FERMENTATION GOALS

• GOALS
  • FERMENTATION SECURITY
  • AROMATICS
  • MOUTHFEEL
  • COLOR
  • STRUCTURE
  • REDUCE RISK OF SPOILAGE

SCOTT LABORATORIES
ACHIEVING FERMENTATION GOALS

• WHAT TO ADD
  • YEAST
  • NUTRIENTS
  • BACTERIA
  • INACTIVATED YEAST
  • ENZYMES
  • TANNINS
  • OAK
  • FINING AGENTS

• WHEN TO ADD
  • HARVEST
  • PRE-FERMENTATION
  • ALCOHOLIC FERMENTATION
  • MALOLACTIC FERMENTATION
  • SETTLING
  • MATURING/AGEING
YEAST USED IN WINEMAKING

• Non-Saccharomyces yeast
  • Torulaspora delbrueckii
    • Biodiva™
  • Metschnikowia pulcherrima
    • Flavia™
  • Metschnikowia fructicola
    • Gaia™
  • Lachancea thermotolerans
    • Laktia™
• Low fermentative capacity
• Low alcohol tolerance
• Very interesting enological properties
  • Aromatic enhancement
  • Produce mouthfeel compounds
  • Confer microbial protection

• Saccharomyces cerevisiae
  • var cerevisiae
  • var bayanus
• S. bayanus
• S. kudriavzevii
  • AMH ™
• S. uvarum
• Hybrid strains
  • x S. cariocanus
    • Exotics Novello
  • x S. paradoxus
    • Exotics Mosaic

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**S. cerevisiae 25g/hL**

**GOAL**
- Convert sugar to ethanol
- No sensory deviations
- Sugar (g/L) / 17 = theoretical ethanol (%)
- Fermentation complete <1g/L

**CHOOSE BASED ON:**
- Ethanol tolerance
- Temperature range
- Nutrients needs
- Malolactic bacteria compatibility
- Sensory contribution
- Aromatic enhancement
- Mouthfeel enhancement
- Varietal optimization
YEAST STRAIN HANDLING AND ACCLIMATIZATION

- Desiccation of the yeast during production causes a water deficit leading to the arrest of cellular functions
- Rehydration is a bi-phasic process
  - Rehydration of plasma membrane
  - Rehydration of intracellular components
- Rehydration influences the viability and the physiological state of the cell, modifying fermentation behavior (particularly the lag phase)
- Temperature is the most important aspect
  - <30°C (86°F) the phospholipids in the plasma membrane crystallizes and the membrane is damaged
    - Loss of internal components
    - Decrease in fermentative capacity
  - >43°C (110°F) negative effect on cell viability

**Step 1 - Rehydration**
- Rehydrate yeast in 10 x weight in chlorine free water @ 95-104°F
- Stir gently
- Leave for 15 minutes
  - Foaming is not an indicator of viability

**Step 2 - Acclimatization**
- Gently add some juice/must to rehydrated yeast
- Drop temperature 15°F and hold for 15 minutes
- Repeat until within 15°F of juice/must to be inoculated

**Consequences?**
SACCHAROMYCES (mis)HANDLING AND ACCLIMATIZATION

- RECONSTITUTION OF CELL WALL AND PLASMA MEMBRANE COMPROMISED
- COMPROMISED VIABILITY
- CELLULAR DAMAGE
- STORAGE CARBOHYDRATES DEPLETED
- PETITE MUTANT FORMATION
NUTRIENTS

- **Rehydration nutrients**
  - Vitamins, minerals and survival factors in a yeast carrier
  - Support the yeast
    - Cell growth
    - Protects yeast
    - Stimulate metabolism
- **Goferm™ & Goferm protect evolution™**
  - 30g/hL

