Grape pathology program
for the Virginia Vineyard Association Summer Technical Meeting
19 July 2023

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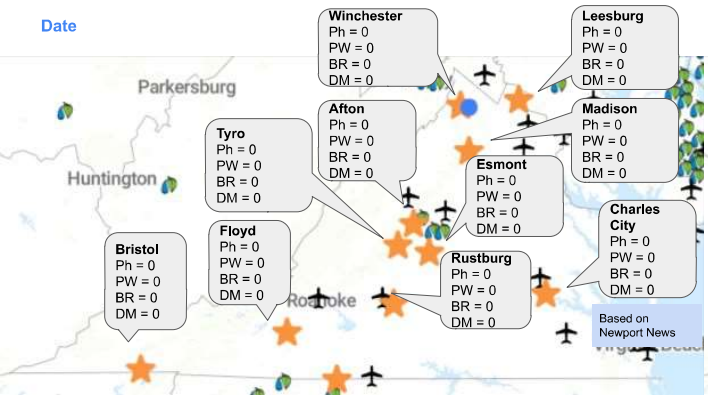
I posted this handout on my blog.

Morning Session

Viticulture updates from around the Commonwealth
the Sentinel Vineyard Project Updates

- The season started two to four weeks ahead of a typical year
- Some vines struggled to come back from the winter
    - A week of single digits over Christmas? (It was warm until that point.)
    - A few days in March when temperatures went down to low 30F and high 20F?
- Bloom lasted longer than usual, probably due to the warm winter
- It has been a relatively dry season until June.
    - Central VA received quite a bit of rain in the past three weeks or so
    - Northern VA and Eastern VA remained relatively dry
    - Depending on the location, vineyards in Shenandoah Valley received more rain.
- Powdery mildew appeared across VA, especially in Chardonnay and other susceptible cultivars.
- Pierce's disease and grapevine yellows are showing up in the past two years, most likely due to warmer winters in the past few years.
- Japanese beetle has been issues with some vineyards.
- Isolated hail and strong winds
    - These events resulted in bruising and holes in berries and leaves
- Spotted Lanternfly: more on that after lunch!
- Maps and Downy Mildew Modeling project

Date



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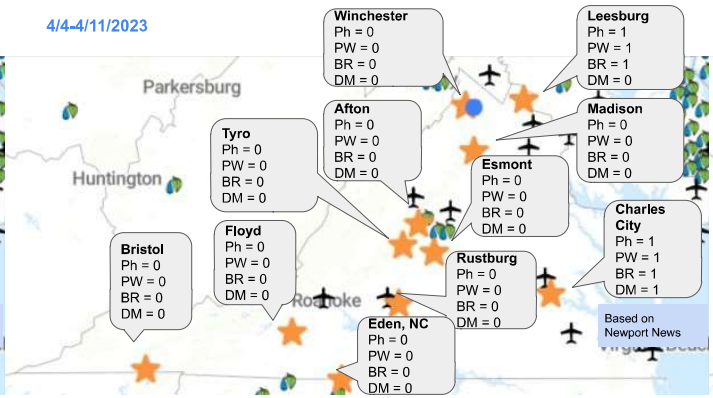

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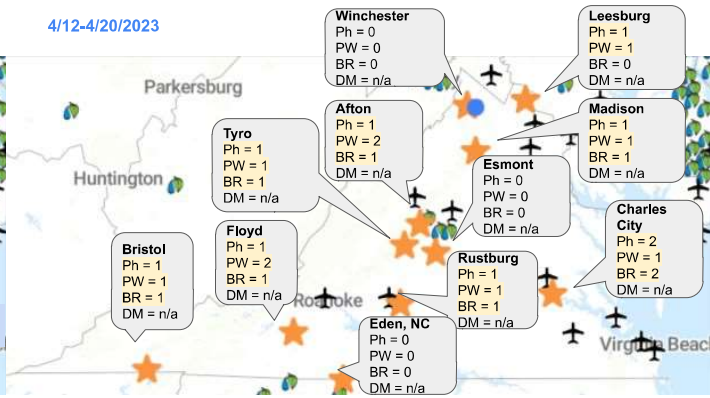

