Early season canopy management
What is “early season canopy management”?

• 5” shoot growth through BB-sized berries
  o Shoot thinning
  o Shoot positioning
  o Lateral shoot and leaf removal
  o Maybe…
    • Hedging (first pass)
When should practices be executed?

• Like pest management...

• ...canopy management is most effective when implemented in a timely fashion
Viticulture Management poster (UGA and Virginia Tech extension publication)
Early season “viticulture” section of poster

CULTURAL PRACTICES

Viticultural practices optimize vineyard health, profitability, and sustainability and improve crop quantity and quality. Like pest management, viticultural practices should be implemented in a timely fashion throughout the growing season to maximize practice efficiency and benefit gain.

CANE AND SPUR PRUNING

Shoot thinning should occur when shoots are about 3-4” long. Shoot thinning helps to identify healthy vs. unfruitful shoots and removes top growth in competing shoots. Shoots should be thinned to roughly 3-5 shoots per linear foot of canopy area.

FROST DAMAGE

Frost damage is a concern once buds have broken. Air-mixing, row wind machines, and shaded pruning are commonly implemented in an attempt to avoid frost injury to vine tissues.

SHOOT POSITIONING

Shoot positioning is more efficient when implemented before shoots emerge pruned to vine and underlying shoots. Shoots should be positioned to accommodate the intended training system—regular vineyard trellising, V-trellising, or high-density training.

LEAF REMOVAL

Leaf removal should be implemented immediately after bud set, usually before the growth of 50% sized leaves. Leaf removal at this early stage eliminates vigorous unneeded foliage and insurances including the fruit of unusual fruited vines, reducing vine load, and producing a more efficient canopy weight.

CANOPY HEDGING

Canopy hedging from the sides of canopy vines, and pruning over the canopy of the vines is an effective way to control canopy weight and reduce the risk of frost injury.
Shoot thinning
Between which growth stages should shoot thinning be implemented?
Shoot thinning – when?

• VERY narrow window of opportunity to implement efficiently

• 5” to 12” shoot growth

• When you are able to see inflorescences
Ideal shoot thinning stages

...ed on shoot growth. Bets must be hedged if the por is short (unfortunate, but often the case).
fore the threat of frost has passed to increase sk efficiently? Or, should shoot thinning commence ssed, potentially beyond the growth stage when it ed? A solution to this problem may be to start vs. nonfruitful shoots es), using active frost l8) to protect the
Too late to start thinning... but ideal density in Merlot
Shoot thinning – why?

- Moderate crop
- Limit cluster touching
- Reduce canopy and fruit zone congestion
- Choose shoots for spur renewal
## Crop moderation

### Shoot density effects on crop yield***

<table>
<thead>
<tr>
<th>Shoot density (per linear foot of row)</th>
<th>T / acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>5</td>
<td>4.8</td>
</tr>
</tbody>
</table>

***9 foot row spacing

***120 g cluster weight

***1.5 clusters per shoot

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[Image: Grapes in a vineyard with text overlay]
## Crop moderation

<table>
<thead>
<tr>
<th>Crop</th>
<th>Shoot density (per ft. of row)</th>
<th>Crop yield (T / acre)</th>
<th>SS (Brix)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chambourcin</td>
<td>4 / 5</td>
<td>6.7 / 11.0</td>
<td>20.3 / 19.7</td>
</tr>
<tr>
<td>Traminette</td>
<td>2.5 / 3.3</td>
<td>2/9 / 3.8</td>
<td>20.5 / 20.0</td>
</tr>
</tbody>
</table>
Congested canopies…

- Limit radiation and airflow and spray penetration
- Rot
- Poor varietal character
Spur renewal?

• We often retain fruitful, “count shoots”...

• But, sometimes basal, less fruitful shoots are retained for future spur positions
What shoot densities are “ideal”?
Shoot thinning – how?

• Density:
  o 3 to 6 shoots per linear foot of row

• Tools:
  o Thumbs are sufficient if done before shoot lignifies at base
  o Pruners needed thereafter
Why the large range in optimal shoot density?

• Training system
  
  o As related to shoot positioning
  
  • And thus fruit zone architecture
    
    o VSP
    o Watson
Training system – linear vs. multi-dimensional
Divided canopy vs. single canopy
The Watson System

UGA Extension Bulletin 1522; March 2020

Watson system
The Watson system
Why the large range in optimal shoot density?