- **Fermentation nutrients**
  - Nitrogen sources
    - DAP
  - Autolyzed yeast (amino acids)
  - Blended
  - Support fermentation rate
  - Support cell growth
  - Support protein and enzyme function
  - Play a role in aroma metabolism (amino acids)
- **DAP, Fermaid O™ and Fermaid K™**
NUTRITIONAL NEEDS OF S. CEREVISIAE

- Phyto-sterols
- Ergosterol
- Lipids
- Nitrogen
- Oxygen
- Carbohydrates
- B-vitamins
- Minerals
- Nutrients required
# Yeast Nutrients: Overview

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>ASSIMILABLE FORM (Grapes)</th>
<th>ROLE</th>
<th>AMOUNT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>Glucose, Fructose &amp; Sucrose</td>
<td>Energy source</td>
<td>-</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Ammonia, Alpha Amino Acids, Peptides</td>
<td>Protein &amp; enzyme synthesis</td>
<td>Minimum 150ppm</td>
</tr>
<tr>
<td>Oxygen</td>
<td>NA</td>
<td>Ergosterol &amp; UFA synthesis</td>
<td>5-10ppm</td>
</tr>
<tr>
<td>Lipids</td>
<td>Phytosterols</td>
<td>Growth factor, ester synthesis</td>
<td>2-6mg/L</td>
</tr>
<tr>
<td>Vitamins</td>
<td>Thiamin, Biotin, Inositol, Ca Pantothenate, Nicotinamide</td>
<td>Growth factor &amp; metabolism</td>
<td>μM level</td>
</tr>
<tr>
<td>Minerals</td>
<td>H, Mg, Ca, Mn, Zn, P, K, S…</td>
<td>Growth factor, structural &amp; functional</td>
<td>mM &amp; μM level</td>
</tr>
</tbody>
</table>
THIAMIN (B1)

- Essential role in central metabolism
  - Co-factor for thiamin diphosphate
- Suspected role in stress response
  - Oxidative, osmotic and thermal
- Used by the native microflora very quickly
- Deactivated by >50ppm SO₂
- Amount required 0.1-1.0 mg/L
PANTOTHENIC ACID (B5)

Pantothenic acid (Ca Pantothenate)
- Precursor for Coenzyme A
- Required for CHO and lipid synthesis
- Amount required 0.2-2.0 mg/L
- Deficiencies
  - Increased levels of acetate and pyruvate
  - Decreased biomass
  - Decrease in fermentation rates

Loss of viability in low pantothenate concentrations when YAN is high.

(Wang et al., 2003)

Similar R&D results from INRA-2015
BIOTIN (B7)

Biotin

- Growth factor
- Stimulates glucose metabolism
- Stimulates fermentation rate
- Involved in all carboxylation and decarboxylation reactions
- Role in aroma metabolism
  - Esters and higher alcohols
- Higher viability at end of fermentation
- Amount required 0.005-0.5 mg/L
  - Affinity related uptake
- Deficiencies
  - High cellular mortality rates
  - Incomplete fermentations

Biotin deficiencies will trigger cell death irrespective of starting nitrogen.

0 μg/L biotin with 60 or 250 mg/l of YAN

Experimental details:
Biotin concentration: 0, 1 & 10 μg/L
YAN levels: 60 mg/l (low) or 250 mg/l (high)
NITROGEN, STEROLS AND OXYGEN

NITROGEN

• Protein and enzyme synthesis directly or indirectly
  ◦ Lag phase: to adapt cells from lag to active growth phase
  ◦ Growth phase: for building blocks
  ◦ Stationary phase: to re-synthesize essential proteins as sugar is converted to ethanol

• Taken up via active transport
  ◦ Controls fermentation rate
  ◦ Cell number
  ◦ Aroma metabolism

STEROLS

• Grape
  ◦ β-Sitosterol, Stigmasterol, Campesterol
  ◦ Essential for cell growth and viability maintenance
    ◦ Amount varies significantly in grape solids
    ◦ No simple relationship between turbidity (ntu’s) and phytosterols
    ◦ Key factor for ALF, fermentation rate and fermentation duration
      ◦ >5mg/L

• Yeast (and O₂)
  ◦ Ergosterol
  ◦ Plasma membrane integrity
OXYGEN IS A YEAST NUTRIENT!

