1

Agenda: 10 July 2025

Fungicide resistance updates

Dr. Anton Baudoin

Seasonal Grape Disease Management Considerations

Dr. Mizuho Nita

Seasonal Viticultural Considerations

Dr. Drew Harner

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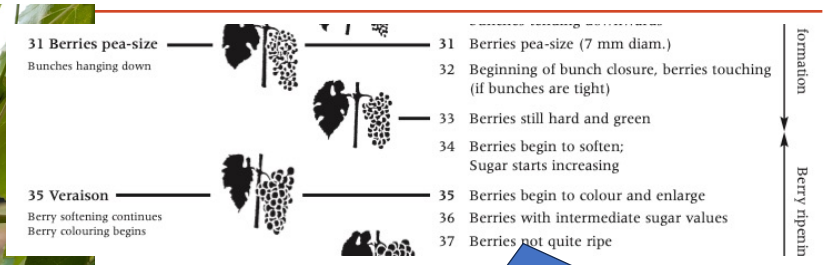
Veraison to Pre-harvest Grape Disease Managemenrt



Sentinel Vineyard Group reported 33 - 34

One of my table grapes this week.

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Resources

1. My blog
    1. My Extension Portal
        1. Handouts and Slides
    2. Weekly Disease Updates
    3. Fungicide template (Google Sheets -> please download it before use)
    4. I changed the notification system Google Groups = Viticulture Note
    5. Facebook (GrapePathVATech) and Twitter (@grapepathology) notification are also available.

