

**Grape Disease Management Update**  
**Early Season, 2024**  
*VCE Monthly Viticulture Meetings*  
4 April 2024

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Fungicide resistance  
Some fungicides are no longer effective

- But why do we need to care about it?  
Chemical companies will produce more products to sell!
- Well, not really...  
Here is a list of recently introduced materials.

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# Pesticide resistance

After several years of use, some pesticides, especially newer ones, become less effective

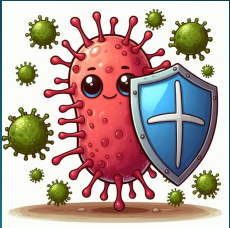
Many new pesticides are targeting a specific gene or gene function

Some of the population (isolates) were not sensitive to begin with

Mutation of the target gene (or gene function) happened after exposure to the fungicide.

Highly specific and thus often safer to other organisms.

Other benefits, such as movement of the chemical into plant tissues



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FRAC groups describe the mode of action = how the pesticide kills or inactivates the target pest and pathogen

GROUP 17 FUNGICIDE

**Elevate 50WDG**  
Fungicide

50% Water Dispersible Granule for Control of Botrytis and Monilinia Diseases and Suppression of Powdery Mildew in Various Crops

**FOR AGRICULTURAL USE ONLY**  
Not for Residential Use

**INGREDIENTS**

|                   |        |
|-------------------|--------|
| ACTIVE INGREDIENT |        |
| Fenhexamid        | 50.0%  |
| OTHER INGREDIENTS | 50.0%  |
| Total             | 100.0% |

\*N-(2,3-dichloro-4-hydroxyphenyl)-1-methyl-cyclohexane carboxamide

For Product Use Information Call: 1-866-761-9397

E.g., fungicides in FRAC = 11 works in the same manner regardless of chemical names or manufacturer.

**FRAC (Fungicide Resistance Action Committee)**  
<http://www.frac.info/>

**IRAC (Insecticide Resistance Action Committee)**  
<https://www.irac-online.org/>

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## Why should we care?

### Examples of relatively new fungicides for grape production and their mode of action

| Trade name | Chemical name       | FRAC group | Year introduced | Materials in the same FRAC group                 |
|------------|---------------------|------------|-----------------|--|
| Aprovia    | Benzovindiflupyr    | 7          | 2018            | Boscalid, Luna                                   |
| Miravis    | Pydiflumetofen      | 7          | 2019            | Boscalid, Luna                                   |
| Kenja      | isofetamid          | 7          | 2018            | Boscalid, Luna                                   |
| Rhyme      | flutriafol          | 3          | 2019            | Rally, Elite, etc.                               |
| Ceyva      | mefentrifluconazole | 3          | 2021            | Rally, Elite, etc.                               |
| Intuity    | mandestrobin        | 11         | 2018            | Abound, Flint, etc.                              |
| Oso        | Polyoxin-D          | 22         | 2016            | Ph-D. The same chemical was available since 80's |
| Prolivo    | Pyriofenone         | 50         | 2018            | Vivando  |

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## Not all fungicides in the same group are made equal.

- Newer generations of group 7 materials (Luna, Aprovia, Kenja, Miravis, etc) have a different way of attaching to the target site
- These differences were enough to make each chemical unique
  - I.e., Not all the boscalid-resistant isolates (previous generation group 7 material) are resistant to Kenja, Luna, or Aprovia
  - Aprovia and Miravis work differently, too.
- However, fundamentally, these materials work the same way.



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## Use the appropriate material for the pest at the right timing

- Misuses of pesticides can lead to unnecessary applications.
  - E.g. Timing: We do not recommend Botrytis fungicide application before bloom because clusters are not susceptible, yet.
  - E.g. Pathogen: Fungicides specific for downy mildew (e.g., Ridomil) often does not work on powdery mildew or any other fungal diseases.

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## Timing of application differ among different targets



**Fungicide:** fungal diseases in our environment are better managed by protecting vines BEFORE infections. Once they establish their foothold in the plant, it will be very difficult to manage.

i.e., Do not wait until you see diseases!!!