- Oxygen is taken up by yeast cells very quickly
  - During the fermentation process it needs to be supplied (~8ppm)
  - Used for yeast cell membrane integrity compounds
    - If deficient
      - Decrease in yeast growth
      - Decrease in yeast viability (at end of fermentation)
      - Decrease in membrane protein activity
      - Increase toxic compounds
  - By supplying Oxygen increasing the cells ability to withstand the toxic effects of ethanol
**HOW MUCH NUTRITION IS NEEDED?**

- Depends on
  - How much sugar is to be consumed
  - Individual yeast strain needs
  - Temperature
  - Winemaking style
    - Oxidative v. reductive

<table>
<thead>
<tr>
<th>Brix</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>150</td>
<td>180</td>
<td>250</td>
</tr>
<tr>
<td>22</td>
<td>165</td>
<td>200</td>
<td>275</td>
</tr>
<tr>
<td>24</td>
<td>180</td>
<td>220</td>
<td>300</td>
</tr>
<tr>
<td>26</td>
<td>195</td>
<td>240</td>
<td>325</td>
</tr>
<tr>
<td>28</td>
<td>210</td>
<td>260</td>
<td>350</td>
</tr>
<tr>
<td>30</td>
<td>225</td>
<td>280</td>
<td>375</td>
</tr>
</tbody>
</table>
OUR FRIEND SACCHAROMYCES
GOAL: FERMENTATION SECURITY

- Not all nitrogen sources are created equally
- The yeast doesn’t use them all the same
- There is a preferential uptake

<table>
<thead>
<tr>
<th>YAN REQUIRED TO SUPPLEMENT</th>
<th>AT YEAST REHYDRATION PHASE</th>
<th>AT 2 - 3 BRIX SUGAR DROP</th>
<th>AT 1/3 SUGAR DROP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0- 50 ppm</td>
<td>30g/hL Goferm Protect Evolution</td>
<td>No addition</td>
<td>30 g/hl Fermaid O</td>
</tr>
<tr>
<td>51- 100 ppm</td>
<td>30g/hL Goferm Protect Evolution</td>
<td>20 g/hl Fermaid O</td>
<td>20 g/hl Fermaid O + 12.5 g/hl Fermaid K</td>
</tr>
<tr>
<td>101-150 ppm</td>
<td>30g/hL Goferm Protect Evolution</td>
<td>40 g/hl Fermaid O</td>
<td>40g/hL Fermaid K</td>
</tr>
</tbody>
</table>

SCOTT LABORATORIES
**GOAL: THIOL OPTIMIZATION**

- Thiols are tropical, citrus and vegetal in nature. Thiols and Terpenes are aroma molecules that are bound.
- Taken up by the yeast at the onset of fermentation.
- Only a very small % of yeast have the ability to release the thiol from its bound form. **STIMULA SB** Amino Acid profile stimulates the production of the enzymes to help cleave thiols and terpenes.

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</thead>
<tbody>
<tr>
<td>0-50 ppm</td>
<td>30 g/hL Goferm Protect Evolution</td>
<td>40 g/hL Stimula Sauvignon blanc</td>
<td>10 g/hL Fermaid O</td>
</tr>
<tr>
<td>51-100 ppm</td>
<td>30 g/hL Goferm Protect Evolution</td>
<td>40 g/hL Stimula Sauvignon blanc</td>
<td>20 g/hL Fermaid O</td>
</tr>
<tr>
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<td>40 g/hL Stimula Sauvignon blanc</td>
<td>40 g/hL Fermaid O</td>
</tr>
</tbody>
</table>

SCOTT LABORATORIES
GOAL: ESTER PRODUCTION

- Esters are fruity and floral in nature and are produced. Ester production is highly influenced by nutrient composition and fermentation conditions.
- Produced by the yeast all along the fermentation pathway (~33% during yeast growth, 66% during stationary phase). At stationary phase, Nitrogen is not used for growth. At this point metabolism changes to Ester production.
- Amino acids are the precursors. The Amino Acid profile will dictate Ester production.
- Amount of esters can be modulated by temperature, lipids level and yeast strain choice.

