Basics of Grape Disease Management

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(Some slides are kindly provided by Dr. Joe Fiola and Ben Beale)
Disease Triangle – factors required for disease infection
Importance of Grape Diseases

• Short term:
  Reduce yield, and fruit / wine quality
  Reduce vine vigor $\rightarrow$ reduced yields

• Long term:
  Shorten longevity of the vineyard
What is a Plant Disease?

**Biotic Disease: Very common**
Caused by living microorganisms such as *fungi*, bacteria, and viruses.

**Abiotic Disease or Disorders: Less common**
Caused by noninfectious factors such as water/heat stress, nutrient deficiencies, soil pH, and soil structure.
Major Grapevine Diseases in the Mid-Atlantic

• Downy Mildew (oomycete)
• Powdery Mildew (fungal disease)
• Phomopsis (fungal disease)
• Black Rot (fungal disease)
• Late Season Bunch Rots * (mainly caused by fungi)

* A variety of bunch rots caused by multiple pathogens
When do you manage fungal fruit diseases? It depends on the disease!
**Important Principles for Disease Management**

1. **CHEMICALS.** *Fungi are the only pathogen group you can control with chemicals*
   - All major fungal pathogens are at risk of becoming resistant to single site of action chemical groups
   - Limit each fungicide group (FRAC codes) to 2 times a season
   - Use primarily multi-site fungicides

2. **TIMING.** Fungal pathogens vary timing of chemical control
   - Scouting and accurate disease identification are key to effective chemical use
   - Understand the environmental conditions under which you need to spray

3. **CANOPY MANAGEMENT.** Critical for control fungal fruit, leaf and cane diseases
   - Reducing humidity reduces infections
   - Canopy management increases penetration of pesticides
Important principles for disease management

4. **INOCULUM SOURCES.** Reduce disease pressure and epidemics of fungal diseases by managing overwintering inoculum
   → If survival is in wood: Dormant sprays kill overwintering inoculum on wood
   → If survival is in berries, canes, and debris: Remove from the canopy; spring cultivate, mulch, remove or burn to suppress spread

5. **CLEAN STOCK.** Important for ALL plant pathogens, but is the ONLY preventative management option for viruses and crown gall

6. **ONLY SOME THINGS CAN BE CURED**
   - There is no cure for viruses, crown gall, root rot or trunk canker diseases
   - Once it’s in the plant, removal would be the only option
**Downy mildew**

*Epidemics cause major yield losses*

*Diagnostic symptoms*
- Leaf spots with white powder on leaf underside
- Infections berries turn light brown and soft, and are often covered with the white mycelium

*The fungus overwinters on ground in infected leaves.*

*Berries become resistant with age, but leaves and fruit stems remain susceptible*

*Effective fungicides: Mancozeb, Revus, Phostrol, Zampro, Ridomil Gold, Captan etc.*

FACT SHEET FOR DOWNY MILDEW: http://nysipm.cornell.edu/factsheets/grapes/diseases/downy_mildew.pdf
**Black rot**

Epidemics can cause major yield losses

**Diagnostic symptoms:**
- Red leaf spot with very small black bodies
- Blackening of immature berries starting early in the season

*Pre-bloom to 2 weeks post bloom is the most critical spray time*

Berries become resistant with age: may have to spray until 6 weeks post bloom

Effective fungicides: Abound, Sovran, Flint, Mancozeb, Rally etc.

FACT SHEET FOR BLACK ROT: https://grapesandwine.cals.cornell.edu/newsletters/appellation-cornell/2014-newsletters/issue-17/managing-black-rot
**Powdery mildew**

Generally less important in Mid-Atlantic region

Diagnostic symptoms:
- Vary with the source of inoculum, tissue age, and the age of the mildew colony
- Characteristic powdery or dusty appearance

2 to 6 weeks following bud break typically is the most critical spray time in the Mid-Atlantic

Effective fungicides: Sulfur, Vivando, Luna Experience, Procure, Rally etc.

