Crop Load Management of Young Vines

UC ANR Foothill Grape Day
March 29, 2018

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UC Cooperative Extension - Fresno County
Thanks for Having Me Here!
What is Crop Load?

• Crop load (Ravaz Index) is the ratio between fruit yield and canopy size (pruning weight).
• Crop load is one of the indicators of vine balance
• Vine balance
  ✓ Pruning weight per canopy length
  ✓ Crop load (Ravaz Index)
  ✓ Leaf area/fruit ratio
  ✓ Point quadrant
  ✓ ...

A vine is in balance when it can bring its fruit to a given **Brix**, with a given summation of **degree days of heat**, which is constant for a **given variety** (Winkler, and Winkler and Williams, 1939)

**Vine balance**
- 0.6 to 1 lbs of pruning weight per foot of canopy length
- Crop load from 5 to 10
- Leaf area/fruit ratio: 0.8 - 1.2 m²/kg: ≈15-18 leaves to ripen 2 clusters per shoot
- Leaf layer number and percent exposed cluster: 50%-75% clusters visible
Vine Balance

• Adequate exposed leaf area to produce carbohydrate (CHO) to make sugar, acid, color, tannin, flavor... plus the future crop!
Optimum Crop Load?

Canopy more than adequate for optimal fruit quality:

- <5 kg fruit per kg of pruning weight

Leaf area limiting to ripen fruit:

- >10 kg fruit per kg of pruning weight

Fruit and Wine Quality

Increasing quality

5 – 10 kg fruit per kg of pruning weight

Increasing crop load

Yield : Pruning Weight Ratio
Yield vs. Fruit Quality

Grape and Wine Quality

Increasing yield

Balanced vine

Increasing quality

Yield per acre

5 vs. 10 tons per acre?
Optimal Crop Load: 5-10

Established Mature Vines
Ways To Manage Crop Load

• Pruning
  a. Less labor intensive than cluster thinning
  b. Rough regulator of yield

• Shoot thinning
  a. Less labor intensive than cluster thinning
  b. Efficient way to regulate yield

• Cluster thinning
  a. Timing: 1) pre-bloom; 2) pre-veraison; 3) post-veraison
  b. Labor intensive
  c. Proven method to reduce yield
  d. The most potential to specifically adjust crop load
Ways To Manage Crop Load
Crop load on Young Vines?

- First crop on the 2\textsuperscript{nd} leaf?
Crop load works on Young Vines?

• Young vines needs more **resources** to build the **vine structure** and crop the yield.
  ✓ Variety: Pinot **vs.** Colombard
  ✓ **Clone:** vigorous **vs.** weak
  ✓ **Rootstock:** Freedom **vs.** 3309C
  ✓ **Trellis:** quadrilateral **vs.** bilateral
  ✓ **Pruning:** cane **vs.** spur
  ✓ **Water:** more
  ✓ **Fertilizer:** more
Cluster Thin vs. No Cluster Thin

- 1st leaf (2015)
- 2nd leaf (2016)
- 3rd leaf (2017)
- ...

**Pinot gris (04) on Freedom with quad**

**cluster thin pre-bloom**
Cluster Thin vs. No Cluster Thin

- Cluster thin to different number per shoot
  - 0%
  - 25%
  - 50%
  - 100%

100% cluster per shoot

0% cluster per shoot
Viticultural Practices

• Irrigation
  ✔ 2016: 1.34 acre-foot
  ✔ 2017: 1.65 acre-foot

• Bloom petiole analysis in 2016 and 2017

<table>
<thead>
<tr>
<th>Year</th>
<th>NO3-N (ppm)</th>
<th>P (%)</th>
<th>K (%)</th>
<th>Mg (%)</th>
<th>Zn (ppm)</th>
<th>Mn (ppm)</th>
<th>B (ppm)</th>
<th>Na (%)</th>
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</thead>
<tbody>
<tr>
<td>2016</td>
<td>1480</td>
<td>0.21</td>
<td>2.8</td>
<td>0.88</td>
<td>65</td>
<td>45</td>
<td>41</td>
<td>0.03</td>
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<tr>
<td>2017</td>
<td>3429</td>
<td>0.12</td>
<td>3.5</td>
<td>0.88</td>
<td>64</td>
<td>28</td>
<td>33</td>
<td>0.01</td>
</tr>
<tr>
<td>Guide</td>
<td>&gt;350*</td>
<td>&gt;0.1</td>
<td>&gt;1.0</td>
<td>&gt;0.2</td>
<td>&gt;15</td>
<td>20-2000</td>
<td>25-80</td>
<td>&lt;0.5</td>
</tr>
</tbody>
</table>

*Christensen 2000, Raisin Production Manual, UC ANR
Visual Overcropping?

- Canopy size @ veraison in 2016

- No cluster thin
- Cluster thin
Yield Summary

- Yield (tons/acre)

Two years’ summary:
- 0%: **16.6** tons/acre
- 25%: **24** tons/acre
- 50%: **20.5** tons/acre
- 100%: **20.3** tons/acre

Fresno in 2016 and 2017
Fruit Chemistry Summary

• Total soluble solids (Brix)

<table>
<thead>
<tr>
<th>Year</th>
<th>TSS (Brix)</th>
</tr>
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<tbody>
<tr>
<td>2016</td>
<td>22</td>
</tr>
<tr>
<td>2017</td>
<td>22</td>
</tr>
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</table>

Two years’ summary:
• Different in 2016
• Similar in 2017
Yield vs. Crop Load

- Yield (tons/acre) and Crop Load (Ravaz Index)

Crop Load in 2016:
- 0%: NA
- 25%: 8.3
- 50%: 16.1
- 100%: 19.9

$r^2 = 0.68$
Impact of Crop Load on Fruit Quality

Established Mature Vines

- Leaf area limiting to ripen fruit: >10 kg fruit per kg of pruning weight
- 5 – 10 kg fruit per kg of pruning weight
- <5 kg fruit per kg of pruning weight

Yield : Pruning Weight Ratio

Increasing crop load

Increasing quality

Fruit and Wine Quality
Crop Load works on Young Vines?

- Crop load (>10) impacts Brix in 2016
Crop Load works on Young Vines?

- Crop load (>10) in 2016 impacts yield in 2017
Overcropping on Fruitfulness

- Canopy size in 2016 impacts bud fruitfulness in 2017

\[ r^2 = 0.61 \]
Overcropping on Vine Structure

• Loss of spur and cordon, sometimes trunk...
• Increase vine training cost!
Maximize Vineyard Economics

• Two years’ summary
  ✓ Price ≈ $400/ton*
  ✓ Mechanical harvest ≈ $300/acre*
  ✓ Cluster thinning pre-bloom ≈ $400/acre*

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Accumulated yield (tons/acre)</th>
<th>Gross income ($/acre)</th>
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</thead>
<tbody>
<tr>
<td>0%</td>
<td>16.6</td>
<td>$6,240</td>
</tr>
<tr>
<td>25%</td>
<td>24.0</td>
<td>$8,900</td>
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<tr>
<td>50%</td>
<td>20.5</td>
<td>$7,500</td>
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<tr>
<td>100%</td>
<td>20.3</td>
<td>$7,820</td>
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</table>

*California Crush Report 2016 and personal communication with industry personnel
Take-home Message

• Vine balance, rather than tons per acre, is more important to achieve maximal viticultural and economic benefits.
• Consider different climate, soils, varieties, rootstocks..., when applying vine balance.
• Young vines need more resources to establish vine structure and produce the crop, and practices should be different on regions.
• Long-term impact needs to be watched.
Acknowledgement

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• SJV wine growers and wineries
Questions?