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<thead>
<tr>
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<th>AT 2 - 3 BRIX SUGAR DROP</th>
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<tbody>
<tr>
<td>0-50 ppm</td>
<td>30 g/hL Goferm Protect Evolution</td>
<td>No addition</td>
<td>40g/hL Stimula Chardonnay</td>
</tr>
<tr>
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<td>30 g/hL Goferm Protect Evolution</td>
<td>20 g/hl Fermaid O</td>
<td>40g/hL Stimula Chardonnay</td>
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<td>40 g/hl Fermaid O</td>
<td>40g/hL Stimula Chardonnay</td>
</tr>
</tbody>
</table>
**Bacteria used in winemaking:**

*O. oeni*

1g/hL

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**GOAL**

- Malic acid => Lactic acid + CO₂
- Theoretical conversion
  - 1g/L malic acid => 0.67g/L lactic acid + 0.33g/L CO₂
- Actuality
  - 1g/L malic acid => 0.5g/L lactic acid
- Acetic acid can be produced as a bi-product

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**CHOOSE BASED ON:**

- Ethanol tolerance
- Temperature range
- pH tolerance
- TSO₂ tolerance
- Nutrients needs
- Sensory contribution
- Aromatic enhancement
- Mouthfeel enhancement

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**Timing of addition:**

24-48 hours after yeast addition: Co-inoculation

Post alcoholic fermentation: Sequential inoculation
ML CAN BE USED TO DRIVE FLAVOR

<table>
<thead>
<tr>
<th>STRAIN</th>
<th>ALCOHOL</th>
<th>pH</th>
<th>TSO2</th>
<th>TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-MEGA™</td>
<td>&lt;16%</td>
<td>&gt;3.1</td>
<td>&lt;60ppm</td>
<td>&gt;57°F</td>
</tr>
<tr>
<td>VP41™</td>
<td>&lt;16%</td>
<td>&gt;3.1</td>
<td>&lt;60ppm</td>
<td>&gt;61°F</td>
</tr>
<tr>
<td>ALPHA™</td>
<td>&lt;15.5%</td>
<td>&gt;3.2</td>
<td>&lt;50ppm</td>
<td>&gt;57°F</td>
</tr>
<tr>
<td>BETA™</td>
<td>&lt;15%</td>
<td>&gt;3.2</td>
<td>&lt;60ppm</td>
<td>&gt;57°F</td>
</tr>
</tbody>
</table>
Specific strains of wine yeast
- Inactivated to suppress their fermentative capacity
  - Inactivated via different means
    - Physical
    - Thermal
  - Whole cells or fractions
- Focus on specific cellular components
- Contribute to
  - Balance
  - Aroma preservation
  - Color stability
  - Detoxification
- 10-40g/hL (except Claristar)

### Added:
- Pre-fermentation
  - Glutastar™, Nutrient VitEND™
- During fermentation
  - OptiWHITE™, Noblesse™
  - OptiRED™, OptiMUM Red™
  - Reskue™, Nutrient VitEND™
- Post fermentation
  - Reduless™, Noblesse™
  - Claristar

