiary development
    - TCA (Trichloroanisole) - chemical present in some corks (stale/mouldy cardboard)
  - **Synthetic cork**
    - Made from plastic
    - Consumer within a year - some premium brands use
  - **Screw caps**
    - Aus/NZ used widely
    - No taint/strong seal from air
    - Preserve primary fruit
    - Some now permit oxygen for tertiary development

Post-bottling maturation

- Most wines to be consumed within year
- Some wines mature in bottle (Port/German Rieslings/cru classes Bordeaux)
  - Age undisturbed/cool (10-15°c)/dark/constant humidity/on its side/etc.

Multiple Choice Practice Questions

1) What is the most common strain of yeast used in winemaking?

a) Latinimum cervisaie
b) Ambient yellowstone
c) Sacher cerevisitim
d) Saccharomyces cerevisiae

2) What does Malolactic Fermentation do?

a) Converts malic acid into lactic acid
b) Converts malic acid into green acid
c) Converts lactic acid into malic acid
d) Filters out any bits

3) Which type of vessel is often used for fermenting and aging wine to add complexity through oxygen exposure?

a) Stainless steel tanks
b) Concrete tanks
c) Plastic containers
d) Oak barrels

4) Why is sulfur dioxide used in winemaking?

a) To increase the alcohol content
b) To add tannins to the wine
c) To prevent oxidation and microbial spoilage
d) To enhance the sweetness of the wine

5) What is the benefit of using inert gas (such as nitrogen or carbon dioxide) during winemaking and bottling?

a) To increase the acidity of the wine
b) To prevent oxidation
c) To enhance the wine's colour
d) To add sweetness to the wine

Answers

1. d) Saccharomyces cerevisiae

2. a) Converts malic acid into lactic acid

3. d) Oak barrels

4. c) To prevent oxidation and microbial spoilage

5. b) To prevent oxidation