**Herbicides:** pre-emergence to target seeds and post-emergence to target seedlings when they are small



**Insecticides:** often applied AFTER you see enough number of the target insect pest

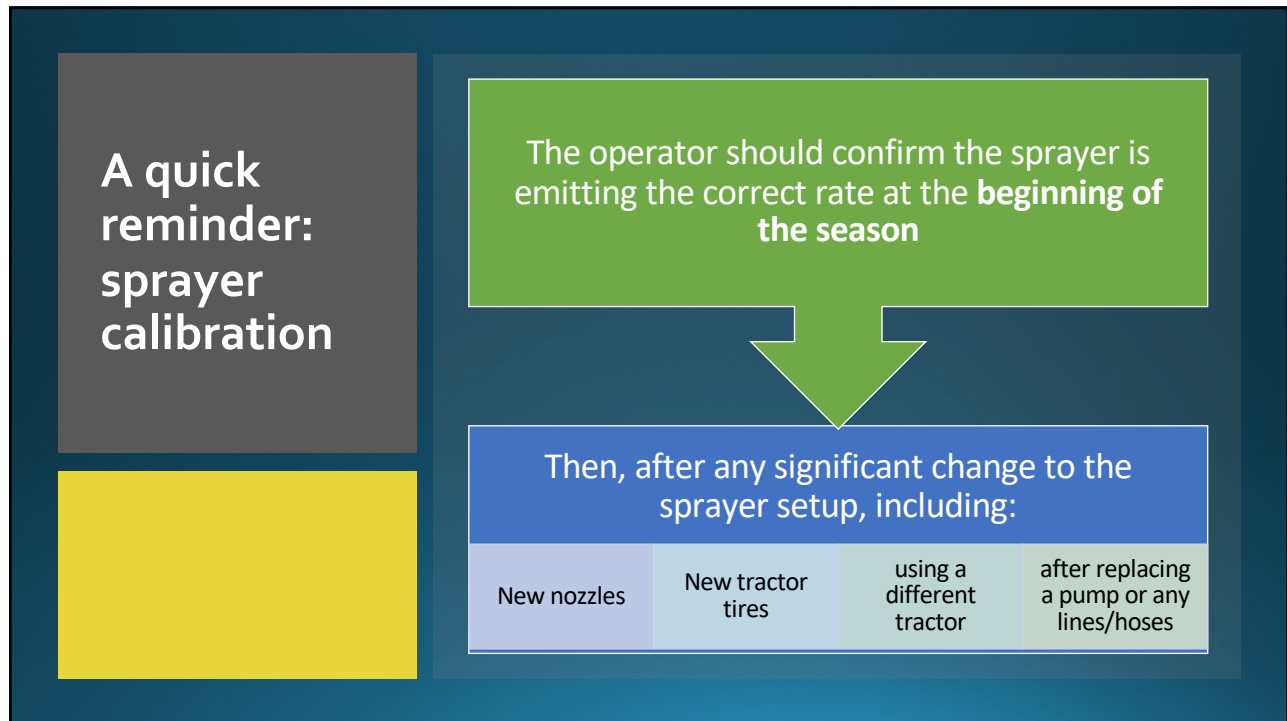
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## Use the recommended rate of the material

- Do not use a lower rate than listed on the label.
- Exposure to a lower-than-lethal dose can lead to the development of resistance
- Make sure that your sprayer provides good coverage!

