BASIC WINE MAKING

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Selecting Varieties:

Table Grapes
- Concord
- Reliance
- Canadice
- Marquis
Selecting Varieties:

Wine Grapes – Red
Marachel Foch
Frontenac
St. Croix
Marquette
Leon Millot
Selecting Varieties:

Wine Grapes – White
  St. Pepin
  Valvin Muscat
  La Crescent
  Brianna
  Prairie Star
Management

Weeds
Disease
Insects
Nutrition
Critters
The point

Determining the optimum time to harvest probably the most important step in quality wine production
Definitions

“Wine Maker”

– A person who makes wine
– Definition (per Bradley Beam, IGGVA Enologist)
  • A person who obsesses over cleaning and sanitation
  • A person who gives yeast the best chance to do its job
  • A person who can conduct critical sensory analysis of wine
  • A person who prevents faults from occurring, and fixes problems should they arise
Definitions

• “Wine”
  – An alcoholic beverage produced by the fermentation of grapes or other fruits

• Types of wine
  – Table wine
    • <14% alcohol
    • Generally consumed with food
    • Dry or sweet
  – Sparkling wines
  – Fortified wine
    • Added spirits raise alcohol as much as 21%
Before you get started...

• What do you really want to accomplish?
  – Wine styles have different purposes
    • Dry red and white table wines
    • Fruit and honey wines
    • Sweet table wines
    • Dessert wines
    • Sparkling wines

• How serious are you?
  – Just for fun
  – Medal-hungry
  – Practicing for commercial production
Pre-planning

- Decisions on style and scope will help determine:
  - Wine processing equipment needs
  - Wine analysis equipment needs
  - Text purchases
  - Fruit types and sources
    - Whole fruit
    - Bulk juice
    - Concentrates – kit wines
  - Overall investment needed to start up
EQUIPMENT AND SUPPLIES

• Bottle and Carboy Flushing Device
• Bottle Filler
• Bottles
• Calculator
• Carboys and Glassware
• Cleaning supplies
• Corker
• Corks
EQUIPMENT AND SUPPLIES

• Crushing/Destemming System
• Draining Rack
• Fermentation Container
• Fermentation locks
• Filtration Apparatus
• Free SO₂ Kit
• Hydrometer – Cylinder
• MLF Monitoring Kit
EQUIPMENT AND SUPPLIES

• pH meter – Calibration Buffers
• Press
• Refractometer
• Residual Sugar Kit (Clinitest)
• Scale
• Siphon and Plastic Tubing
• Thermometer
• Titratable Acidity Apparatus
CHEMICALS

(Available in small reasonably priced quantities)

• Acid Blend – Acidification
• Calcium Carbonate – Deacidification
• Fining Agents
• Malolactic Fermentation Culture
• Pectic Enzyme
• Potassium Bicarbonate – Deacidification
• Potassium Metabisulfite – Stabilization and Spoilage Prevention
• Potassium Sorbate
• Tannin
• Yeast
• Yeast Nutrient
Consequences

• Poor cleaning and sanitation in first 1-5 years
  – Chronic infestation of acetobacter, Brettanomyces, and wild MLF bacteria in years 3-6+
  – Once achieved, can lead to spontaneous MLF, brett-y wines and resistance to sorbate, SO₂, etc.
  – Impact on wine:
    • Vinegar, geranium, wet dog, cheesiness, band-aid, barnyard, mousey, etc.
Spoilage organisms in wine

- **Brettanomyces**
  - Horsey, mousey, band-aid
- **Acetobacter**
  - Nail polish, vinegar
- **Wild yeasts**
- **Lactobacillus/wild LAB**
  - Sauerkraut, briny
- **Mycoderma – film yeast**
  - Combination of yeast, acetobacter, molds
  - Oxidation, nail polish, vinegar
Spoilage organisms in wine

