Monitoring Ripening for Harvest and Winemaking Decisions

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“The Wine is made in the Vineyard”
Objective:

• Produce best wine possible with a particular crop of fruit

• Understanding annual growing season variability

Monitoring Ripeness

Berry Ripening Stages:

• Vegetative Period
  - to 20 g/Kg sugar and acid

• Veraison – start of ripening
  - color change; swell; >elastic

• Maturation (40-50 days)
  - >sugar, <acid

• Over-ripening
  - <water; >concentration
**Ripening Distinction:**

- **Physiological Maturity**
  - the time when the grape reduces acid, increases sugar, ripens seeds, and reaches maximum berry diameter.

- **Technological Maturity**
  - the picking time in relation to ultimate utilization – making a “premium” wine

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**Increasing Sugars/Decreasing Acidity**

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**Relative Maturation Timeline**

Adapted from Long (1996)
Monitoring Ripeness

*Brix/Maturity/Wine Quality

"Brix Fixation"

• Cold to Cool Climate
  – Brix strongly correlated to quality
• Warm Climate
  – Correlation much less robust

Monitoring Ripeness

Brix Increase vs. Dehydration

High quality wine is the confluence of
  – Fruit derived flavor components
  – Fruit derived aroma components
  – Reduction of immature tannins
  – maturation

*Not necessarily corresponding to the desired sugar and acid ranges
Grape Maturity and Wine Quality

Primary metabolites:
- Sugar and related compounds

"Secondary metabolites":
- Fruit derived flavor components
- Fruit derived aroma components
- Tannins/phenols

*Note: Secondary metabolites are the main source of wine aroma, flavor, color, and taste sensations

Berry Maturity

*NOTE: the physiological mechanism that the plant uses to make sugar is NOT the same as used to produce secondary metabolites such as aroma/flavor and phenolic compounds

Source: Zoecklein (2001)

Monitor/Sample Your Vineyard

“Footprints in the vineyard”
Monitoring Ripeness

Berry Sampling

Important Principals:
- Random
- Un-Biased
- Representative

Source: Jordan and Croser (1983)

Avoid edge rows and first 2 vines in row
Collect samples from both sides of vine
For each row, estimate the proportion of shaded clusters and sample accordingly
Collect berries from top, middle, and bottom of cluster
Collect berries from all sides of clusters
Maximum sample area should be < 2A

Source: Jordan and Croser (1983)

*NOTE: About 90% of the variation in berry sampling is believed to come from variation in the position of the cluster and degree of fruit exposure
Monitoring Ripeness

High cordon

Strive for uniformity

Monitoring Ripeness

Strive for uniformity

Berry Sampling

*NOTE: The greater the vineyard variability, the greater the potential negative influence on the wine, the larger the sample must be to get an accurate assessment of the maturity.
**Monitoring Ripeness**

**Grape Sampling - Accuracy**

- **Berry Sampling**
  - +/- 1.0° Brix: 2 x 100 berries
  - +/- 0.5° Brix: 5 x 100 berries
- **Cluster Sampling**
  - +/- 1.0° Brix: 10 clusters

Sources: Jordan and Croser (1983); Kasimatis and Vila (1985)

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**Monitoring Ripeness**

**Berry Sampling**

*NOTE: The most accurate sampling method is to take a MINIMUM number of berries from a LARGE number of vines.*

Source: Zoecklein (2001)

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**Monitoring Ripeness**

**Evaluating maturity: Priorities**

1. Quality and quantity of varietal aroma/flavor
   - Unripe/green – ripe/fruity – over/jammy
2. Texture of grape tannins
   - Suppleness/degree of polymerization
3. Seed ripeness
4. °Brix, total acidity, and pH
5. General fruit condition – berry softness
6. Berry size/weight
7. Ability to ripen further

Source: Zoecklein (2001)
Monitoring Ripeness
Development of Varietal Flavors and Aromas - Cabernet Sauvignon

- Green
- Herbaceous – “Stemmy”
- Herbaceous – “Green Pepper”
- Minty
- Red Cherry – Black cherry
- Blackberry
- Black currant
- Elderberry

Source: Zoecklein (2001)

Monitoring Ripeness
Berry Sampling/Wine Quality

*NOTE: To obtain a desired characteristic aroma or flavor in the wine, it must be present in the grapes at the time of harvest, therefore the individual sampling must be diligent to monitor for that aroma and/or flavor in the sample.
Monitoring Ripeness
The Most Sensitive Flavor Reception Apparatus in the World!