- Vine “vigor”
  - Resource availability at site
  - Vine age and health
  - Cultivar
  - Rootstock

- High vigor
  - 3309
  - Retain more shoots to produce crop

- Low vigor
  - *Riparia*
  - Retain fewer shoots to aid perennial vine health
I bet this vine wished it was more vigorous.

Don’t text and drive tractors (down tight vineyard rows)
Prioritizing shoot thinning

- **Cultivar**

- **Hybrid or American**

- **Vinifera**

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Time of budburst (in days)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chenin Blanc, Chardonnay</td>
<td>0</td>
</tr>
<tr>
<td>Gewürztraminer, Viognier</td>
<td>1</td>
</tr>
<tr>
<td>Pinot Blanc</td>
<td>2</td>
</tr>
<tr>
<td>Pinot Gris, Pinot Noir, Merlot</td>
<td>3</td>
</tr>
<tr>
<td>Petite Verdot, Tannat</td>
<td>5</td>
</tr>
<tr>
<td>Riesling, Cabernet Franc, Semillon</td>
<td>6</td>
</tr>
<tr>
<td>Grenache, Muscat Ottonel</td>
<td>7</td>
</tr>
<tr>
<td>Sauvignon Blanc, Syrah, Tempranillo</td>
<td>8</td>
</tr>
<tr>
<td>Carignan, Marsanne</td>
<td>10</td>
</tr>
<tr>
<td>Counoise</td>
<td>13</td>
</tr>
<tr>
<td>Cabernet Sauvignon, Mourvedre</td>
<td>14</td>
</tr>
</tbody>
</table>

*The relative number of days that budburst occurs in these cultivars after budburst is observed in ‘Chenin Blanc’ and ‘Chardonnay.’
Ideal (left); too dense (right)
Rot tolerance

- Relatively sensitive:
  - Chardonnay, Sauvignon blanc, Vignoles, Pinot noir, Riesling, Gruner Veltliner, Merlot

- Relatively less sensitive
  - Hybrids
  - Petit Verdot, Albarino, Petit Manseng
Shoot thinning – cane vs. spur pruning
Table 1. The effects of training and pruning on shoot numbers.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total shoot count (number/vine)*</th>
<th>Total shoot count (number/vine)**</th>
<th>Count shoot percent (of total shoot number/vine)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cordon training and <em>spur</em> pruning</td>
<td>45</td>
<td>47</td>
<td>56</td>
</tr>
<tr>
<td>Head training and <em>cane</em> pruning</td>
<td>22</td>
<td>27</td>
<td>71</td>
</tr>
</tbody>
</table>


**White and Hickey (2018); data averaged across 2017 and 2018 seasons in ‘Petit Manseng’.
Shoot thinning – cane vs. spur pruning

• Labor and time

• Cane: greater inputs in dormant period
  o Maybe less time sensitive

• Spur: greater inputs during spring
  o Greater time sensitivity
Shoot positioning

Best when done BEFORE tendrils “grab” neighboring shoots
Shoot positioning

• When done properly:
  - Improves canopy light interception
  - Improves spray penetration
  - Limits cluster touching
Shoot positioning is particularly important in divided systems

- Ballerina
- Lyre
The training system is optimized only when shoots are trained (positioned)
Fruit zone leaf and lateral removal
Fruit zone leaf removal

- When?
PB-4  |  PB-8  |  PFS-6
2.1 t |  1.2 t |  3.5 t
How many leaves to remove?

Figure 4. The relationship between fruit zone leaf layer number (LLN) and *Botrytis* bunch rot incidence and severity, summer 2017. As tissue layers surrounding clusters are reduced, *Botrytis* bunch rot severity is reduced more so than incidence. Incidence = visual inspection of the infection of one berry or more per cluster; severity = visual inspection of percent damage per cluster.
How many leaves to remove?

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Botrytis incidence (%)</th>
<th>Botrytis severity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>54.0</td>
<td>4.6</td>
</tr>
<tr>
<td>PB6</td>
<td>30.0</td>
<td>1.6</td>
</tr>
<tr>
<td>PFS6</td>
<td>10.0</td>
<td>0.1</td>
</tr>
<tr>
<td>NO</td>
<td>44.0</td>
<td>0.9</td>
</tr>
<tr>
<td>PB6</td>
<td>32.0</td>
<td>0.6</td>
</tr>
<tr>
<td>PFS6</td>
<td>32.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Table 1. Fruit-zone leaf removal effect on Botrytis bunch rot incidence and severity in two Cabernet franc clones in North Carolina in 2017.
How many leaves to remove?