- All require oxygen!
- Prevention tips:
  - Sort fruit in field
    - GIGO
  - Keep containers full!
    - Variable capacity
  - Keep wine SO2 levels at .8ppm molecular
    - pH dependent – adjust high-pH wines at crush
General rules

• Clean everything before use, then sanitize
• Clean everything right after use
• Clean the premises on a regular basis
  – Floors, drains, etc.
  – Identify high-risk areas
• Keep the working area free of clutter
• Watch for pests (bacteria, mold, wild yeast, rodents, etc.), remove them, and prevent their return
• Deal with pressed fruit ASAP
Harvest – bare minimum

• Manually crush fruit in container
  – Manually remove stems too
• Squeeze pressed fruit through cheesecloth to remove solids
  – Less quality control
  – A little dangerous!
  – Lower juice volume
  – Time-consuming
Wine containers

• Plastic tubs – Rubbermaid storage, etc.
  – For crushed fruit, red fermentation
  – Not for long-term storage
• Glass carboys
  – Great, heavy, breakable, expensive
• Food-grade plastic fermenters, carboys
  – Fine, a bit expensive
• Stainless steel
  – Ideal, very expensive, var. capacity
Acidity in Grapes

- Types originating in the grape
  - Tartaric acid
    - 1/2 to 2/3 of all acids in grape
  - Malic acid
    - Most widespread in plants
    - Very high in green grapes, low in finished wine
      - Degraded during ripening and during malolactic fermentation
  - Citric acid
    - Not plentiful in grapes, degraded during fermentation
pH vs. Acidity

- pH gives a measure of $H^+$ and is not a complete measure of acidity.

- Titratable acidity measures both free $H^+$ and un-dissociated acid concentration.
Pre-fermentation Additions

• Sugar
  – Crystallized table sugar
  – Conversion to alcohol: °Brix X 0.55

• Acid
  – Tartaric for grape wines
  – To reduce pH < 3.6

• Calcium carbonate
  – To reduce very high acidity
Sulfur dioxide

• To prevent microbial growth in juice, during fermentation
  – At least 0.8 ppm molecular SO$_2$
  – Some wild yeasts will tolerate 0.8 ppm SO$_2$

• To prevent spoilage/oxidation during aging
  – At least 0.5 ppm for reds

• Amount necessary to add depends on pH
White Wine Production

1. Crushing/de-stemming
2. Pressing
3. Analysis/treatment
4. Fermentation
5. Racking
6. Clarification
7. Stabilization
8. Maturation
9. Finishing/Adjustments
10. Bottling
Juice Settling

- Add:
  - Pectic enzyme
  - \( \text{SO}_2 \) (25 ppm)
- Keep cool
- Hold 12-48 hours
- Rack off lees
Fermentation

- Fermenters/storage vessels
  - Glass, stainless steel, some plastics
  - Food grade/acid resistant
  - Fill 2/3 full
  - Cap with airlock
Yeast

• Use yeast developed for winemaking!
  – Liquid or active dry form
  – Wild/native yeasts unreliable

  – Which strain is best?
When is fermentation finished?

- Airlock bubbling slows/stops
- Wine will clear
- Sugar at 0.2%
- Hydrometer
  - °Brix: -1
  - S.G.: <1
Aging

- Rack into full containers.
- Cold stabilize if possible.
- Store in cool, dark area.
- What’s happening?
  - Slow, controlled oxidation
    - Slight browning of pigments
    - Softening of tannins
    - Complexing of flavors/aromas
Aging: Additions

• Sugar:
  – dissolve in small quantity of wine

• Sorbate:
  – yeast inhibitor; necessary if sugar is added

• Oak chips/cubes/staves:
  – suspend in mesh bag in wine

• Tannins

• Acidification/deacidification
Deacidification

- Amelioration
- Blending
- Malo-lactic fermentation
- Cold stabilization
- Carbonate additions
Clarification: Fining Agents

