Mid-Late Season Grape Disease Management

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Review of late season grape disease issues for northeastern growers

- Downy mildew
- Powdery mildew
- Botrytis bunch rot
- Sour rot
- Ripe rot
- Grapevine leafroll associated virus
Mid-late season Downy Mildew; Management

- Fruit resistant 2-4 weeks after bloom but...
- Rachises still susceptible after fruit are resistant (2-3 weeks longer?)

- Leaves can be infected all season; less susceptible as they mature.

- Late season sprays (leaf infections) may be necessary if disease reactivates
Downy mildew: leatherberry symptoms
Downy mildew: symptoms
Downy mildew on fruit
Mid-late season Downy Mildew; Management

- Fruit resistant 2-4 weeks after bloom but...
- Rachises still susceptible after fruit are resistant (2-3 weeks longer?)

- Leaves can be infected all season; less susceptible as they mature.

- Young/immature leaves: oil spot symptoms
- Older leaves: red/brown, angular. Lesions die as they age.
Young leaves: Oil spot symptoms
• red/brown angular spots (late summer)
• Lesions die as they age
• Can cause leaf abscission
Downy Mildew; Secondary Cycles

- Infections sporulate at night, >95% RH
- Spores blown to wet plant surfaces, infect
- 4-5 day generation time under ideal conditions
- Epidemics occur in warm, wet summers
- Hot, dry weather inhibits development; can reactivate if wet in fall
Chemical control of downy mildew

• No substitute for chemical control
  - Our options are shrinking; loss to resistance, label changes.
  - No new star materials since 2013.
  - Make sure you understand what controls dm and what does not!
  - Must understand and apply resistance management.
Sterol biosynthesis inhibitors:
NONE OF THESE AIs WILL CONTROL DM!!!

- PM and BR ONLY!!!!!!
- **Myclobutanil**: Rally
- **Tebuconazole**: Elite, Tebuzol, Tebustar, Luna Experience
- **Tetraconazole**: Mettle
- **Difenconazole**: Inspire Super, (Revus Top does control dm), Aprovia Top, Quadris Top?
- **Flutriafol**: Rhyme, Topguard EQ?
- **Triflumizole**: Viticure, Trionic
- **Mefentrifluconazole**: Cevya
Strobilurins (FRAC 11)

- DM resistance 1\textsuperscript{st} documented in 2005 (VA, MD, PA), now widespread.
- **DO NOT RELY ON THESE FOR CONTROL OF DM ANYMORE!!!!!**

- **Azoxystrobin:** Abound, Azaka, Quadris Top, TopGuard EQ

- **Trifloxystrobin:** Flint, Flint Extra, Luna Sensation…very weak on dm anyway.

- **Kresoxym methyl:** Sovran

**Pyraclostrobin:** Pristine
Succinate dehydrogenase inhibitors (SDHIs; FRAC 7):
NONE OF THESE CONTROL DM!!!!

- Boscalid: Endura
- Fluopyram: Luna Experience, Luna Sensation
- Benzovindiflupyr: Aprovia (Top)
- Pydiflumetofen: Miravis Prime
Downy Mildew; Current Chemical control

- Old Standards: mancozeb, captan, ziram, copper/lime
- Gavel 75DF: zoxamide (22) + mancozeb
- Ridomil (w copper or mancozeb); mefanoxam (4)
- Rampart, ProPhyt, Phostrol, Fosphite, Reveille, etc: Phosphites/phosphorous acid (33)
- Revus 2SC, Revus Top: mandipropamid (40)
- Ranman; cyazofamid (21); effective alone and mixed with phosphorous acid.
- Zampro: New in 2013, Initium (45) + dimethomorph (same FRAC (40) as Revus)
- *Bacillus mycoides*: LifeGuard (?)

- ....Not a long list
<table>
<thead>
<tr>
<th>Chemical class/product</th>
<th>FRAC</th>
<th>PHI</th>
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<tbody>
<tr>
<td>Gavel (zoamide)</td>
<td>22</td>
<td>66</td>
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<td>Phosphorus acid: Prophyt, Phostrol, Fosphite, Rampart, Reveille, etc.</td>
<td>33</td>
<td>0</td>
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<tr>
<td>Ranman</td>
<td>21</td>
<td>30</td>
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<td>Revus, Revus Top</td>
<td>40</td>
<td>14</td>
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<tr>
<td>Ridomil Gold/MZ, Copper</td>
<td>4</td>
<td>42, 66</td>
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<tr>
<td>Strobilurins: Flint, Sovran, Abound, Azaka, Quadris, Quadris Top, Pristine, Reason, Luna Sensation, TopGuard EQ</td>
<td>11</td>
<td>14</td>
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<tr>
<td>Zampro</td>
<td>40,45</td>
<td>14</td>
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</table>
Powdery mildew: *Uncinula necator*
Powdery Mildew; Secondary Infection Cycles

- Spores (conidia) from primary infections wind dispersed
- Rainfall not required
- Generation time only 5-7 days under ideal conditions (60-80°F)

Courtesy APS (W. Gärtel)
Powdery Mildew; Cultural Control

• Maximize air circulation and sun exposure, reduce RH:
  - shoot thinning, leaf removal, trellis system,
  - proper site selection
  - excellent weed control