<table>
<thead>
<tr>
<th>SIY</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glutastar</td>
<td>Protection color and aromas from oxidation</td>
</tr>
<tr>
<td>OptiWHITE</td>
<td>Balances mouthfeel and protects aromas</td>
</tr>
<tr>
<td>OptiRED</td>
<td>Stabilizes color and minimizes harshness</td>
</tr>
<tr>
<td>OptiMUM RED</td>
<td>Integrates and stabilizes color and tannins</td>
</tr>
<tr>
<td>Noblesse</td>
<td>Integration, boosts fruit and sweetness</td>
</tr>
<tr>
<td>Reduless</td>
<td>Removes sulfides</td>
</tr>
<tr>
<td>Reskue</td>
<td>Removes fermentation inhibitors (SMCFA)</td>
</tr>
<tr>
<td>Nutrient VitEND</td>
<td>Binds residual fungicides &amp; SMCFA</td>
</tr>
</tbody>
</table>
• In general, oenological tannins are:
  • Polyphenolic compounds
  • Different botanical origin
    • Oak, Chestnut, Quebracho, Gall Nut, Tara, Grape
  • Differ in extraction methods, production, processing
  • Different in degree of polymerization (mDp)
  • Highly reactive
    • Bind proteins
      • Increases as mDp increases
    • Act as anti-oxidants
      • Increases as mDp increases. Inhibit laccase in grapes affected by Botrytis and other rot
    • Color stabilization
      • Decreases as mDp increases
      • Sensory impact
        • 1-50g/hL

• Add directly onto grapes
  • Scott’Tan FT Rouge ™, FT Rouge Soft ™

• Add in the fermentation
  • Uva’Tan ™, Uva-Tan Soft ™
  • FT Blanc, Blanc Soft, Blanc Citrus
  • FT Color-Max ™, FT Rouge Berry ™

• Add during aging
  • Uva’Tan ™, Uva-Tan Soft ™, Estate ™

• Add pre-bottling
  • Riche ™, Riche Extra ™, Onyx ™, Royal ™, Radiance ™
ENZYMES

- Enzymes are natural catalysts that act upon the grape cell wall and pulp
- Generally available as blends (blend can contain >2 enzymes)
  - Pectinase (PG, PL and PE),
  - Cellulase, Hemicellulase, Protease, Glycosidase, Glucanase

PECTIN

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ENOLOGICAL ENZYMES - WHITE WINE PRODUCTION

- Skin contact
  - Aroma extraction before pressing
- Optimize processing
  - Increase free run fraction of juice
  - Press at lower pressure
- Clarification
  - Clarification before racking to fermentation tank
- Post fermentation
  - Release bound up aromas
  - Break down glucans
  - Break down residual pectin's/colloids

**Function:**
- Skin contact
  - Pectinase and glycosidase
  - Lallzyme cuvee blanc & Rapidase Expression aroma
    - Release bound terpenes & thiols
    - Assists with pressing and yield
- Into the press
  - Pectinase
  - Scottzyme Cinn-Free
- Into settling tank
  - Pectinase
  - Scottzyme Pec5L, Color Pro
- Post fermentation
  - Glycosidase and glucanase
    - Lallzyme Beta, Scottzyme BG
    - Lallzyme MMX
    - Scottzyme KS
ENOLIC AL ENZYMES- RED WINE PRODUCTI ON

- Directly onto grapes
  - Macerating
  - Extraction/diffusion
- Post fermentation
  - Release bound up aromas
  - Break down glucans
  - Breaks down residual pectin's/colloids

Function:
- Grapes
  - Pectinase main function
    - Cellulase
    - Hemicellulase
    - Protease
  - Lallzyme EX, EX-V, Scottzyme Color Pro
- Post fermentation
  - Glycosidase and glucanase
    - Lallzyme Beta, Scottzyme BG
    - Lallzyme MMX
HOW MUCH ENZYME DO YOU NEED?

• This is highly depending on:
  • Varietal
  • Level of ripeness
  • Harvest method
  • Skin thickness
  • Process used
  • Temperature
  • Contact time
WHEN THINGS GO WRONG!

