The Art of Winemaking in an Ever-Changing World

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The Art of Winemaking in an Ever-Changing World

Outline

- Vintage-to-Vintage variation
- Flexibility in practices/regulations
- Grape/must temperature
- Yeast nutrient content
- Ripeness assessment
- Color extraction/Copigmentation
- (Seed) tannin extraction
- Alcohol/aroma adjustments
Introduction
Noviembre 2005
La bodega Ferrer-Bobet de Falset
Wine and Regional Warming/Cooling

Slowing of the Gulf Stream
Wine Production

Gallons x 10^6

-19%

-36%

1979 1990 2005

World
Europe
Wine Quality

- Grapes: 75%
- Equipment: 10%
- Barrels: 10%
- Winemaker: 5%

Thomas Eddy, 2000
In: Wine Marketing
University Press
World Viticulture
Latitude Comparison

- California: 32°
- Indiana: 42°
- Francia: 
- Iberia: 

Location maps of California, Indiana, Francia, and Iberia showing latitude comparisons.
Regional Warming/Cooling

Annual Temperature Fluctuation

Oakville, Napa Valley, EE UU

T (°F)

6C
California

Degree Days (55°F)

- Central Valley
- North Coast
- Central Coast

Vintage:
- '90
- '91
- '92
- '93
- '94
- '95
- '96
- '97
- '98
- '99
California
Vintage Degree Day Overlap

Degree Days (13°C+)

Vintage

'90  '91  '92  '93  '94  '95  '96  '97  '98  '99
California

Degree Days (55+ºF)

Wine Quality Scores
Oakville, Napa Valley
Artificial Neural Networks

Dr. David Block
UCDavison

Clone
Rootstock
Weather
Soil Type
Vine Spacing
Irrigation
Fertilizer
Pest Control
Yield
Management

Grape Juice
Characteristics

Yeast/Bacteria
Characteristics

Processing
Parameters

Fermentation
Kinetics

Chemical
Analysis

Sensory
Analysis
Grape Growing Conditions and Vintage Quality Scores

Neural Network Fit

Model Fit

\[ R = 0.77 \]

\( p < 0.001 \)

Predicted and actual values for Napa Cabernet Sauvignon Quality

- Actual Quality
- ANN Prediction

Quality Score

Vintage Year

Model Fit

\[ R = 0.77 \]

\( p < 0.001 \)

D. Block, UC Davis
Flexible Practices/Regulations

- **Irrigation**
  - 1st year only vs. DI/PRD

- **Varietals**
  - 15 = 0.9x10^6 ha = 75%

- **Aging Requirements**
  - Gran Reserva (5 years total/2 barrel/3- bottle)
  - Reserva (3 years total/1+ barrel/2- bottle)
  - Crianza (2 years total/1 barrel/1 bottle)
Ripeness Variation

@ Veraison = @ Harvest

R. Boulton, UC Davis
Brix
- 20.0 - 21.1
- 21.1 - 22.1
- 22.1 - 23.0
- 23.0 - 24.9

Range: 20.0 - 24.9
Mean: 22.1 +/- 0.9

Ripeness Variation
R. Boulton, UC Davis
Fig. 6.39. Variations in the accumulation of anthocyanins in grape skins during ripening, according to vintages and vineyards. For the same vintage: 1. ideal situation, good grape--vineyard match; 2. late-ripening vineyard requiring slight overripeness; 3. very late-ripening vineyard, where the grapes are unlikely to produce a high-quality red wine; 4. Vineyard not very well-suited to this grape variety, as phenolic maturity occurs too early (Glories, 1986)
Night Harvest
Impact of Berry Expansion

Diurnal Effects

<table>
<thead>
<tr>
<th></th>
<th>Berry A</th>
<th>Berry B</th>
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<tbody>
<tr>
<td>Diameter</td>
<td>10.0 mm</td>
<td>10.5 mm</td>
</tr>
<tr>
<td>Volume</td>
<td>0.524 mL</td>
<td>0.606 mL</td>
</tr>
<tr>
<td>pH</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>T.A.</td>
<td>10.0 g/L</td>
<td>8.6 g/L</td>
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</table>
Fruit/Must Chilling
Fruit/Must Chilling

Skin Contact Time = f (Temperature)
Yeast Available Nitrogen Content

Variation by Varietal and Region
Yeast Available Nitrogen Content
Deficiency Variation by Varietal

Juices < 140 mg N/L (%)

- Pinot noir
- Zinfandel
- Merlot
- Cabernet Sauvignon
- Cabernet franc
- Chardonnay
- Sauvignon blanc
Nitrogen & élevage sur lies

Fermentation Temperature = f (Fermentation Rate)
Fermentation Rate = f (Yeast Available Nitrogen)

Yeast Biomass = Mannoproteins = f (Yeast Available Nitrogen)
New Diseases?