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**More than one application and the use of multiple modes of action are required**

**In commercial settings:**

- Mix with a relatively low-risk fungicide
  - Do not rely on the material with number-only FRAC (e.g., 3, 40, etc.)
- Rotate pesticide mode of action between treatments.
  - Limit the use of high-risk materials
  - Use of “alternative” fungicides: biocontrols and plant defense activators

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## Example of the mixing partner in grape production: Mix one of them with other MOA

- **Black rot:** mancozeb (M<sub>3</sub>), ziram (M<sub>3</sub>)
- **Downy mildew:** mancozeb (M<sub>3</sub>), copper (M<sub>1</sub>), captan (M<sub>4</sub>), ziram (M<sub>3</sub>), phosphite (Po<sub>7</sub> - please do not overuse!)
- **Powdery mildew:** sulfur (M<sub>2</sub>) [some growers use stilet oil, but the oil cannot be used with sulfur or captan - make sure to have at least two weeks in between sprays!]
- **Botrytis:** captan (M<sub>2</sub>) or copper (M<sub>1</sub>) (both are poor-to-fair materials for Botrytis, but I think they are good mixing partners)
- **Ripe rot and bitter rot:** mancozeb (M<sub>3</sub>), captan (M<sub>4</sub>), or copper (M<sub>1</sub>) (copper products do not list ripe rot as a target, but provided moderate reduction in some of our trials)

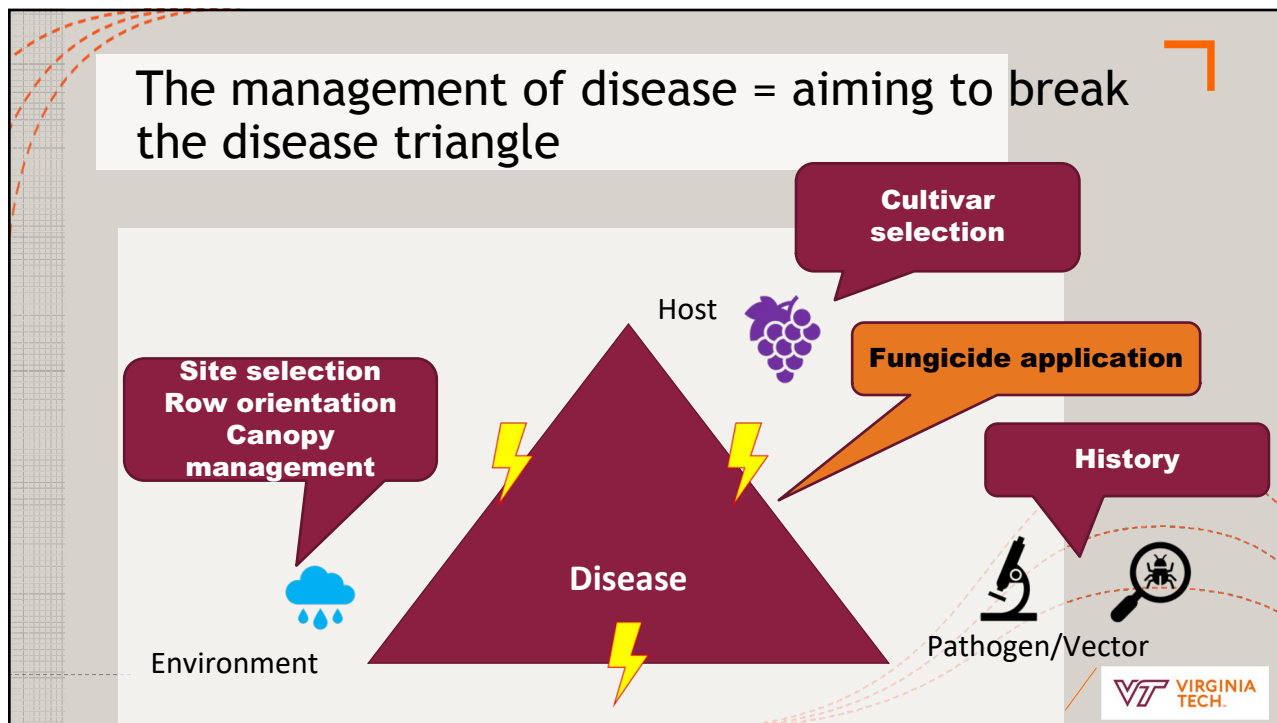
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## Spend time BEFORE the season starts!