- Stuck fermentations
- MLF begins during ALF
- VA begins to rise
- Diminished fruit
- Oxidation
- Sulfides

React and intervene asap!
FERMENTATION PROFILES & INCOMPLETE FERMENTATIONS

• A favorable profile is ~2-4 °Brix drop/day

• Once you have reached ~1°Brix and you are dropping about 0.25°Brix/day you should anticipate a stuck fermentation

• A sugar level that has remained stable for 48 hours is considered stuck

• What is the final fermentation goal (realistic!)
CAUSES OF PROBLEMATIC FERMENTATIONS

- **Long Lag phase**
  - Toxin(s) present, high viscosity, deficient populations of healthy yeast

- **Sluggish throughout**
  - Problems with yeast growth and adaption to conditions, vitamin and mineral deficiencies

- **Becoming sluggish/ Abrupt arrest**
  - Nutrient deficiencies/ imbalances, temperature, complete anaerobiosis, microbial activity, chemical antagonisms, processing decisions/impact

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PROBLEMATIC FERMENTATIONS

React quickly!

Know what’s going on:
- Analytical
  - Alcohol, Glucose:Fructose, VA, malic acid, pH...
- Microbial

Adapt a protocol that is simple but effective!
- Getting the yeast back into suspension
- Check the temperature (goal ~68°F)
- Detoxify...

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**Microbial Control Agents: Yeast**

**Sulfur Dioxide (and bacteria)**
- Impact depending on
  - Winemaking stage
  - Wine chemistry
  - Amount added
  - Level of binding compounds
- Inodose 2g and 5g tablets
- Potassium metabisulfite
- MSO₂ 0.5-0.8ppm

**No Brett Inside**
- Chitosan targets Brettanomyces primarily
  - Secondary effect on Zygosaccharomyces

**Mode of action**
- Bi-phasic
  - Adsorption of cells onto matrix = fining
  - Interaction with cell walls/membranes resulting in damage, cellular leakage
- Impact of the polymers molar mass
  - Several log reduction
- Add post MLF
- 4-8g/hL

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**SCOTT LABORATORIES**
• If fermentation stops and
  • >15g/L sugar and <12% ethanol
    • Restarting fermentation is relatively easy
  • <10g/L sugar and >12% ethanol
    • Restarting fermentation is challenging

• What if ML has started?
MALOLACTIC FERMENTATION

- ML dry <0.1g/L

If ML completes during ALF => inhibit completion of ALF
If ML stops partial completion:
⇒ Easy to restart if malic >1g/L
⇒ Hard to restart if malic <0.7g/L
MICROBIAL CONTROL AGENTS: BACTERIA

**Lysozyme**
- Muramidase enzyme
  - Hen egg whites
- Active against gram positive bacteria **ONLY**
  - Lactic acid bacteria
  - Preventative control to total inhibition
    - 100-500 ppm
- Can be used at any time in the winemaking process
- Inactivated by protein binding compounds
  - Tannins and bentonite
- Must rack once settled
- Remove from wine before protein instability (heat) test

**Bactiless**
- Chitin-glucan and chitosan
  - 20-50g/hL
- Active against gram positive and gram negative bacteria
  - Lactic acid and Acetic acid bacteria
  - Preventative control to total inhibition
    - 40-80 ppm
- Gets caught up in solids
  - Only use post MLF
- Must rack after 10 days

**IMPACT OF BACTILESS ON WINE SPOILAGE BACTERIA**

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>CONTROL</th>
<th>BACTILESS (20g/hL)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acetic acid</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>L. brevis</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>L. plantarum</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>L. kunkeei</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>O. oeni</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Pediococcus</strong></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

SCOTT LABORATORIES
VOLATILE ACIDITY

General:
- VA increase at the beginning ALF => yeast
- VA increase at the end ALF => bacteria
- VA increase during aging => spoilage yeast (Brettanomyces) and Bacteria (LAB and AAB)
- If VA >0.8g/L and sugar is still present => ALF difficult to restart
- Expect a VA increase at the end of MLF
  - Citric acid => 50% diacetyl + 50% acetic acid