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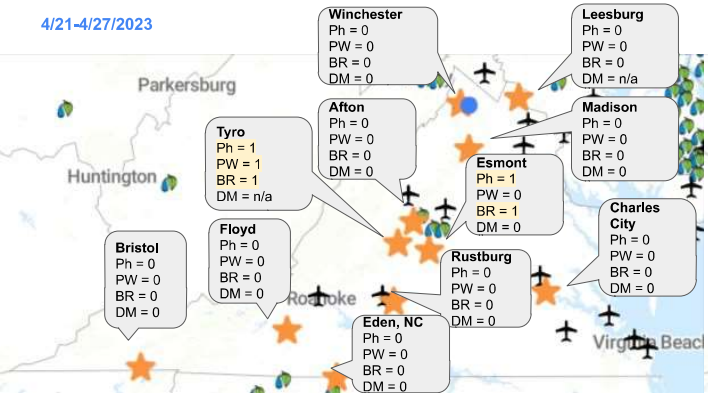

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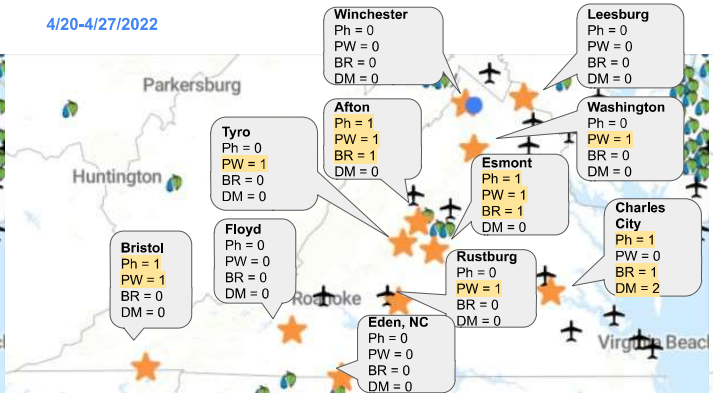

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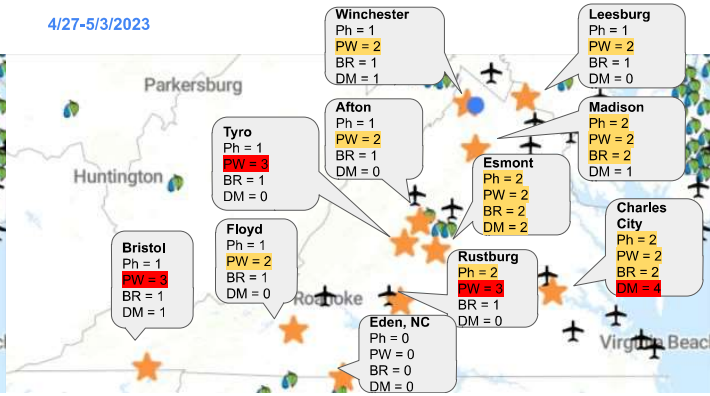
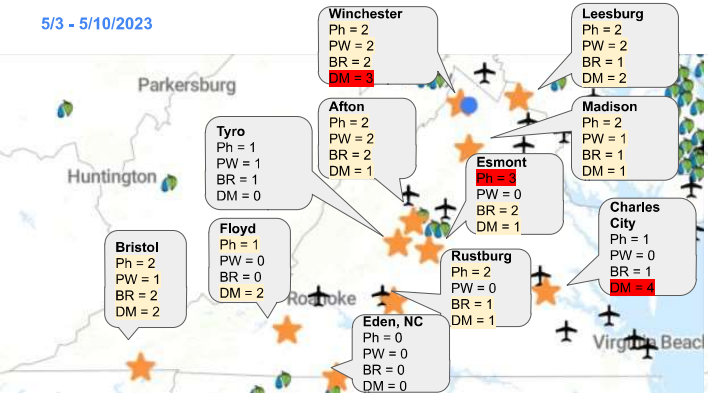


5/3 - 5/10/2023



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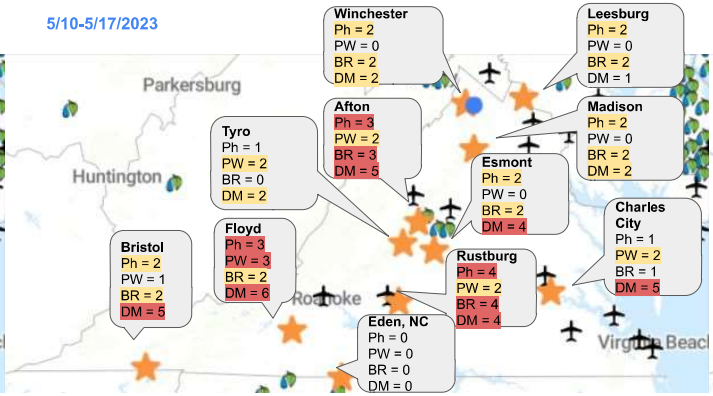