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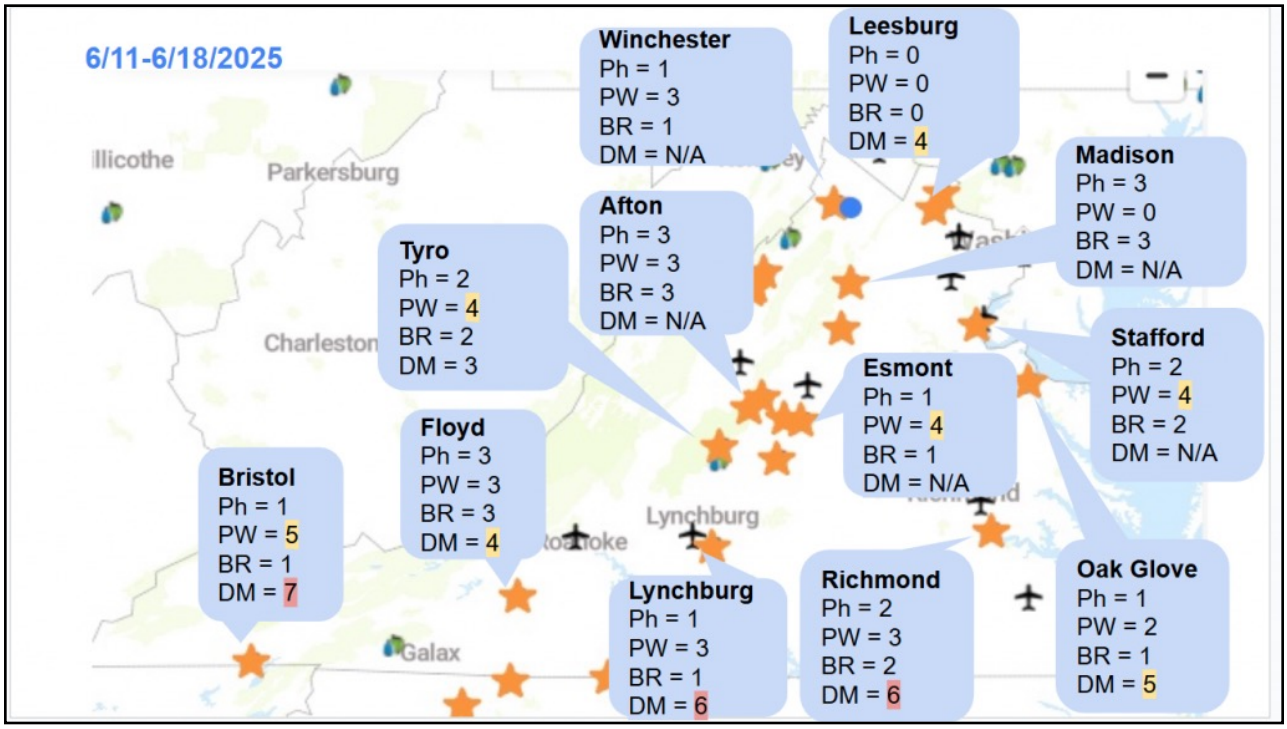
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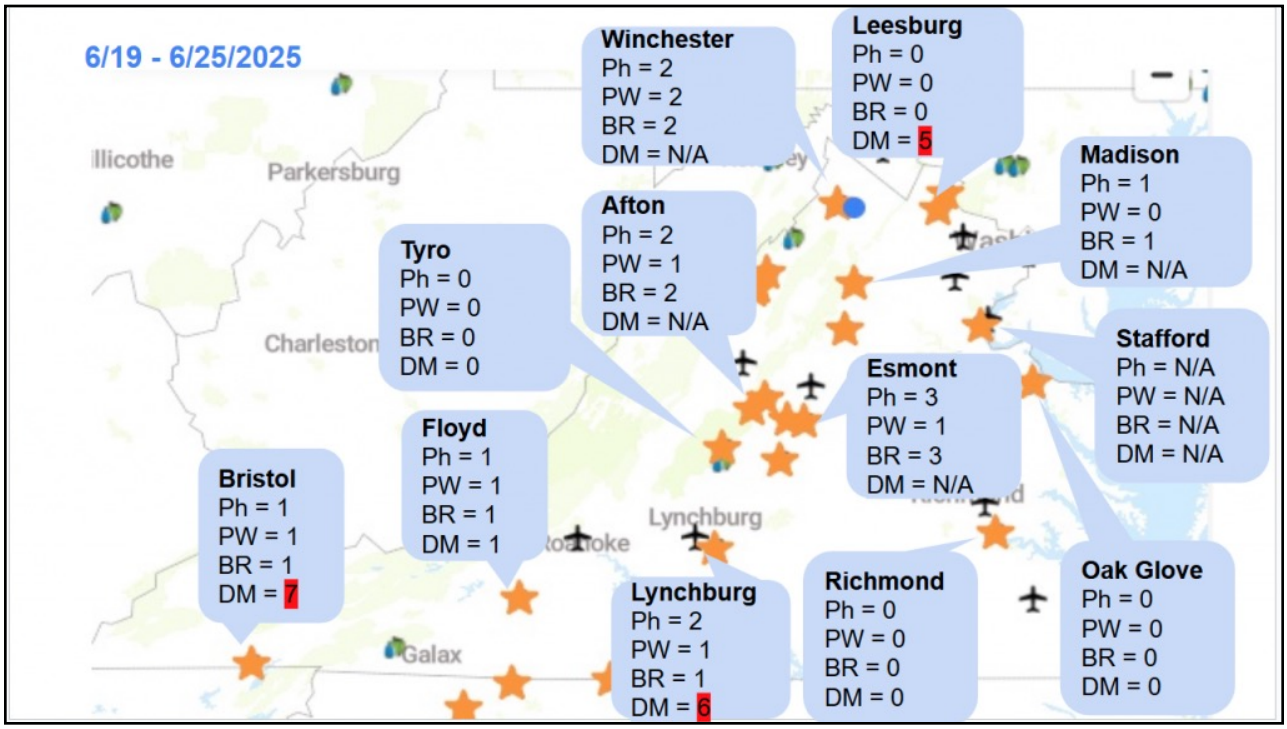
Galax