**Table 4. Fruit-zone leaf removal effect on Cabernet franc Brix: titratable acidity (TA) ratio and canopy-side specific total grape phenolics and anthocyanins in North Carolina, and Georgia in 2017.**

<table>
<thead>
<tr>
<th>Treatment&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Brix: TA ratio</th>
<th>Phenolics (au/g berry)</th>
<th>Anthocyanins (mg/g berry)</th>
<th>Phenolics (au/g berry)</th>
<th>Anthocyanins (mg/g berry)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East canopy side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>6.1</td>
<td>87</td>
<td>0.56</td>
<td>82</td>
<td>0.59</td>
</tr>
<tr>
<td>PB6</td>
<td>6.6</td>
<td>97</td>
<td>0.61</td>
<td>103</td>
<td>0.66</td>
</tr>
<tr>
<td>PFS6</td>
<td>6.1</td>
<td>98</td>
<td>0.59</td>
<td>98</td>
<td>0.65</td>
</tr>
<tr>
<td>West canopy side</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>3.7</td>
<td>102</td>
<td>0.64</td>
<td>101</td>
<td>0.67</td>
</tr>
<tr>
<td>PB6</td>
<td>4.2</td>
<td>135</td>
<td>0.81</td>
<td>131</td>
<td>0.75</td>
</tr>
<tr>
<td>PFS6</td>
<td>4.3</td>
<td>132</td>
<td>0.74</td>
<td>114</td>
<td>0.73</td>
</tr>
</tbody>
</table>

<sup>a</sup> No treatment.
Radiation is a “tool” to manage fruit composition and target wine styles.
Radiation is a “tool” to manage rot, fruit composition and target wine styles
How many leaves to remove?

- No simple answer

- Time is limited
  - Especially over large acreages

- Typically, removal of an average of 2-3 leaves per shoot will create a fruit zone with 1 to 2 LLN
  - (Reynolds and Wolf 2008)
### Prioritizing leaf removal

<table>
<thead>
<tr>
<th>Leaf removal priority</th>
<th>Species</th>
<th>Berry color</th>
<th>Cluster morphology</th>
<th>Rot tolerance</th>
<th>Grape skin</th>
<th>Training system</th>
<th>Fruit zone architecture</th>
<th>Climate</th>
<th>Price premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>American</td>
<td>Loose</td>
<td>High</td>
<td>Thick</td>
<td>High Wire</td>
<td>Multi-dimensional; spacious</td>
<td>Dry, arid</td>
<td>Lower cost</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Hybrid</td>
<td>Red</td>
<td>Normal</td>
<td>Medium</td>
<td></td>
<td></td>
<td>Humid, subtropical</td>
<td>Higher cost</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Vinifera</td>
<td>White</td>
<td>Compact</td>
<td>Low</td>
<td>Thin</td>
<td>Linear; confined</td>
<td>Humid, continental</td>
<td>Higher cost</td>
<td></td>
</tr>
</tbody>
</table>
OR…. to avoid late season rots

• Pick everything in late August / early September:
  o 17-18 Brix
  o 3.2 pH
  o 12 g/L acidity

  o And make sparkling wines
Hedging

• When?
  o First pass...
Hedging

• Hedge shoot ops before they fall over and shade canopy

• After first “topping”
  - Laterals will need hedged to limit fruit zone shading
Resources – extension publications

• Viticulture Management Poster

• Shoot thinning
  • [https://secure.caes.uga.edu/extension/publications/files/pdf/C%20152_1.PDF](https://secure.caes.uga.edu/extension/publications/files/pdf/C%20152_1.PDF)

• Fruit zone management:
  • Soon to be published (out for review now)
  • Webinar – June 3 (Michela and I)
Thank you
Kathy Kelley
PSU Wine and Grape Team
PSU Extension
PA wine and grape industry stakeholders
YOU – for listening in

Best wishes for mild temps this weekend
Thank you for joining our webinar. Please connect with us to learn about future webinars and events:

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