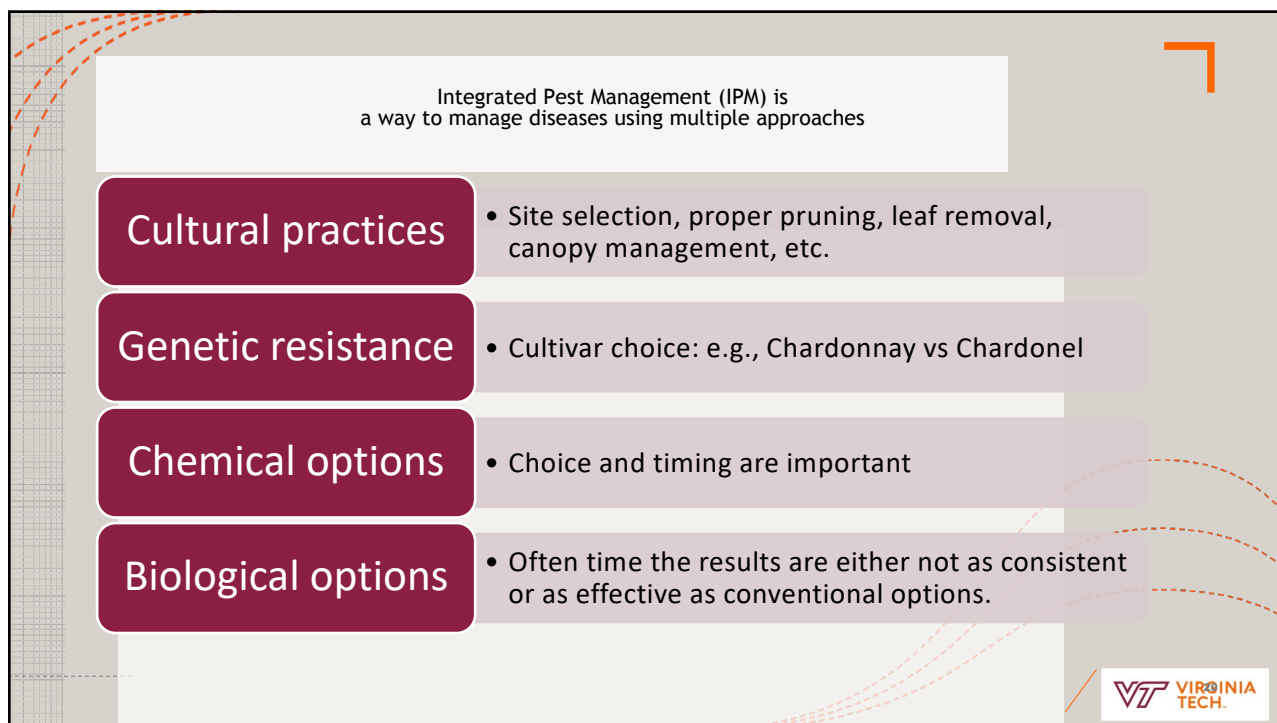
- You can create your plan(s): Yes, your plan will change depending on the weather, but it will help you plan your season and purchase materials.
- Please attend one of our workshops. ;)



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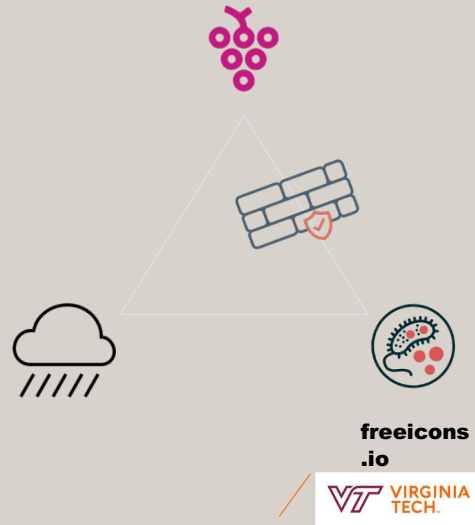


