Prevention and Management of Grape Fungal Diseases Close to Harvest

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Fungal disease of Grapevines

Commonalities

• Overwintering Inoculum
  – Mummies
  – Canes/Spurs
  – Trunks/Bark
  – Floor

• Substrate
  – Green tissue
  – Juice
Progression from One to Another

- Powdery Mildew
- Wounds
- Leaks
- Bunch Rots
- Rot Organism Spores

Spores

Wounds

Leaks

Bunch Rots

Rot Organism Spores

Powdery Mildew Spores
Cultural Controls

• Sanitation
  – Remove infected material from the vineyard
  – Burn it
  – Uneconomical in California production vineyards
  – Air quality issues
  – We need some innovations/techniques/technologies to make this possible
Cultural Controls

• Sanitation
  – Removal/burning
    • Hot spots?
      – Invest resources in worst area(s)
    • Small blocks?
      – At least some areas have reduced spore loads
    • Small vineyards?
      – That’s why they can do it in France
  • Different blocks/areas every year?
  • Most susceptible varieties?
  • Areas upwind?
Environmental Factors

• Air Flow
• Light
• Moisture
• Humidity
Manipulating Environmental Factors

• Canopy Management

• Irrigation Management

• Fertility Management
Consider treating downwind as well as infected area.
Powdery Mildew

• Even “inconspicuous” PM infections are associated with increased severity of Botrytis at harvest

• And therefore, wine spoilage organisms
# Dangers of Losing Control

## Year 1

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Final Spore Load*</th>
<th>Spring Discharge of Overwintering Spore Load**</th>
<th>Spring Spore Load Compared to Final Spore Load Previous Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>A- Stop sprays at Labor day</td>
<td>1,300</td>
<td>260</td>
<td>-</td>
</tr>
<tr>
<td>B- Stop sprays in August</td>
<td>5,300</td>
<td>1,060</td>
<td>80% of A</td>
</tr>
<tr>
<td>C- Stop sprays in July</td>
<td>28,700</td>
<td>5,740</td>
<td>108% of B, 441% of A</td>
</tr>
</tbody>
</table>

*Chasmothecia (#/Kg of Bark)  
**Assuming 20%

Dangers of Losing Control

Year 2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>PM Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-&quot;Weak spray program&quot;</td>
<td>11%</td>
</tr>
<tr>
<td>B-&quot;Weak spray program&quot;</td>
<td>22%</td>
</tr>
<tr>
<td>C-&quot;Weak spray program&quot;</td>
<td>48%</td>
</tr>
</tbody>
</table>

*Same Vines as Year 1*
Canopy Management: All about timing

• The Experiment
  – Chardonnay, New York state
  – Clusters inoculated with PM
  – No fungicides

• Treatments
  – Leaf removal 2 weeks after boom (Early)
  – Leaf removal 5 weeks after bloom (Late)
  – 1 leaf removed above and below cluster (Light)
  – 2 leaves removed above and below cluster (Heavy)
  – Control- no leaves removed
Canopy Management: All about timing

• Results
  – Both Light and Heavy leafing Early
    • Lower severity than control
  – Both Light and heavy leafing Late
    • Same severity as control

(Austin & Wilcox 2011)
Effect of Irrigation on PM Severity

$1X = 4L/hr$

$2X = 8L/hr.$

12 hours per week, 12 weeks
Downy Mildew
(*Plasmopara viticola*)

- **Damage and Symptoms**
  - Attacks any green tissue on the vine.
  - Destroys tissue in a few days.
  - Symptoms include large yellow spots on the tops of leaves, called “oil spots,” and white, cottony (“downy”) colonies on the undersides.
  - Infections also attack shoots, shoot tips, petioles, berries, and rachises.
Downy Mildew
(Plasmopara viticola)

Photo Credit: Mark D. Welch, M.S.
Downy Mildew  
(Plasmopara viticola)

• Life Cycle
  – Oospores overwinter in fruit and leaves on the vineyard floor.
  – Oospores can be viable for several years.
  – Primary infections begin in the spring at 52°F or higher and after a rain event of at least 0.1”.
  – Secondary infections of sporangia form after humid nights followed by a rain event.
  – Sporangia then release zoospores which move onto or around the vine via wind or rain (splashing).
Downy Mildew
(*Plasmopara viticola*)

**Life Cycle**
- Zoospores enter the plant through the stomates.
- Downy mildew infections spread rapidly after this point.
- Under ideal conditions the time between generations is 4 to 5 days.
- Ideal conditions are night and morning temperatures between 65-77°F.
- Limiting temperatures are below 52°F and above 86°F.

**MANAGEMENT**
- See “*Downy Mildew*” on UC Statewide IPM Website for specific recommendations.
- See *Grape Disease Control for 2017* by Wayne Wilcox for recent research on the control of downy mildew with fungicides.
Bunch Rots- Botrytis

• Contributing Factors
  – Orange Tortix larvae
  – Abrasions on berries
  – Swollen berries
  – Tight clusters
  – Flower trash in the cluster left over from bloom
  – Scars from cap fall
  – Spore load from previous year
Latent Infections

• In Tissue Since Bloom
• Factors affecting activation
  – Nitrogen
    • *More N = More Botrytis*
  – Relative Humidity
    • *More humid = More Botrytis*
  – Soil Water Status
    • *Wet = More Botrytis*
    • *Dry = Less Botrytis*
    • *If humidity is high enough, infections still occur on water stressed vines*
      – *There are latent infections there, just not activated*

*Wilcox 2017*
Sour Rot

- A complex of fungi, yeast, and bacteria
- Botrytis is often found as part of that complex, but not necessarily
  - Organisms found in the complex can include *Botrytis cinerea*, *Aspergilis niger*, *Gluconobacter* spp., *Acetobacter* spp.
- Fruit flies (*Drosophila* spp.) are necessary
- Requires wounds to the berry
  - Can be micro-abrasions which cannot be seen with the naked eye
- Starts at 15° Brix or higher with no observable symptoms until then
Fungal Diseases of Grapevines

- Factors you cannot control
  - Variety
  - Cluster architecture (or can you...?)
  - Climate
  - Weather
  - Spore Load History
Fungal Diseases of Grapevines

- Factors you can control
  - Light
  - Canopy density
  - Irrigation
  - Fertilization
  - Fungicide selection and rotation
  - Fungicide timing
  - Scouting frequency and resolution
Fungal Diseases of Grapevines

• Next year’s infections are out there now.
• Bloom is a critical time.
• Leaving diseased material in the vineyard is not good.
• Control of Powdery Mildew reduces incidence of Bunch Rots.
SOURCES:


  - Bunch Rots
  - Downy Mildew
  - Powdery Mildew


RESOURCES

• See “Downy Mildew” on UC Statewide IPM Website for recommendations.
• See Grape Disease Control for 2017 by Wayne Wilcox for recent research on the control of fungal diseases of grapes with fungicides.
• Vineyard Team Podcasts
  – “New Discoveries about Sour Rot Episode 17”
  – “Fungicide Resistant Mildew Episode 09”
  – “Fungicide Resistance in Grape: Grower Perspective Episode 6”
  – “Bunch Rot with Larry Bettiga Episode 1”
  – “Grape Powdery Mildew Management and Inoculum Monitoring Episode 5”
• Vineyard Team Technical Articles
  – “Downy Mildew (Plasmopara viticola)”
• Vineyard Team Online Educational Module
  – “Effective Vineyard Spraying”
  – 1 hour DPR(O) available $20
• Books
  – Effective Vineyard Spraying by Andrews Landers $50
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