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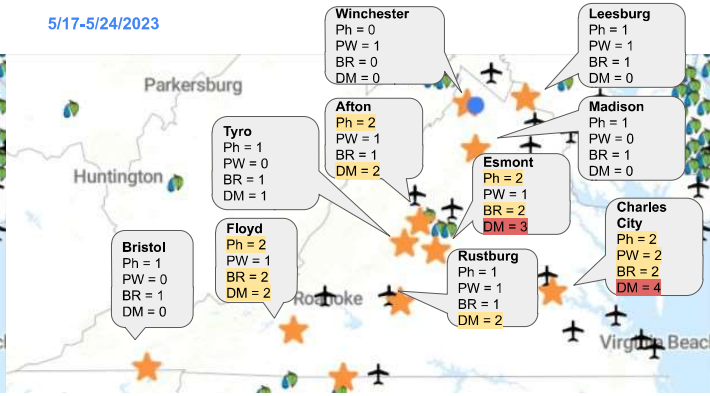

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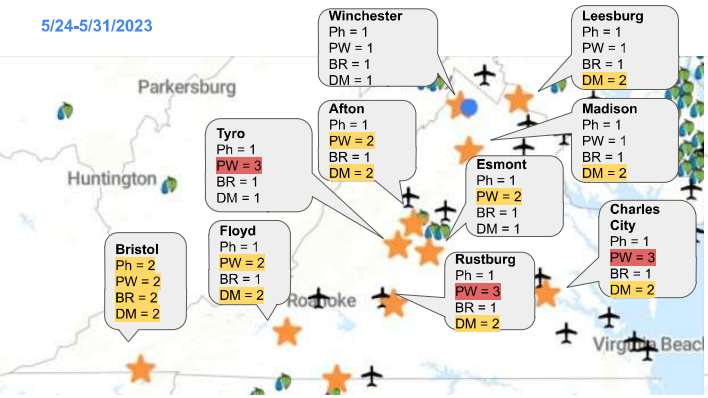

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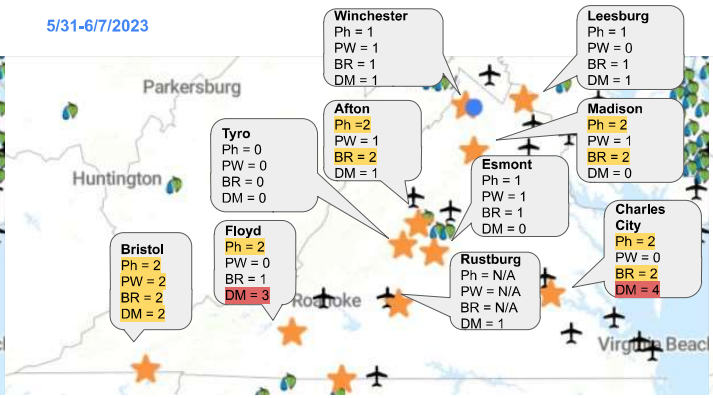

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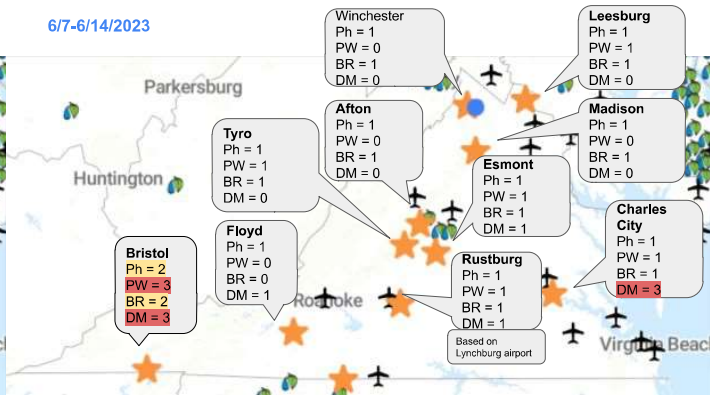