26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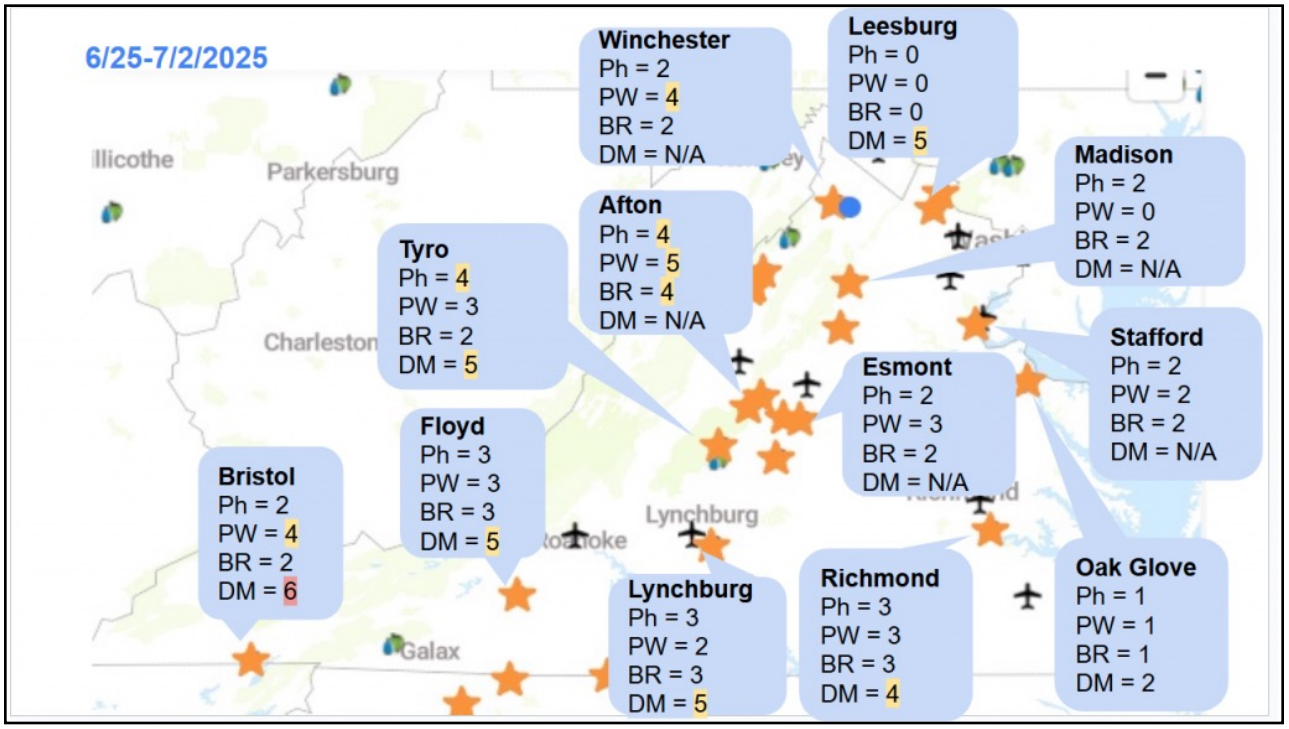
Galax