Glassy Winged Sharp Shooter

*Xylella fastidiosa* (bacterium)

Pierce’s Disease  Dying Grapevines
Wine and Regional Cooling
Annual Precipitation

Average Regional Variation

San Francisco, EE UU
Nueva Inglaterra, EE UU
Burdeos, Francia
Borgoña, Francia
Gulf Stream Effect
Precipitation Variation

Long Island, New York

October rain: 2005
305 mm

Average
94 mm
Rain at Harvest

- No sun: Suspended ripening
- Water on clusters: Dilution, Rot
- Water in soil: Dilution
- Berry splitting: Rot
- High humidity: Rot
Cold Maceration/Fermentation Timing

Skin Contact Time = f (Temperature)
Red Wine Color

Extraction vs. Stability

Anthocyanins

**Berry:**
- 100% in skin
- 0% in seeds
- 0% in pulp

**Wine:**
- 25% Cabernet
- 15% Pinot Noir
Copigmentation

Anthocyanin

Cofactor

Copigment Stack
Relationships between Copigmented and Red Wine Color

R. Boulton, UC Davis
Color and Cofermentation

Photo: Wine Spectator
Pinot Noir/Pinot?
Syrah/Viognier?
Sangiovese/Trebbiano?
Garnacha/Viura?

Color and Cofermentation
Cap Management Technique

Does it matter?
Extraction of Anthocyanins

Anthocyanins (g/L)

Skin contact time (days)
Extraction of Tannins

Tannins (g/L)

Skin contact time (days)
Anthocyanin vs. Tannin Extraction

Anthocyanins (g/L)

Tannins (g/L/6.25)

Skin contact time (days)
Seed Number per Berry
Variation by Vineyard Sample

Date
11-Sep 18-Sep 25-Sep 2-Oct 9-Oct 16-Oct

Seed Number
1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0

Variation by Vineyard Sample
+30% seed tannin
Seed Number per Berry

Variation/Ripeness = f(Vintage)
“Maceration of wine on the pomace after fermentation is through, increases tannin but adds nothing to color.”

Prof. Eugene Hilgard
University of California
Berkeley, 1887
¿Sabor del cacao?

Cap Management
Maceration = f (Temperature)
Extraction and Temperature

Extractable Phenolics (%)

Skin Contact Time (hours)

Temperature

30°C
20°C
10°C
Extraction and Alcohol

Extractable Phenolics (%)

Ethanol (%vol)

Skin Contact Time (hours)
Dehydration, Sugar and Alcohol

Shiraz Shrivel
# Reverse Osmosis

## Aroma Removal

### Molecular Weights:

<table>
<thead>
<tr>
<th>Compound</th>
<th>Molecular Weight</th>
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<tbody>
<tr>
<td>Ethyldecadienoate</td>
<td>196</td>
</tr>
<tr>
<td>Oak Lactone</td>
<td>156</td>
</tr>
<tr>
<td>Vanillin</td>
<td>152</td>
</tr>
<tr>
<td>4-Ethylphenol</td>
<td>122</td>
</tr>
<tr>
<td>2-Phenylethanol</td>
<td>122</td>
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<tr>
<td>Methoxypyrazine</td>
<td>110</td>
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<tr>
<td>Ethylacetate</td>
<td>88</td>
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<tr>
<td>Diacetyl</td>
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<td>Molecular SO₂</td>
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<tr>
<td>Acetic acid</td>
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<tr>
<td>Ethanol</td>
<td>46</td>
</tr>
<tr>
<td>CO₂</td>
<td>44</td>
</tr>
<tr>
<td>Water</td>
<td>18</td>
</tr>
</tbody>
</table>
How to Unfilter?

- No Un-Filtration
- No Routine Filtration
Winemaking Advice

- Always question your traditions
- Be flexible with vineyard/wine regulations
- Watch similar international regions
- Invest money in wine and grape research
- Extend and use scientific information
- Be out in the vineyard
- Cold-store wines for comparison
Winemaking Advice

- Save money to replant, buy equipment
- Be pro-active - don’t wait too long
- Watch your yeast nutrient status
- Don’t over-extract before/after fermentation
- Measure your seed numbers
- Don’t believe in miracle cures/equipment
- Use intuition and intellect
Wine Quality

- Grapes: 75%
- Equipment: 10%
- Barrels: 10%
- Winemaker: 5%
¡Gracias, Sr. Pancho!