FACT SHEET FOR POWDERY MILDEW:
http://www.practicalwinery.com/marapr03/marapr03p16.htm
Downy mildew is easily confused with Powdery mildew
Controlled VERY differently
How to tell them apart:

DOWNY: White mildew is on leaf underside

POWDERY: White mildew is on leaf top
**Phomopsis cane and leaf spot (and fruit spot)**

**Diagnostic symptoms:**
- Black spots and scabs on green shoot
- Old shoots bleached with black spots

**Inoculum in wood and canes**

**Sanitation is important (Dormant pruning)**

*Spray from 1” shoot growth through fruit set (Broad-spectrum protectants)*

**Effective fungicides:** Mancozeb, Captan etc.

Extremely local dispersal; monocyclic nature of this disease
Late-season rots

1. *Botrytis bunch rot* (caused by *Botrytis cinerea*)

Diagnostic symptoms
- Fruit turning brown at first followed by production of gray spores

*Often occurs after varaison as fruit is nearing harvest*

Overwinter as sclerotia in berry mummies or as dormant mycelium in plant debris

*Largely relies on fungicide control, but resistance issues are common*

Effective fungicides: Captan, Switch, Kenja, Luna Experience etc.
2. Ripe rot (*caused by Colletotrichum spp.*)

Symptoms: berry shriveling and browning; black specks on surface

Overwinters in mummified fruit or plant debris

Dispersal by water splash and/or wind

Infection can occurs anytime from bloom to harvest
3. Sour rot (disease complex)

- Characterized by sour odor
- Considered to be a disease complex, consisting of insect damage (fruit flies), bacterial and fungal infections.

- No fungicides available
  - Good control of fruit flies after 15 Brix may be helpful
4. Other late season rots

In an association with secondary pathogens such as Alternaria, Aspergillus, and Penicillium.... Secondary pathogens normally need entry points to infect
An example of schematic diagram of fungicide spray schedule

Preventative sprays are of paramount importance!
Fungicides should be applied before disease occurs!

FRAC codes included:
M3 (3x), M4 (3x), FRAC 1 (1x), FRAC 3 (2x), FRAC 7 (2x), FRAC 9 (1x), FRAC 12 (1x), FRAC 40 (2x)
FRAC 45(1x)
Management of other important diseases in the region

Grapevine leaf roll virus
About 25% of vines with premature senescence symptoms are GvLR
Tested for in clean stock programs
Mealy bug vectored in the vineyard

Grapevine red blotch virus
Newly described disease
About 21% of vines with premature senescence symptoms are GvRB—hard to distinguish from GvLR
VA creeper leafhopper and *Spissistilus festinus* vectored in the vineyard

FACT SHEETS: [http://www.nysipm.cornell.edu/factsheets/grapes/diseases/grape_leafroll.pdf](http://www.nysipm.cornell.edu/factsheets/grapes/diseases/grape_leafroll.pdf)
Crown Gall: caused by Agrobacterium vitis

- A big problem in cold years: facilitated by winter injury
- Kills vines; No chemicals are truly effective.
- Clean stock; avoid cold locations for sensitive varieties

Trunk cankers (many fungi)
- Will reduce longevity of vineyards over time
- Present in ~15% of vines in this region
- Control: clean vines, pruning in the spring / double pruning; minimize harvest / nutrient stress

Pierces disease (a bacteria)
- Southern and eastern shores
- Proximity to woodlots very important
  → Insect vector survives on alternate hosts
- Control: cut out diseased canes

Minor viruses
- Clean nursery stock
Putting It All Together

• Use an integrated approach: Proper canopy management, biological controls, good variety selection, sanitation, and fungicides.

• Target fungicide applications on current and near term weather, growth stage, disease pressure and environment.

• Use spray guides to develop an initial plan and modify as the season develops

• Rotate mode of actions. Pay attention to reports of fungicide resistance in your area.
Putting It All Together

• Expect 5-8 fungicide applications the first and second year
• Expect 12-16 fungicide applications for years 3 +
• Organic grape production is challenging due to the high disease pressure in our area. Organic producers will still need to apply multiple sprays using OMRI approved products
2016 New York and Pennsylvania Pest Management Guidelines for Grapes

Sample Wine Grape Spray Schedule - 2016

Target Diseases | Anticipated Pressure
--- | ---
Crown Gall | Very High
Phylloxera | High
Phomopsis | Low
Botrytis | Low
Bacterial | Medium
Gray Mold | High