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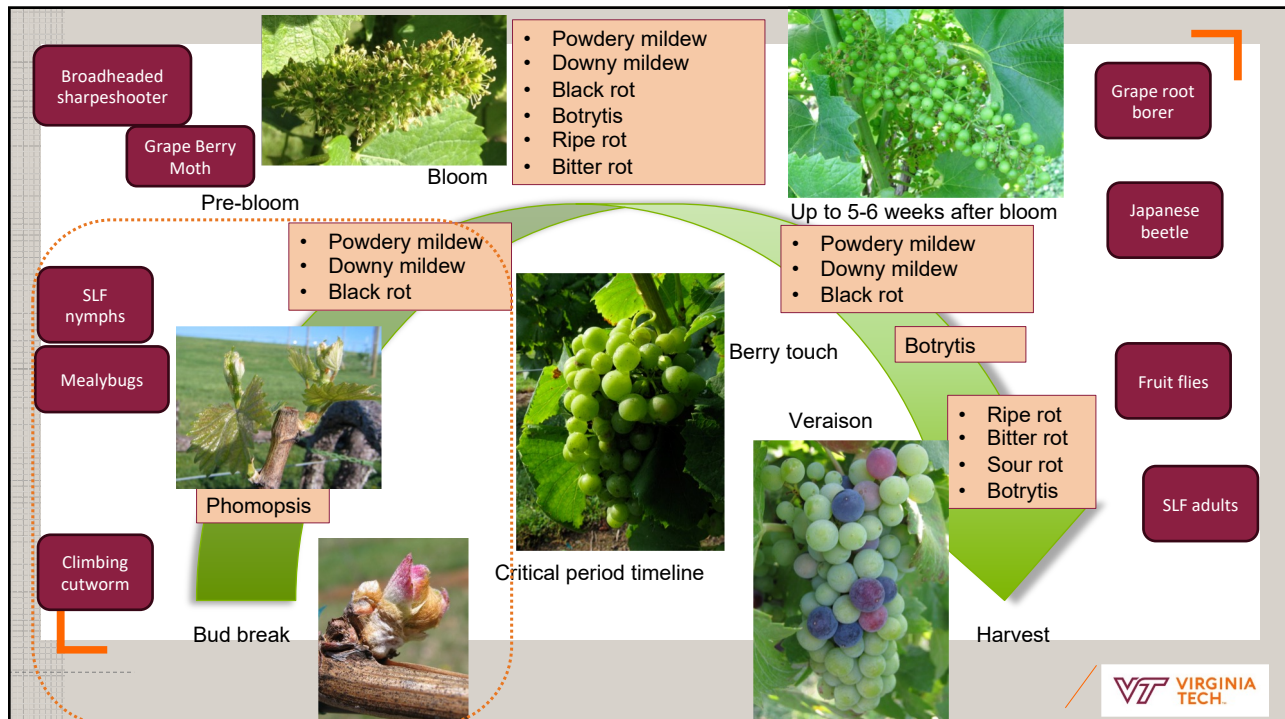


## Biofungicides: Biological control agents and plant defense activators (not the main focus for today)

- **These are different from conventional fungicides in many aspects.**
  - **Competition, interruption, predation, antagonistic, or turn on plants' defense mechanisms**
- **Preventative application is the best practice.**
  - **We need to set the stage for them before pathogens come in contact with the host.**
  - **Both biofungicides and conventional materials won't work after you see diseases.**
  - **We need to know the target pathogen(s) for each product**



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# Bud break

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# Phomopsis




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Phomopsis cane and leaf spot of grape

**Protecting young shoots (~ 1 to 3 inches) is important.**

**Mancozeb, QoI, and SDHI work well**



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**Protective application at 1-3 inch shoot growth is the best for management of Phomopsis cane and leaf spot**

**Good materials (*Note: Group = FRAC group = Mode of action*)**


**Mancozeb (Group M3), Ziram (Group M3), and Captan (Group M4)**

**Fair to Good**

**QoI/Strobilurins (Abound, Flint, Intuity, Group 11), Topsin-M (thiophanate-methyl, Group 1), Pristine (pyraclostrobin + boscalid (Group 11 and 7), and some SDHI (Aprovia, Miravis Prime, etc. , but you probably want to keep these for other diseases)**

**Poor**

**Fixed copper (Group M1), sulfur (Group M2), lime sulfur**



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## Dormant application of lime sulfur against Phomopsis (and very effective on anthracnose!)