27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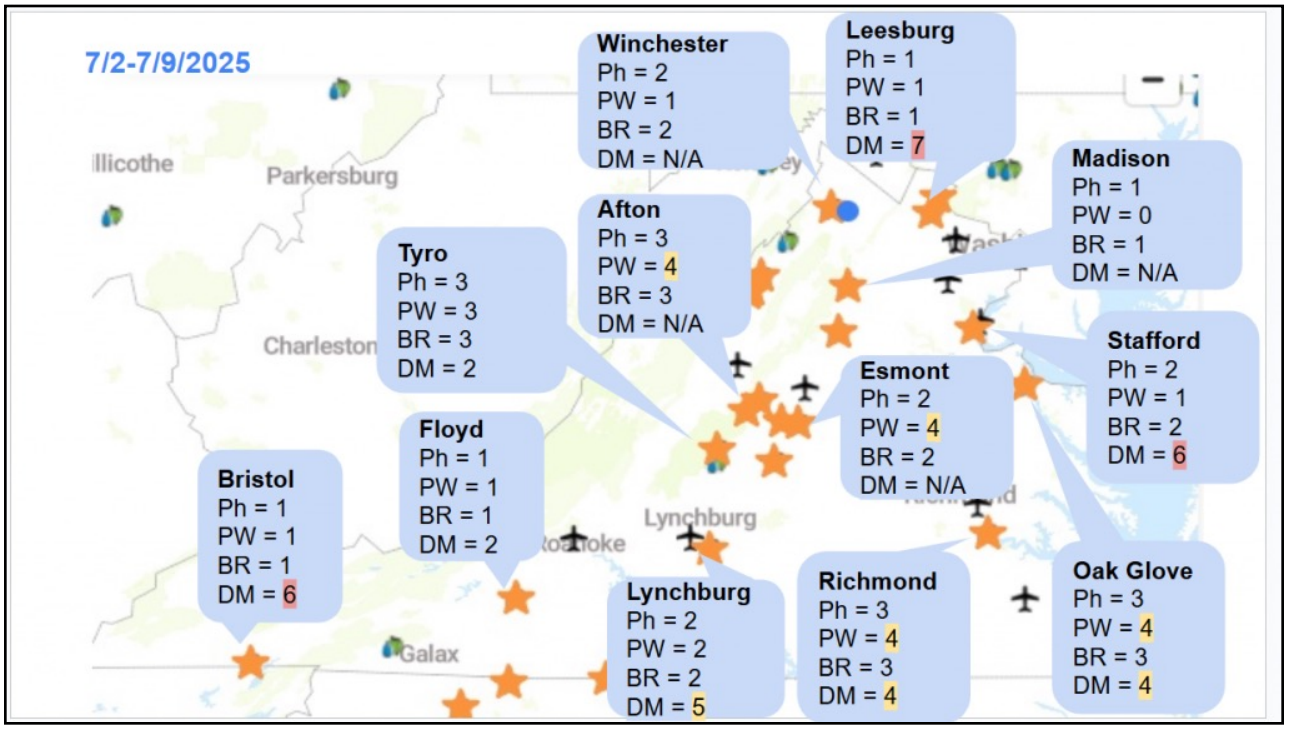
28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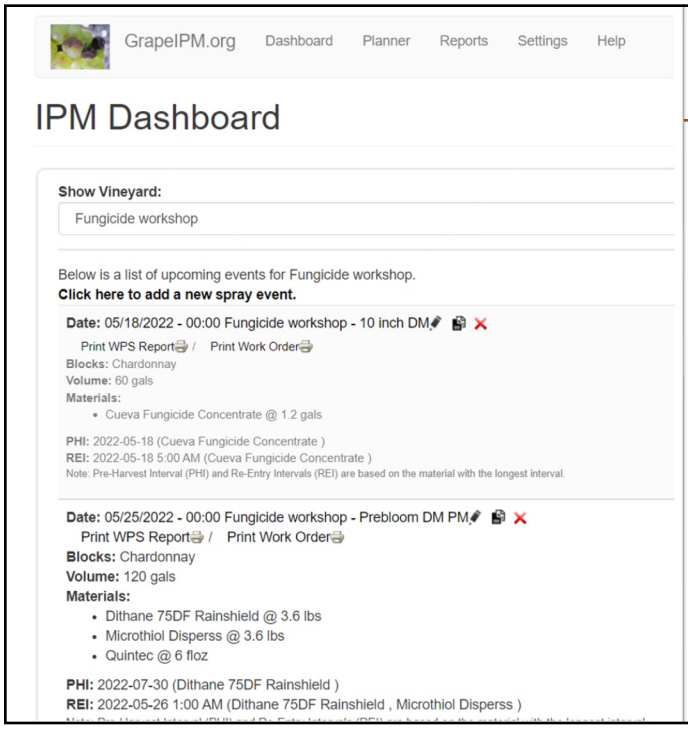

GrapeIPM.org

- Personal database for growers
  - Inventory management
  - Spray planner and support system
  - Record keeping
  - Reporting (e.g. Worker Protection Standard requirements.)

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Pest Management Guides and other resources from VCE

Commercial Grapes
Look for Grape under “Chapter” menu on the right

Home Garden
Look for Fruits Chapter

Misc. Grape Guides

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NEWA: Network for Environment and Weather Applications

- https://newa.cornell.edu/
- Agriculture Weather Network operated by Cornell University
- Virginia Tech is a partner institute
  - Our AREC faculty members pay annual fees to cover for Virginia

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NEWA: Grape Diseases

Grape Disease Infection Events

Download CSV

Forecast Details

DATE (2024)	PHOMOPSIS	POWDERY MILDEW	BLACK ROT
June 9	No	No	No
June 10	No	No	No
June 11 Forecast	No	No	No
June 12 Forecast	No	-	No
June 13	No	-	No

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Spotted Lanternfly and Grape Berry Moth Model as of today

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Downy mildew…

I have a difficulty with the NEWA model in the past two years…

We are developing an alternative option.