Assumptions:
- Downy Mildew likely resistant to streptomycin type fungicides and Primine/Endura
- Powdery Mildew likely resistant to streptomycin type fungicides
- Early blight resistant to streptomycin type fungicides
- Best products for wine: Luna Experience, Primax
- Best products for downy mildew: Rovral Gold, Mancozeb, phostoxin, and 3-phenoxybenzyl (second to Rovral and Mancozeb—good prevention)
- Best products for powdery mildew: Luna Experience, Gaunec
- Varieties being sprayed are NOT sulfur sensitive
- Disfomer: Always read the pesticide label. The label is the law and users must follow all rates and restrictions according to label directions.
### Efficacy of selected fungicides against diseases of bunch grapes

<table>
<thead>
<tr>
<th>Chemical name (Fungicide product name)</th>
<th>Anthracnose</th>
<th>Black rot</th>
<th>Botrytis rot</th>
<th>Downy mildew</th>
<th>Phomopsis cane and leaf spot</th>
<th>Feretery mildew</th>
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</thead>
<tbody>
<tr>
<td>Azoxystrobin (Abound)</td>
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<td>Borecoid (Endurant)</td>
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<td>Borecoid + Pyraclostrobin (Pristine)</td>
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<td>Captan (Capitan, Captan, etc.)</td>
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<tr>
<td>Copper oxychloride and Bordeaux mixture (various)</td>
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<td>Cyazofamid (Tivam)</td>
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<td>Cyprodin (Vanguard)</td>
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<td>Cyprodin + Flashzone (Switch)</td>
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<td>Cyprodin + Difenoconazole (Larrie Super)</td>
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<td>Fenbuconazole + cymanzal (Tano)</td>
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<td>Fenbuconazole (Elevate)</td>
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<td>Ferti (Ferbox)</td>
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<td>Fenvianon (Fernish)</td>
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<td>Fluazinam (Prestige)</td>
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<tr>
<td>Fludioxonil + tebuconazole (Luna Experience)</td>
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<td>Fludioxonil + pyraclostrobin (Luna Transquility)</td>
<td>NA</td>
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<td>Hydram (Reveral Meteor)</td>
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<td>Mefanoxam (Sova)</td>
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<td>Luna Sulfur + copper application</td>
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<td>Mancozeb (various: Pancozeb, Dithane, etc.)</td>
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<td>Mancozeb (Revers)</td>
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<td>Manzol (Mancozeb (Kraai Top))</td>
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<td>Mefanoxam + Copper (Kromasil Gold Copper)</td>
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<td>Mefanoxam + Mecobal (Kromasil Gold MZ)</td>
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<td>Metrafenone (Vimzone)</td>
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<td>Myrobactrin (Rally)</td>
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<td>Phosphonate (Pro-Phyt, Phascet, etc.)</td>
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<td>Sulfur (various)</td>
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<td>Tefometzono (Eteze)</td>
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<td>Thiram (Kollert)</td>
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<td>Thiamethoxam methyl (Topin M)</td>
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<td>Thidiazmino (Fiat)</td>
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<td>Trifunazol (Procure and Viticure)</td>
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<td>Ziram (Ziran)</td>
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</table>

* The efficacy rating: NA = no significant activity, + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity, ++++ = excellent activity

* Resistance (or occasional failure of control) has been observed in some southeastern states, thus, if control failure occurs, it could indicate resistance has developed. The efficacy rating could be impacted by resistance development. If resistance has occurred, use of fungicides in the same class would likewise show resistance, and a substitute fungicide should be considered for pathogen management.

* Insufficient data for the pathogen-chemical combination. The rating was given based on the general knowledge on the material.

* Sulfur will cause burn on sensitive varieties, especially on hot days. >SF.
Books / other resources

• A Pocket Guide for Grape IPM Scouting of Grapes in North Central & Eastern U.S.
• APS Compendium of Grape Diseases
• Guidelines for Developing an Effective Fungicide Spray Program for Wine Grapes in Maryland, 2012 (+ 2013 update)
MyIPM Smartphone Application

A tool to facilitate communications of IPM (Integrated Pest Management) practices and improve fungicide resistance management

**Main features:**

1. Active Ingredient and Tradename tables
2. High-quality disease pictures
3. Fungicide Efficacy, PHI, REI, Rate, and Toxicity info
4. Pest Biology ....

A Live Demo......
Any questions?

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