**Phomopsis survives in infected woody tissues from the previous years.**

**If you have a serious Phomopsis issue, a dormant application of lime sulfur (10 gal/A or 1 gal/A with Sulforix) is recommended**

**Sulforix seems to be better due to its low rate**

**Its efficacy is “fair”, and even with the dormant fungicide application, in-season applications of mancozeb to protect young shoots (from 1 inch to several inches, until your downy mildew treatment starts) is very important.**



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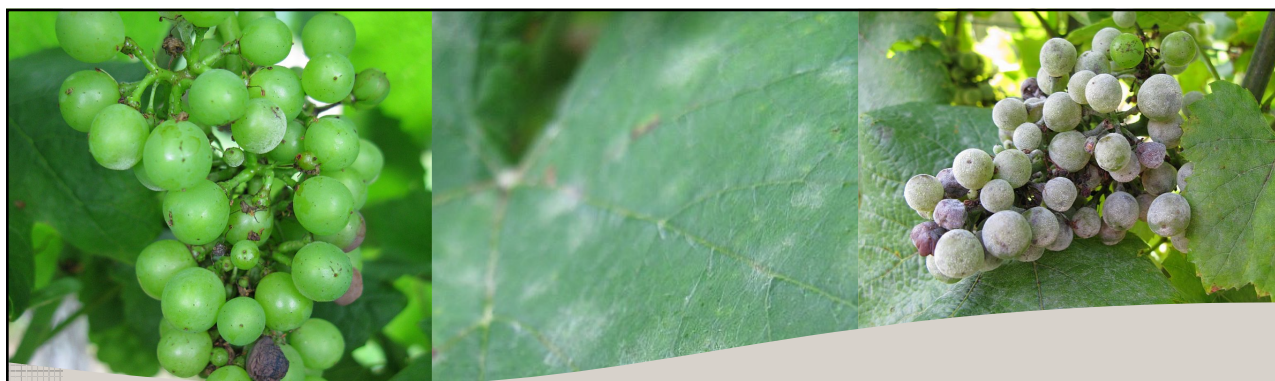
## Climbing cutworms

They feed on emerging buds



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## *Powdery mildew*



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## Powdery Mildew Management

### **Canopy management for**

**Good air circulation**

**Good light penetration**

**Timing for chemical management is pre-bloom to harvest**

**However, the risk of infection is low when the temperature hits 90F or higher, so, if you keep the vines clean until mid-July or so, you may not need to worry about powdery mildew.**

**Young berries infected by the powdery mildew pathogen tend to crack open later, thus, early season PM management will be important for Botrytis, sour rot, and fruit fly management too!!**



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## Powdery Mildew

Timing: pre-bloom to harvest

Clusters are susceptible from bloom to 4-6 wks after bloom

**Good: Sulfur (Group M2), Vivando (50 (used to be U8)), SDHI (Pristine, Endura, Luna Experience, Kenja, Aprovia, Miravis Prime, etc. Group 7), Good, but...: DMI (Sterol-inhibitor, Rally, Mettle, Rhyme, Top Guard EQ (3+11), etc., Group 3), Quintec (Group 13, one case of resistant isolate found in VA)**

**Fair: Fixed copper (Group M1), Torino (Group U6), etc.**

**DMI: there are evidence of chemical resistance in Europe, AND good evidence of resistance development among VA isolates**

**Torino works, but not as strong as others. Good mixing partner to sulfur to have an extra kick**

**Bad: Qol (group 11) or Topsin-M most likely not going to be help**



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## Powdery Mildew Management “Curative” fungicide options

