Balanced Harvest

Gill Giese
Extension Viticulture Specialist
Maturity?, Ripeness?, Balance?  
...when to pick?

- **Mature**: state of fruit at end of maturation
- **Maturation**: fruit changing, seeds become viable?
- **Ripening**: change from unfavorable to favorable
- **Ripe**: optimum state for intended use
- **Overripe**: beyond optimum state for intended use
- **Hangtime? physiological maturity? technical maturity?**
- **Watch Dr. Keller’s presentation @**
  https://www.youtube.com/watch?v=EXJwq3fyxMk
... just ask this guy!

“The optimum state for the intended use”
Grape Maturity and Harvest Decisions

• Vineyard
  – Cultivar, climate, soil and site
  – Vine balance, vineyard practices

• Grapes to Wine
  – Sugar, pH, acid, phenolics, YAN
  – Visual, tactile, sensory clues

• Reality
  – Economics, weather, labor
  – Hang time?
Cultivar, climate, soil and site... or... ‘terroir’
Do you know balance when you see it?...

But...what are we seeking to balance?

Meter x meter spacing in Chablis (left) and North Carolina (right)
Canopy management, ideal canopy

- 15 shoots/m of canopy, 3-5 per foot
- 10-15 nodes per shoot
- 1.5 – 2.0 leaf layers (few interior leaves)
- >50% exterior clusters
- >80% exterior leaves
- <5% active shoot tips at véraison
- medium sized, dull green leaves

- What do all these tell us?:
  - Maintain low to moderate nitrogen and soil moisture, adjust crop load and optimize cluster light exposure
### Leaf removal, Gruner Veltliner

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Berry wt (g)</th>
<th>Rot-infected berries (%)</th>
<th>Rot intensity (% clusters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.65 ab</td>
<td>4.58 a</td>
<td>71.7 a</td>
</tr>
<tr>
<td>Cluster thinned</td>
<td>1.70 a</td>
<td>3.06 ab</td>
<td>69.2 a</td>
</tr>
<tr>
<td>Total basal leaf removal</td>
<td>1.63 ab</td>
<td>4.16 ab</td>
<td>55.8 b</td>
</tr>
<tr>
<td>Fruit set leaf removal</td>
<td>1.56 b</td>
<td>2.67 b</td>
<td>57.1 b</td>
</tr>
<tr>
<td>P-value (T)</td>
<td>0.024</td>
<td>0.070</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Photo from a talk by Mr. Mark Chien

Hickey and Wolf, AJEV 69  2018

Smith and Centinari, AJEV 70  2019

![Graph showing berry weight over time with different treatments.]
<table>
<thead>
<tr>
<th>Compound</th>
<th>% in grapes</th>
<th>% in wine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>75.0</td>
<td>86.0</td>
</tr>
<tr>
<td>Sugars</td>
<td>22.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.1</td>
<td>11.2</td>
</tr>
<tr>
<td>Organic acids</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Minerals</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Phenolic compounds (tannins etc.)</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Volatile aroma compounds</td>
<td>trace</td>
<td>trace</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.2</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Berry Compositional Factors

• Sugars
• pH
• Acidity
• Nitrogen...YAN
• Phenolics

• Volatiles: methoxypyrazines, terpenes, rotundone... ‘flavor is a point in time’

• $K^+$, Ca effect on pH?
Berry Compositional Factors

- **Sugar**: range from 16° to ~25° Brix
  - 1° Brix ≈ 0.6% alcohol in final wine
  - Depends upon style of wine
  - Sucrose from leaves = glucose and fructose in fruit

Ref: Dr. Linda Bisson, In Search of Optimal Grape Maturity
Berry Compositional Factors

• Sugar
• **pH:** concentration of the H+ ions, some say: *effective* acidity.
  – 3.1 to 3.4 --- whites
  – 3.3 to 3.6 --- reds

  – Affects:
  – Color and solubility of tartrates and proteins
  – Microbial and protein stability
  – Little impact on flavor at pH > 3.0
Berry Compositional Factors

• Sugars
• pH
• **Acids:**
  – decreases throughout ripening...pH rises
  – impact sourness and tartness
  – titratable acidity: Whites -- 7.0 - 9.0 g/L
  Reds -- 6.0 - 8.0 g/L
- malolactic fermentation, stability, ageing
Acid, sugar, pH... over time
Nitrogen... YAN

• What is YAN?
• Ammonium salts (NH4+) and free amino nitrogen (FAN) = yeast assimilable nitrogen YAN
• Should you measure it? How?
• Varies by site and cultivar
• Vineyard nitrogen versus winery nitrogen
• Impact on flavor and aroma
• Fermentation dynamics
• **Minimum: 150-200 mg/L @ 21Brix, 250 mg/L at 23 Brix**  
   “ideal” YAN depends on Brix level
Berry Composition Improvement?