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Related projects

- Downy mildew prediction model using freely available model-based weather data (i.e., you do not need a weather station)
- Please contact me, if you wish to test it this year.

VIRGINIA WINE

Virginia Wine Board supported project

Grape Downy Mildew Risk Assessment System

Mizuho Nita (nita24@vt.edu), Naohiro Murayama, Shuichi Ohno, and Kazunori Hayashi

Reporting date: 12 June, 2024, 07H

Thank you for volunterring our grape downy mildew risk assessment model beta-test. This is our effort to use a public weather data to forecast grape downy mildew risk events. It assesses night-time temperature and relative humidity to estimate spore production level. Then, it uses a 48-hour and 7-day forecast data to assess risk of infection.

At this point, we are still in beta-testing phase. We do need your inputs on the interface improvement and also accuracy of the information at your site. Please feel free to contact me (nita24@vt.edu) for suggestions, concerns, etc.

This effort has been funded by the Southern Region Small Fruit Consortium (2023-2024) and the Virginia Wine Board (2024-2025)

Note: Weather information is based on OpenWeatherMap.org, and we do not have control over its accuracy.

version 2024.4EN

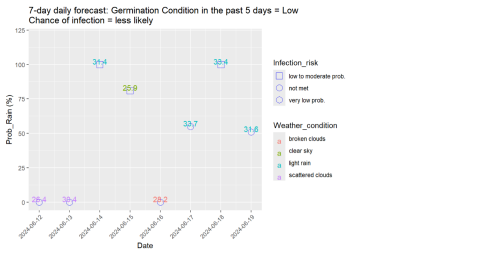
Location = AHS AREC, Winchester, VA

Downy mildew infection risk based on a 48-hour weather forecast

Time	Ave_Temp (°C)	Max_Temp (°C)	Min_Temp (°C)	Rain_Hour	Prob_Rain (%)	Infection_Risk
~24h	19.3	27.7	13.7	0	0	not met
25h~48h	23.9	32.4	15.7	0	0	not met

Downy mildew infection risk based on a 7-day weather forecast. Please note that this will be less precise than the 48-hr one.

The color of icon: Blue = Low risk due to low spore production in the past five days.



Date	Description	Ave_Temp (°C)	Prob_Rain (%)	Amt_Rain (mm)	Infection Risk
2024-06-12	scattered clouds	26.4	0	0.00	not met
2024-06-13	scattered clouds	30.4	0	0.00	not met
2024-06-14	light rain	31.4	100	1.82	low to moderate prob.
2024-06-15	clear sky	25.9	81	0.00	low to moderate prob.
2024-06-16	broken clouds	28.2	0	0.00	not met
2024-06-17	light rain	33.7	55	0.99	very low prob.
2024-06-18	light rain	33.4	100	2.04	low to moderate prob.
2024-06-19	light rain	31.6	51	0.60	very low prob.

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Seasonal overviews

The scale and goal of your operation matters.