- Compounds added to the wine to
  - Clarify
  - Stabilize
  - Remove/reduce certain components
  - Enhance wine quality
Fining Agents: Bentonite

- Bentonite
  - Volcanic clay (Wyoming)
  - White and red wines
  - Removes proteins
# Fining Agents

<table>
<thead>
<tr>
<th>AGENT</th>
<th>SOURCE</th>
<th>WINE</th>
<th>REMOVES</th>
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<tbody>
<tr>
<td>EGG WHITES, ALBUMIN</td>
<td>EGGS</td>
<td>RED</td>
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<tr>
<td>GELATIN</td>
<td>BONES, HIDES</td>
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<td>ISINGLASS</td>
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<td>CASEIN</td>
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<tr>
<td>PVPP</td>
<td>MANUFACTURED</td>
<td>WHITE</td>
<td>COLOR, SMALL TANNINS</td>
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Potassium sorbate

• Yeast inhibitor
• Will not stop active yeast!
• Rate: 1.2 – 1.3 g/gal
  – Too little has no impact
  – Too much has bubble-gum sensory effect
• Additive effect with SO2, alcohol
• Do not add to dry wine, especially if MLF!
  – Often included in kits
Corking Bottles

- Corks
  - Don’t reuse!
  - Store in cool, dry place
  - Soften prior to insertion:
    - Soak in warm water or warm $\text{SO}_2$ solution
Corking Bottles

• Corker
  – Compresses corks to allow insertion into bottles
  – Adjustable screw controls depth of cork insertion
Bottle Aging

• Don’t get in a hurry to open and share!
• Wine typically “shocked” for 2-3 weeks after bottling
• Extended bottle age can
  – Soften tannins/astringency
  – Mature color
    • Bright magenta toward brick red
  – Add complexity
    • Chocolate, soy sauce, coffee, molasses, dried fruit
Red Wine Production

1. Crushing/destemming
2. Analysis/treatment
3. Fermentation
4. Pressing
5. MLF
6. Racking
7. Stabilization
8. Aging
9. Finishing/Adjustments
10. Bottling
Fermentation

- SO$_2$ to 50 ppm; yeast
- Punch down cap 2-3 times a day
- Ferment on skins 2-8 days
- Press
- Rack to regular container- ¾ full
Malolactic Fermentation (MLF)

• Occurs when Lactic Acid Bacteria (LAB) convert malic acid to lactic acid

\[
\text{L}(-)\text{-malic acid} \xrightarrow{\text{NAD}^+} \text{L}(+)-\text{lactic acid} + \text{CO}_2
\]

*Boulton et al., 1998*
Malolactic Fermentation

- Secondary fermentation
- Decreases acidity
- Adds aroma/flavor complexity
  - Buttery, creamy notes
  - Reduces fruitiness
- Removes nutrients from wine
  - Impacts wild microbial populations

**DO NOT** attempt MLF after adding potassium sorbate—geranium off-odor will result.
MLF Inoculation: Culture

• Direct-addition cultures available
  – Much easier to use than traditional build-up
  – Rehydrate in distilled water and pitch
MLF Monitoring: Paper Chromatography

Micro Vinification, Figure 8.8 (Color Plates)

- Lactic Acid: $R_f = 4.5/6.0'' = 0.75$
- Malic Acid: $R_f = 3.25/6.0'' = 0.54$
- Citric Acid: $R_f = 2.7/6.0'' = 0.45$
- Tartaric Acid: $R_f = 1.7/6.0'' = 0.28$

Solvent Front
6 inches

Base Line
Common Flaws/Faults

- Sulfur compounds
- Volatile acidity
- Oxidation
- Brettanomyces
- Lactic acid spoilage
- Cork taint
- Geranium taint
Prevention is Key!

- GIGO
- Cleaning and sanitation
- Keep pH low
  - Harvest
- Feed your yeast!
- Maintain appropriate SO2 levels
- Avoid excess oxygen
- Conduct regular sensory and chemical analysis