The human tongue and mouth!

Monitoring Ripeness
Berry Contents - Relative Maturation

"Organoleptic evaluation"
- Few "random" berries in mouth
1. Press out juice - do not chew seeds!
   • Evaluate for sugar and acid
   • Sugar front and acid back side of tongue
2. Spit out seeds into hand
   • Evaluate ripeness
3. Chew remaining skins
   • Evaluate astringency in cheek

Meritage cvs
Monitoring Ripeness

**Evaluating maturity: Priorities**

1. Quality and quantity of varietal aroma/flavor
   - green - herbaceous - fruity - jammy
2. Texture of grape tannins
   - Suppleness/degree of polymerization
3. Seed ripeness
4. °Brix, total acidity, and pH
5. General fruit condition – berry softness
6. Berry size/weight
7. Ability to ripen further

Source: Zoecklein (2001)

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**Phenols and Wine Quality**

- Structure
- Body or volume
- Tannin intensity and quality
- Astringency
- Bitterness
- Dryness
- Color
- Aging Potential

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**Anthocyanin/Tannin**

<table>
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<tr>
<th></th>
<th>Red</th>
<th>White</th>
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<tr>
<td>skin</td>
<td>1859 (33%)</td>
<td>904 (23%)</td>
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<tr>
<td>pulp</td>
<td>41 (0.1%)</td>
<td>35 (1%)</td>
</tr>
<tr>
<td>juice</td>
<td>206 (0.4%)</td>
<td>176 (5%)</td>
</tr>
<tr>
<td>seed</td>
<td>3525 (63%)</td>
<td>2778 (71%)</td>
</tr>
<tr>
<td>total</td>
<td>5631</td>
<td>3893</td>
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</tbody>
</table>

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Monitoring Ripeness

Tannin Maturity
Changes in Seed Tannin Extractability with Grape Maturity

Monitoring Ripeness

Development of Grape Tannins

- Hard
- Course
- Green
- Firm
- Chewy
- Dusty
- Supple
- Fine
- Silky

Monitoring Ripeness

Evaluating maturity: Priorities

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Source: Zoecklein (2001)
Monitoring Ripeness

Seed Ripeness

Unripe

Ripe

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Monitoring Ripeness

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Source: Zoecklein (2001)

Monitoring Ripeness

Cluster/Berry Condition

• Presence of disease
• Toughness of rachis
• Adherence of berries – shatter
• Diseases of rachis
• Drying and browning of rachis
• Skin toughness

Late-Season Rots

Botrytis

Ripe Rot

Sour Rot

Bitter Rot
Monitoring Ripeness

Must/Wine Oxidation

- Polyphenol oxidase
  - Grape enzyme
  - Sherry Madeira
  - Some phenols
  - Inhibited by SO2

- Laccase
  - Botrytis enzyme
  - Most phenols
  - Resistant to SO2
  - Must and wine
  - Extended activity

Evaluating maturity: Priorities

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3. Seed ripeness
4. °Brix, total acidity, and pH
5. General fruit condition – berry softness
6. Berry size/weight – “berry shrivel”
7. Ability to ripen further

Source: Zoecklein (2001)
Monitoring Ripeness

**Evaluating maturity: Priorities**

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   - green - herbaceous - fruity - jammy
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Source: Zoecklein (2001)

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Monitoring Ripeness

*Noble rot*

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Monitoring Ripeness

**Tannin Development**

*NOTE: Tannins may continue to mature even late in the season when it would appear that no addition ripening can transpire.*
Monitoring Ripeness

Wine Styles:
• Winemaker
• Know your clientele

Winemakers have many options available to them

“Wine makes daily living easier, less hurried, with fewer tensions, and more tolerance.”

~Benjamin Franklin

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