New Tools for an Old Foe: II. Powdery Mildew Management

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Managing Powdery Mildew

- It is not a question of whether or not you will have it.
- It is a question of how much you want to live with and what you are willing to spend to achieve that goal.
- It is a numbers game, get behind and you loss
How do we make disease management decisions?

- We make assumptions
  - Overwintering and other inoculum exists in vineyard
  - All acreage of the same genotype is equally at risk
  - Some assume conditions are always favorable
  - The fungicides and sprayers work as advertised
What is in our Toolbox?
What is in our Toolbox?

- Culture Practices
- A well calibrated sprayer
- Synthetic fungicides
- Sulfur
- Copper
- Oils
- Carbonates
- Phosphites
- Biological
Cultural Practices

- Reduce Vigor
  - hedging doesn’t count
- Shoot positioning – keep it open
  - Consider a sloppy VSP if high vigor
- Early Leaf pulling
  - Light and air exposure
Pre-bloom Leaf Removal

Patty Skinkis and Walt Mahaffee
Effect of Leaf Removal on Powdery Mildew Flower Infection - 2008

* Statistically different from control at P=0.05
Figure 1. Mean (+ SEM) percent incidence and severity of powdery mildew infections of 25 berries selected randomly from harvested clusters. Difference from the control at P<0.05 indicated by (*). The control is "none" which did not have leaves pulled. Data gathered from experimental plots at commercial vineyard sites.

* Statistically different from control at P=0.05
2008 and 2009 **no** difference in:

- SS, pH and TA
- total anthocyanins and phenolics
- fruit set
No difference in fruit set during 2008 or 2009.

Influence of leaf pulling on fruit set 2010

% Fruit Set

Timing of leaf pulling

Pre-bloom | Bloom | Control
---|---|---

**P=0.0024**

**P=0.0061**
No difference in fruit ripening 2008-2010

Soluble Solids of Fruit from Various Leaf Pull Treatments - 2010

Timing of Leaf Removal:
- pre-bloom
- bloom
- fruit set
- pea-size
- bunch close
- control

Bar graph showing the soluble solids in fruit from different leaf pull treatments. There is no significant difference in the soluble solids between the treatments.
Effect of exposure on berry anthocyanins and phenolics

- No difference by treatment 2008-2009.
- Bloom > Control at one site
2010 Disease Data

Incidence of Botrytis Bunch Rot in Clusters at Harvest 2010

Timing of leaf pulling

- Pre-bloom
- Bloom
- Fruit set
- BB to Pea
- Bunch close
- None

Data representation with error bars indicating variability.
Severity of Botrytis Bunch Rot in Clusters at Harvest 2010

Timing of leaf pulling

- Pre-bloom
- Bloom
- Fruitset
- BB to Pea
- Bunch close
- None

%
Reduced cluster compactness and exposure doesn’t always ensure prevention of botrytis infection if weather is a major factor (2010).
Conclusions

- There is a longer window of opportunity for leaf pulling.
- Severe leaf pulling even significantly before flowering does not negatively impact fruit quality.
- There are significant benefits for disease management.
Synthetic Fungicides

- **Strobilurins** (high probability of resistance development)
  - Flint (Trifloxystrobin)
  - Sovran (Kresoxim-methyl)
  - Abound (Azoxystrobin)
  - Pristine (mix of pyraclostrobin/boscalid)

- **Sterol inhibitors (Si or DMI)** (some resistance present)
  - Rally (Myclobutanil)
  - Rubigan (Fenarimol)
  - Elite (Tebuconazole)
  - Procure (triflumizole)

- **Anilide** (high probability of resistance development)
  - Endura (boscalid)
  - Pristine (mix of pyraclostrobin/boscalid)

- **Quinoline** (Resistance present but fitness cost)
  - Quintex (quinoxyfen)

Always check current label before using
Contact Fungicides

- **Oils**
  - Petroleum based
  - Plant extracts
- **Soaps**
  - Potassium laurate
- **Carbonates**
  - Potassium bicarbonate
- **Peroxides**
  - Hydroperoxide

- Can strip waxes and make tissue more susceptible
- Resistance potential very low
- Use to augment program
- Short residual, little or no protection
- Phytotoxicity possible under certain conditions
- Can reduce beneficial insect populations

Always check current label before using
Arimicarb Damage
Other Protectant Fungicides

- **Sulfur** *(unknown mechanism/no resistance in 100+ years)*
  - Micronized
  - Dusting
  - **Limesulfur** *(dormant applications only)*

- **Copper** *(increases cuticle thickness)*
  - Copper Hydroxide

- **Phosphonates** *(induced resistance)*
  - Phosphorous acid
  - Mono and di-potassium phosphites

Always check current label before using
Sulfur

- Check for phytotoxicity
- Use micronized product for longer residual
- Use when highs are >60°F but do not apply when temperatures are >90°F???
- Heavy use will reduce beneficial insects
- Even leaf coverage not necessarily the best
Biologicals/plant extracts

- **Seranade**
  - Antibiotic produced by *Bacillus subtilis*
  - Contact activity – little residual

- **Sonata**
  - Antibiotic produced by *Bacillus pumulis*
  - Contact activity – little residual

- **Plant Shield**
  - *Trichoderma harianum*

**Surfactant can be the active ingredient**

Always check current label before using
Other products? out there

- **Surround** (kaolin clay)
  - Barrier
- **Elexa 4 plant defense booster** (chitosan)
  - Elicits plant defense responses
- **Cinnacure** (cinnamaldehyde)
- **Auxigro** (glutamic and aminobutyric acid)
- Many others

*Surfactant can be the active ingredient*
What is in our Toolbox?
What is the real Active ingredient?

Water helps control powdery mildew

Leaflet Incidence

- No spray
- Water spray
- Chicken-no air
- Chicken-aerated
- CMC-no air
- CMC-aerated
- Yard-no air
- Yard-aerated
- Latron@1oz/100gal
- T-22@0.33oz/gal
- T-22@1.0oz/gal
- T-22@5.0oz/gal

10/15/1999
How do we use them?

- Make sure sprayer is setup, correct nozzles, properly calibrated and targeted
- Check your coverage
- Timing
Polycyclic Disease

% Disease

May July Oct.

Primary Inoculum Limiting

Biology of Pathogen Limiting

Host Limiting
Controlling a Powdery Mildew Epidemic Targeting Both Cleistothecia and Conidia

- No Control
- Decrease Initial Inoculum (1 spray)
- Protect against Condial Spread (10 sprays)
- Both (7 sprays)

 Indicates application of a control measure