Nitrogen management is critical for wine flavour and style

YAN = FAN + NH₃-N
YAN: Yeast assimilable nitrogen
FAN: Free amino nitrogen
NH₃-N: Ammonia nitrogen

Trt 1: control
Trt 2: soil N
Trt 3: foliar N
Trt 4: foliar N+S

* Values are significantly different at  p < 0.05

Kelly et al., 2017, J Wine Res
Phenolics, skin and seed tannin

11% in skin tissue
89% in seed tissue

Grape tannin

29% of skin tannin extracted
36% in skin tissue
9% extracted during maceration
64% in seed tissue

Wine tannin

6% of seed tannin extracted

Adapted from: J. Kennedy, Practical Winery and Vineyard, May/June 2007
Berry development and composition

Adapted from Coombe and McCarthy, 2000
Vegetative vigor
Overcropping?

- Too much crop may delay ripening
- Growing shoot tips compete with ripening berries
- Avoid lateral growth after veraison?
Optimal ripeness and flavor

• **Whites: progression of aroma/flavor**

  - grass
  - citrus
  - tree fruit
  - tropical
  - banana
  - overripe?

Jim Law, VVA 2006, Knowing the Right Time to Harvest your Grapes
Optimal ripeness/flavor for reds: lab tests?

Ref: Jim Law, VVA 2006, Knowing the Right Time to Harvest your Grapes
Does size matter?

Adapted from UC Davis Viticulture for Winemakers
Maturity indicators: vine

- Visual
  - Timing and speed of veraison
  - Young vines = dimpled fruit, resemble golf balls
  - Proportion of growing shoot tips @ veraison
  - Cane lignification
Maturity indicators: fruit

Fruit Maturities

- Cap Stem Maturity: 09/07
- Pulp Maturity: 08/30, 09/07, 09/10, 09/14
- Skin Maturity: 09/10
- Seed Maturity: 09/14

Adapted from Delteil (1998)
Maturity indicators: seeds

Greater extraction at longer maceration times, not necessarily at greater alcohol levels

**Comparing Seed Maturity and Tannins**

**Early Harvest**
- 2011 Season
  - Concentration: $3.14 \pm 0.2 \text{ b}$
  - Seed color: $4.20 \pm 0.07 \text{ c}$
- 2012 Season
  - Concentration: $3.69 \pm 0.3 \text{ a}$
  - Seed color: $3.78 \pm 0.03 \text{ d}$

**Late Harvest**
- 2011 Season
  - Concentration: $2.97 \pm 0.1 \text{ c}$
  - Seed color: $5.45 \pm 0.20 \text{ a}$
- 2012 Season
  - Concentration: $3.15 \pm 0.1 \text{ b}$
  - Seed color: $4.76 \pm 0.08 \text{ b}$

**nut-like vs. harsh, bitter**
Reality...

- Labor: If scheduled and locked in ahead of harvest...is quality taking a backseat?
- Adjust your spray regime as harvest approaches
- Predation: quality versus quantity
- Rain: from where and when?

Ref: Jim Law, VVA 2006, Knowing the Right Time to Harvest your Grapes
Berries, seeds, beetles, birds and sunburn...
Hang time?
Harvest

• Mechanized...
Or hand harvest?
Cluster or berry sampling?

<table>
<thead>
<tr>
<th>DATE</th>
<th>SAMPLED BY</th>
<th>FLAVOR</th>
<th>AROMA</th>
<th>BRIX</th>
<th>TA</th>
<th>pH</th>
<th>TANNINS</th>
<th>JUICE COLOR</th>
<th>% BROWN SEEDS</th>
<th>COMMENTS</th>
</tr>
</thead>
</table>

Track ripening over time and seasons: describe trends = “harvest history”

Ref: Chateau Morrisette, Floyd, VA
Vine to wine web: vine, berry, and wine characteristics

- Vine
  - leaf area/fruit yield/vine
  - bunch exposure
  - pruning weight
  - date 13 Brix reached

- Berry
  - berry weight
  - juice pH
  - juice TA
  - berry color
  - aroma intensity
  - vegetation: blackberry, mint

- Wine
  - wine score
  - body
  - acid balance
  - tannin intensity
  - balance

Soil types:
- clay loam soil
- sandy soil
Winegrape Berry Sensory Assessment in Australia

Erika Winter
John Whiting
Department of Primary Industries
Victoria, Australia
and
Jacques Rousseau
Institut Coopératif du Vin
Montpellier, France
Thank you!
for for your attention

ggiese@nmsu.edu

“It is not what you do not know
that gets you into trouble...

...it is what you are sure of, that just ain’t so...” Mark Twain
References

References


• Howell, S., Grapevine Crop Balance: The Key to Sustainable Production of Ripe Grapes. Michigan State University


References

- Keller, Marcus. Grape Ripening. https://www.youtube.com/watch?v=EXJwq3fyxMk
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  http://nysaes.cornell.edu/hort/faculty/pool/hort444/estimatingcrop/estimatingcropwt7-2001

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