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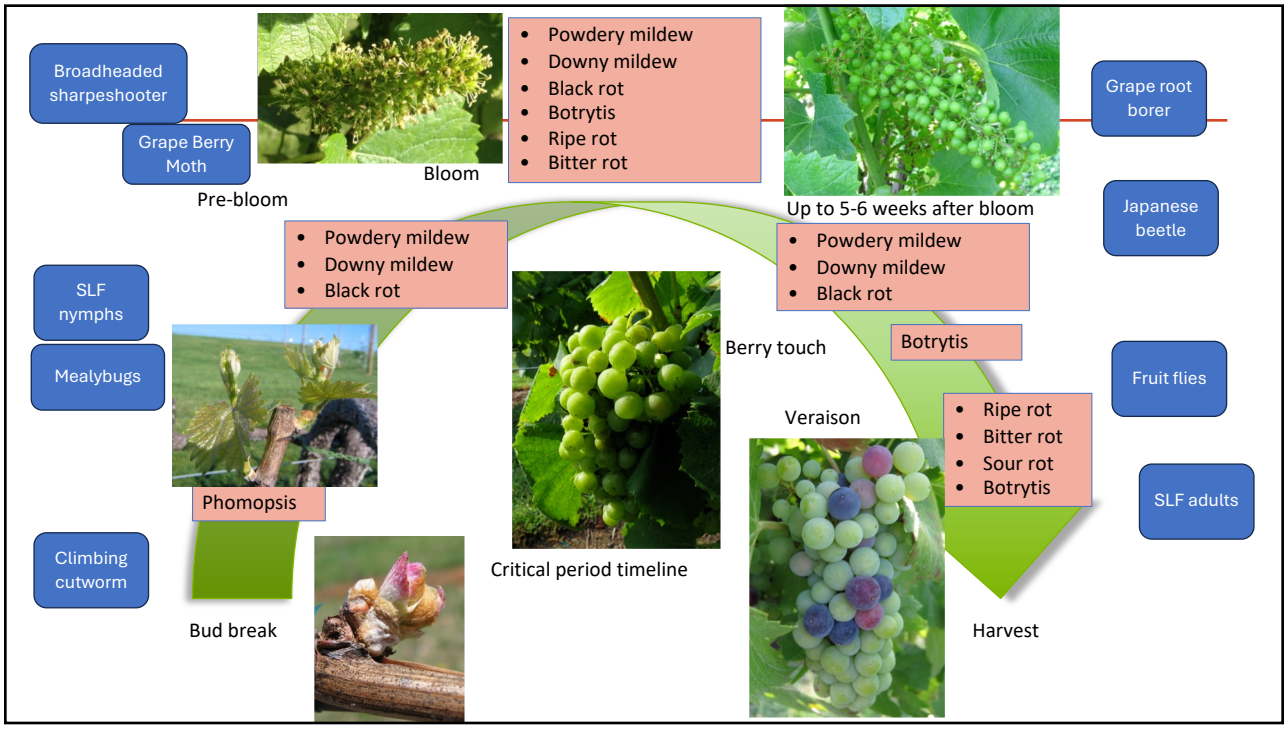

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Powdery mildew

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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), Stylet Oil (Group M)

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

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Powdery Mildew: "Curative" fungicide options

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

- Efficacy = Good, needs a good coverage
- **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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Powdery mildew outbreak?

It is safer to use sulfur or oil-based materials.

For the next year, use SDHI+DMI fungicides at pre-bloom.

We have tested Miravis Prime + Sulfur at pre-bloom, repeated in 7 days (at bloom) for two years, and it resulted in a significant reduction in powdery midew (100% to almost none).

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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 a critical time, Leaves are still susceptible to the infection.
  - Late summer infections: Watch out for humid nights

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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 21m- 30-day PHI), captan (Group M4), copper (Group M1)

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

Mixed: Lifeguard (defense activator) and Zonix (blocks spores) - 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.)

69

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): Both have the potential fungicide resistance risk

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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Downy mildew: after an outbreak

Stick with copper, mancozeb, or captan

Spraying other materials will increase the risk of fungicide resistance.

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Downy mildew: Biopesticides?

My student, Jonathan Ames, is currently evaluating several materials.

So far, Zonix seems to be OK: i.e., it can suppress downy mildew to some extent.

- Zonix can be a good mixing partner or a material for a low-pressure situation (the coverage could be critical).
- A runner-up was Stargus

A very weak material was Lifegard, but not good enough to recommend…

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Botrytis management

Timing: At bloom, bunch closure (the last opportunity to deliver fungicides inside of the cluster), and at veraison (spore availability)

Canopy management is critical because the outbreak is often associated with a long wetness event.

Injury management (***Grape Berry Moth***, Birds, PM) is also important

Caps remaining on clusters ***can*** host the pathogen

It won't be the major source of inoculum, but make sure to have good coverage!