Monitoring VA producing organisms
- Chemical analysis
  - pH, FSO₂, TSO₂ and VA monthly
- Microbiological analysis
  - Traditional or genetic based

Controlling VA producing organisms
- Management of pH, FSO₂, TSO₂, cellar temperature
- Additives
  - Lysozyme and Bactiless
• Enzymatic
  • Primarily in grapes
• Non-enzymatic
  • Post fermentation
  • Occurs when oxygen + catalyst present
• Loss of aromas
• Degradation of color

• Avoid oxidation
  • Glutathione, yeast lees
  • Glutastar™, OptiWhite™, Pure Lees Longevity™

• Treat oxidation
  • Casein, PVPP
  • Adjust SO₂
  • 50ppm tannin pre-racking to sacrificially bind O₂ (Australia)
VOLATILE SULFUR COMPOUNDS

- Factors impacting:
  - Yeast genetic background
  - Yeast stress (osmotic, temp, mechanical, compaction)
  - Solid level
  - Nutrient availability (Nitrogen, vitamins, oxygen, balance)
- Treatment:
  - Reduless™, copper sulfate
  - Take care with splash racking
POST-FERMENTATION EVALUATION

HOW DOES YOUR WINE TASTE?
WHAT DOES YOUR ANALYSIS TELL YOU?
WHAT IS YOUR GOAL?
WHEN IS THE WINE BEING BOTTLED?
IS THE WINE FOR THE DOMESTIC MARKET? EXPORT?

SCOTT LABORATORIES
EVALUATING WINE

Not enough weight
• Add polysaccharides, sweetness

Too acidic
• Remove acidity via deacidification
• Re-balance by increasing other mouthfeel components (weight)

Too astringent/tannic/drying
• Remove via protein based fining aid
• Re-balance by increasing other mouthfeel components (weight, acidity, tannin profile)

Too bitter
• Remove via PVPP fining
• Re-balance by increasing other mouthfeel components (weight, acidity)
FINING AIDS

<table>
<thead>
<tr>
<th>Color Reduction</th>
<th>Tannin Reduction</th>
<th>Volume of Lees</th>
<th>Clarity &amp; Stability</th>
<th>Potential to Overfine</th>
<th>Quality Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>Gelatin</td>
<td>Bentonite</td>
<td>Bentonite</td>
<td>Gelatin</td>
<td>Carbon</td>
</tr>
<tr>
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<td>Albumen</td>
<td>Gelatin</td>
<td>Carbon</td>
<td>Albumen</td>
<td>Bentonite</td>
</tr>
<tr>
<td>Casein</td>
<td>Isinglass</td>
<td>Casein</td>
<td>Isinglass</td>
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<td>Gelatin</td>
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<td>Bentonite</td>
<td>Isinglass</td>
<td>Gelatin</td>
<td>Albumen</td>
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</tr>
<tr>
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<td>Carbon</td>
<td>Carbon</td>
<td>Albumen</td>
<td>Isinglass</td>
<td></td>
</tr>
</tbody>
</table>

Dependent upon the wine, the agent used, method of preparation and addition, concentration, pH, metal content, temperature, age, and previous treatments. General usage: 1-200g/hL
• Once we have determined direction, we set up small scale trials

• Why small scale?
  • A cellar addition of 3g/hL = 0.001g/100mL
  • A cellar addition of 100g/hL = 0.1g/100mL
  • If you cannot accurately weight out and add then you can have errors in the cellar
  • You make stock solutions (1, 5 or 10%) to ensure accuracy

• You never add something post-fermentation without a predictable outcome
THANK YOU!
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Thé Tentation aux Baies de Goji

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- pH
- Malic acid (MLF)
- Residual sugar
- Dissolved oxygen
- YAN
- ABV%

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