**Stylect Oil (Group M) [early season, some varieties may show phytotoxicity when applied on premature fruits]**

**Efficacy = Good**

**DO NOT mix oil with sulfur or captan!!!**

**Cannot spray within two weeks of each other**

**You may be able to spray a certain oil product then sulfur after one week (try in a small area first!)**

**Potassium salt products (Group M, Kaligreen, Milstop, etc.)**

**Efficacy = Good**

**Requires through coverage, and it is expensive!**



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# Downy Mildew



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## Downy mildew

### Canopy management

**Pre-bloom:** Consider not only infection event (=rain), but also warm and humid nights (>60F and 80-90%) that promote spore production (2009, 2013, and 2018...)

**Overwintering spores are active for 3 to 6 months**

**After bloom:** Critical time for the cluster runs about 4-6 weeks.

**After critical time:** Leaves are still susceptible to the infection.

**Late summer infections**



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Downy Mildew  
 Timing: all season  
 Clusters are susceptible from bloom to 4-6 wks after bloom

#### Preventative fungicide application

**Good: Mancozeb, ziram (Dithane, Penncozeb, Gavel, etc. Group M3), Ranman (Group 21), captan (Group M4), copper (Group M1)**

**Good, but...: Revus/Forum (Group 40 - resistance spreading quickly), Zampro (Group 40 + 45),**

**Don't know: Lifeguard and Zonix (defense activators) - inconsistent reports, please use them with a caution (can be a good rotation or tank mix partner)**

**Bad: Any QoI (Group 11) fungicides (e.g., Aboud, Pristine, etc.)**



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Downy Mildew  
 Timing: all season  
 Clusters are susceptible from bloom to 4-6 wks after bloom

#### **Kick-back fungicide application (after the rain, not after you see downy!)**

**Good: Phosphonate (Prophyt, Phostrol, etc. Group P07 (used to be 33)), Ridomil products (Group 4),**

**Poor: Tanos (Group 11 + 27) note: we did not find a good result with Tanos in VA), Tanos need a mixing partner**



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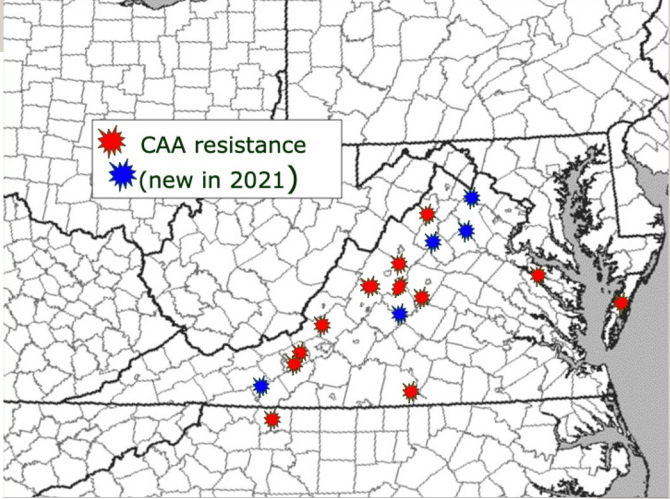



## Group 40 (Revus, Forum, and part of Zampro)

**Dr Anton Baudoin's lab at VA Tech has been tracking resistance isolate against dimethomorph (the a.i of Revus), and results are not promising...**

**If you suspect that Revus is not working for you, it is probably better not purchase in the future.**

**If you have some, my recommendation is to use it early in the season as protectant and mix with captan, mancozeb, or copper.**





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## SLF management

**Do not panic! We have a list of effective materials.**

**For vineyards, wait until they move into leaves and shoots (~ mid-May in our areas).**

**One spray should be good for the rest of the season until they migrate into vineyards from the outside.**

**You can select materials to hit more than one species.**

**E.g., May spray to deal with mealybugs and SLF**



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# Grapevine leafroll disease

**Caused by several species of grapevine leafroll-associated viruses.**

**Vectored by mealybugs and scale insects.**

**Timing: early spring (2-3 weeks after bud break) and bloom**