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Botrytis Management
Preventative fungicide options

Fair to Good: Group 2: iprodione (Rovral/Meteor – resistance = low/mod risk),

Good, but…: Group 7 (SDHI): ~~boscalid (Endura),~~ Luna Experience, Kenja, Miravis Prime (– resistance = high)

Good: Group 9: cyprodinil (Vanguard, Inspire super, Switch- resistance = mod)

Good: Group 12: cyprodinil + fludioxinil (Switch – resistance = mod)

Good: Group 17: fenhexamid (Elevate – resistance = unknown)

Fair: Group 19: polyoxins (Oso, Ph-D – resistance = mod)

Fair: Group M4: captan – fair activity, but it will be a good mixing partner!

Fair: Group M1: copper (the same comment as above)

Bad: QoI fungicides, Pristine (7 + 11), Topsin-M

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Ripe rot

Caused by *Colletotrichum* species.
We found the average of 2.7 species per vineyard in our previous survey.
They vary in the level of susceptibility against fungicides.
We tested 10 modes of action, but **none** produced satisfying results consistently.

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Ripe rot application timing: at bloom, veraison, plus you may need one or two more, if you have susceptible cultivars with a history of outbreak…

- All materials shown here are "fair" in efficacy by itself
- MIX mancozeb (M3), captan (M4) or a fixed copper (M1) with
  - a QoI (Pristine, Flint, Abound, FRAC = 11), Rovral (2), Switch (9 + 12), tebuconazole (3),
  - or Howler (not as good as Switch)
  - Copper is not as effective as mancozeb (66-day PHI) or captan
- In 2022-23 trial, Mancozeb or Aprovia Top (42-day PHI) applied at bloom, then Howler plus captan or Switch plus captan applied at veraison and on provided good controls.
  - Another successful treatment was Switch plus Howler applied three times

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Re-application of fungicides after a big rain event

The rule of thumb is "two weeks or two inches of rain"; however, the first months or two for wine grapes are more like "7 to 10 days or 1.5 inches of rain" since tissues are growing so quickly.

If you sprayed 5 to 7 days ago and were hit by 1.5 inches of rain, *PLUS* you expect some rain in a few days, then I think it is a good idea to consider re-application.

One example is a phos acid (e.g., Prophyt, Agri-Fos, etc.) for downy mildew, a DMI (e.g., Rally, tebuconazole, etc.) for black rot, and add them with mancozeb/captan/copper and sulfur to have a forward protection.

The choice of materials depends on the time of the season, the vineyard history, and environmental conditions.

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Sour rot management

Timing: ~ 15 Brix

Current recommendation is **TWO** applications of an insecticide (to control fruit flies, e.g., Mustang MAXX) plus a fungicide [Oxidate (NC) or Switch (9 + 12), or Oso (19), or Howler (NC)], 7 to 10 days apart

Do not use Mustang Maxx more than twice a season!

Captan did not work in our trials

Ph-D (19), which has a higher concentration of polyoxin, probably works better.

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Alternative to Mustang MAXX

Spotted-wing drosophila	Entrust 2SC	4.0-8.0 fl oz	Spotted-wing drosophila is more important in some varieties than others; growers should incorporate block history. Berries become most vulnerable at about 15 degrees Brix. It is critical to rotate among differing modes of action in order to delay the development of resistance. PyGanic has a short residual life which limits its efficacy. Surround, Entrust and PyGanic are organic alternatives. Be watchful for flare-ups of secondary pests (mealybugs, spider mites) following application of pyrethroids. When available, flowable (F) formulations pose less risk of phytotoxicity that emulsifiable (EC; oil-based) formulations. Avoid using captan and oil-based pesticides within 14 days of each other. Removing foliage from the fruit zone will reduce habitat suitability for SWD. For more information on SWD, visit www.virginiafruit.ento.vt.edu/SWD.html.
	Delegate 25WG	3.0-5.0 oz	
	Malathion 8F	1.88 pt	
	Malathion 5EC	3.0 pt	
	Mustang Maxx 0.8EC	4.0 fl oz	
	Tombstone 2EC	2.4-3.2 fl oz	
	PyGanic 1.4EC	64.0 fl oz	
	Surround WP	25.0-50.0 lb	
	Sevin XLR Plus	1.0-2.0 qt	

We also tested Entrust 2SC and AzaGard, which provided a moderate reduction.
Please check the IRAC code and ROTATE!