• Nitrogen management to limit shoot growth
Powdery Mildew management

- Strobilurins; Flint, Sovran, Abound/Topguard EG, Pristine….RESISTANCE!!!
- SIs; tebu, tetra, difenoconazole: Rally, Elite, Orius, Mettle, Tebuzol, Tebustar, Inspire Super, Revus Top, Luna Experience, Rhyme/Topguard EQ
- Quintec: quinoxyfen
- Vivando/Prolivo: metrafenone, pyriofenone
- Torino: cyflufenamid
- SDHIs: Luna Experience (fluopyram + tebuconazole), Aprovia (benzovindiflupyr)
- Old standards: Sulfur, copper/lime
- Alternatives: Nutrol, K bicarbs, oils, plant extracts, biologicals, Regalia, OSO/Ph-D, etc.
- Sunlight!!!
Powdery mildew infections on fruit....rots later

- Protect fruit for 3-4 wks after capfall.
- Early infections = severe mildew, splitting.
- Later infections = diffuse infections, “invisible”
  - breaches, dead zones in skin
  - exacerbates fruit splitting
  - provides opportunities for rot fungi.
**Botrytis bunch rot**

- Late season condition, ripening.
- Complex cluster rot involving many factors,
- Essential to **prevent injury**
- **Compactness** determines susceptibility and spread within cluster
Bunch/sour rot control (also pm, dm)

- Varietal selection
- Leaf pulling, shoot thinning
- Shoot positioning

- Cover crops (competition for water/N/etc)
- Wound management!!!: birds, bugs, pm, compactness.
Chemical vs integrated (chemical + leaf removal + reduced compactness)

- Results over 6 seasons
- # = 71% rot reduction vs 2 fungicide check, significant in 4 of 6 yrs.
Mechanization is key

- Improves timing
- Improves cost effectiveness (?)
- Improves adoption
For Botrytis: chemistries

- Vangard, Inspire Super (cyprodinil), Scala (pyrimethanil)
- Switch (relatively new) – cyprodinil (systemic) + fludioxonil (contact)
- Elevate (fenhexamid)
- Rovral, Meteor (iprodione) - efficacy improved with surfactant
- Strobilurins - Flint effective at 3 oz rate, Pristine at 18.5-23 oz rate, Intuity at 6 fl oz rate.
- SDHIs: Endura (boscalid), Luna Experience (fluopyram) - effective against Botrytis and powdery mildew.
- Alts: Fracture, Botector, Ph-D/OSO/Tavano (PolyD)
- Rotate, rotate, rotate!...no more than 2 apps of any chemistry per season.
New research: sour rot

- Drs Megan Hall, Wayne Wilcox, Greg Loeb; Cornell University.
- Wendy McFadden-Smith; OMAFRA
Sour Rot: What we know

- **Starts with berry injury:** excess rainfall (cracking), bird/insect damage, hail, compactness.
- Complex of microbes: yeasts and bacteria, many of which are opportunists.
- Exacerbated by Bot, PM
- ***Fruit flies essential!***
Putting it together

• Begin sprays around 15 brix, before symptoms best
• Most control (average of 35%) from insecticide sprays (Mustang Maxx, Delegate, Azadirachtin).

• **Best:** combine fruit fly AND microbe control (Oxidate, Copper formulations, Fracture).
• Insecticide resistance to Mustang Max, malathion, Assail, found in F.Lakes
Insecticide resistance in Finger Lakes vineyards.

- Since Insecticide resistance was found in several modes of action in fruit fly (*D. melanogaster*) populations in the FL, resistance not thought to be a result of overuse/improper use in vineyards.
- Resistance probably due to lots of use of these Ais in other lines of agriculture in the area (vegetable fields, use in other fruits, etc.)
- Resistance of *D. melanogaster* is widespread to organophosphates, neonicatinoids, pyrethroids.
Ripe rot of grapes

- *Colletotrichum spp*: *acutatum* and *gloeosporioides*.
- Serious problem in warm, wet seasons; optimum temps in 80s.
- Identified during the ripening period; no symptoms until after veraison.
- Pink or orange colored slimy spore masses appear on infected fruit after a wetting period. Fruit become mummies.
- No foliar symptoms
Ripe rot on Marquette

Pictures courtesy of Michela Centinari
Ripe rot on Traminette

Pictures courtesy of Michela Centinari
Ripe rot management

• Overwinters in fruit mummies/clusters, bark/cankers
• Spores spread by rain
• Fruit susceptible ALL season!!!
• Cultural control: sanitation, prune out dead/older wood, old clusters
• Chemical control: mancozeb, captan, strobies…every 2 weeks in southerly regions…bloom-harvest
Grapevine leafroll associated viruses

- Rolling, loss of chlorophyll in *Vitis vinifera* leaves by late summer, interveinal tissue turns red (Cab franc), veins still green
- NOT ALL VINIFERA SHOW LEAF ROLLING!
- Symptoms are not necessarily diagnostic.
Cabernet franc vine positive for GLRaV-1 and/or 3
Grapevine leafroll associated virus: Biology

- Inhabits phloem tissues: disrupts flow of resources.
- Can reduce vigor, growth, yield.
- Can reduce cold hardiness
- Can delay ripening
Thank you: PWMRB, LERGP/NYWGF, Mark Wheeler, Sei Paulson, Michela Centinari, Cristina Rosa, Alex Varaksa