95

Bitter rot

- Timing: after veraison
- Materials: captan (M4) or a QoI fungicide (Abound, Flint, Pristine, Intuity, etc., FRAC = 11)
  - Copper (M1) seems to be not effective

Photo courtesy of Mike Ellis (OSU)
Note the characteristic concentric rings of black fruiting bodies

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Japanese beetle

Second Cover: 7-10 days after first cover spray (when berries are about pea size, but before they touch in cluster)			
Japanese beetle, June beetle, wasps	Sevin XLR PLUS	1.0-2.0 qt	Apply when beetles are common. Sevin may not be applied within 7 days of harvest. See Table 3.4 for Restricted Entry Intervals. beetleGone *(Bacillus thuringiensis galleriae)* is OMRI approved; it should be applied in up to 30 gallons of water per acre. Neemix and Trilogy are to be combined.
	Surround 95WP	12.5-50.0 lb	
	Imidan 70WP	2.0 lb	
	Belay Insecticide	2.0-4.0 fl oz	
	Actara 25WDG	1.5-3.5 oz	
	Assail 30SG	2.5-5.3 oz	
	Avaunt 30DG	3.5-6.0 oz	
	Neemix 4.5 + Trilogy	7.0-16.0 fl oz, 2% solution	
	beetleGone	2.5-17.5 lb	

Wait until you see them feeding heavily on the top part of the canopy
Grapevines can take more than 10% feeding damage unless it is a baby vines.

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Grape root borer

Pheromone-based mating disruption (Isomate GRB) and pheromone bucket traps are the only viable options at this point.

The section 18 label was issued: contact Nutrien or Helena

Lorsban (chlorpyrifos) may be available again in 2025, but the efficacy is not great

Some nematode treatments available

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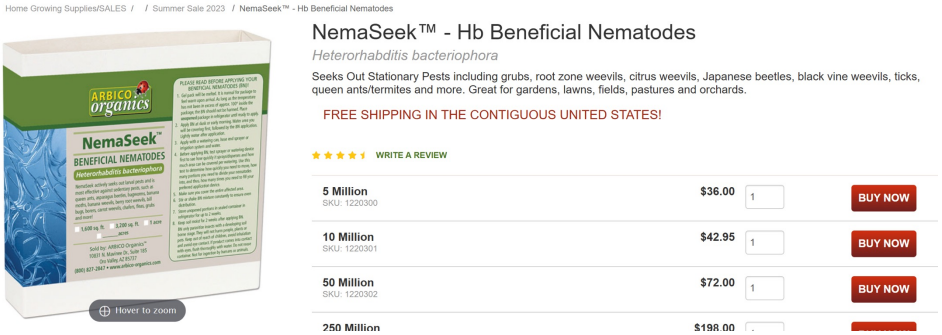

The nematode, *Heterorhabditis bacteriophora*, has been demonstrated to effectively reduced grape root borer in the field

It was found to be as effective as the insecticide, chlorpyrifos (Williams et al., 2002).

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Spotted Lanternfly (SLF)

I would approach it like management of Japanese beetle.

Table 3.1 - Disease and Insect Control (continued)

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
Spotted lanternfly	Brigade 10WSB	3.2-6.4 oz	Adults begin to appear in mid-July, and will be present through most of the fall. A provisional action threshold is 5-10 adults per vine. Assess frequently; continued re-immigration is a problem with SLF. Adults may develop high numbers on surrounding Ailanthus before moving into vineyard blocks. Pay close to attention to PHI and season maximum applications or amount of material per season.
	Actara 25WDG	1.5-3.5 oz	
	Scorpion 35SL	1.25-5.0 fl oz	
	Admire Pro (G)	1.0-1.4 fl oz	
	Mustang Maxx (G)	4 fl oz	
	Sevin XLR Plus	1.0-2.0 qt	
	BoteGHA ES	3 qt	
	PFR-97 20WDG	1-2 lb	

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Any Questions?

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