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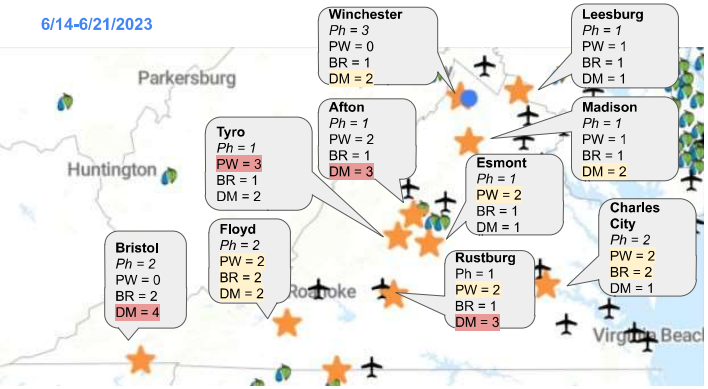

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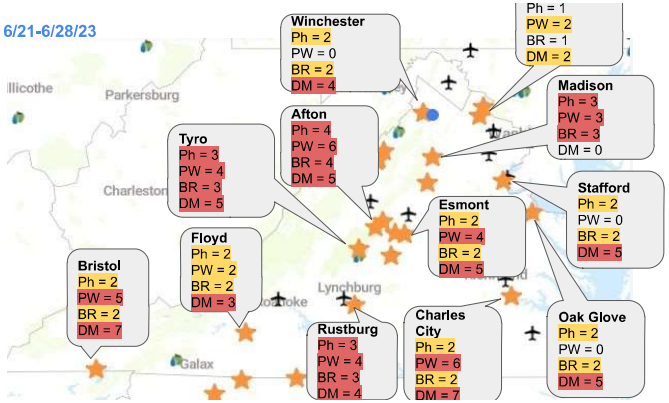

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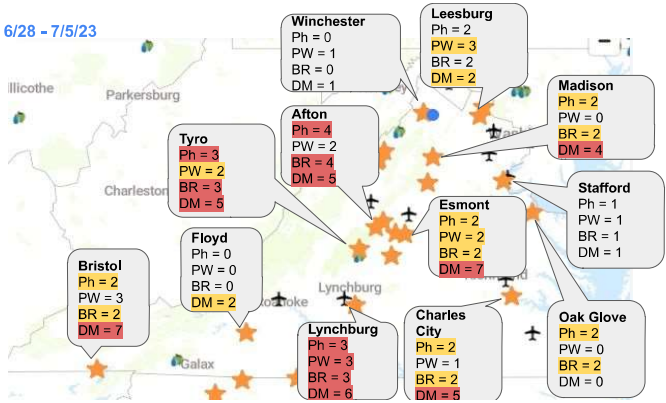

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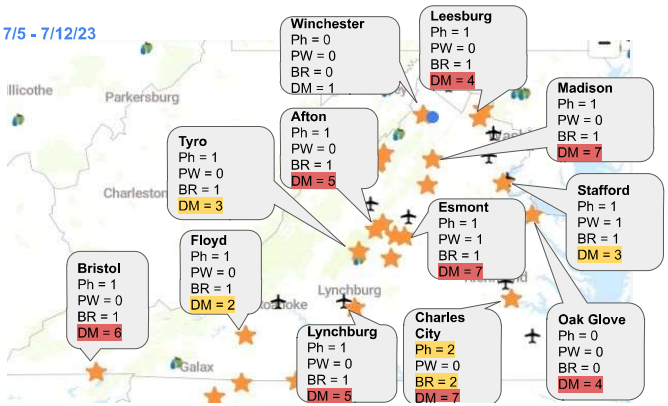


Grape Downy Mildew Risk Assessment Model

Mizuho Nita (nita24@vt.edu), Coded by Naohiro Murayama

This is our attempt 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.

The coding is almost done, and we need some volunteers to refine the outputs.

Downy mildew sporangiophore germination risk based on night time weather conditions (past 5 days)

Date	AverageTemperatureAtNight(℃)	MaxTemperatureAtNight(℃)	MinTemperatureAtNight(℃)	AverageHumidityAtNight(%)	Risk
2023-07-14	21.2	24.0	18.8	90.2	No Risk
2023-07-15	19.8	21.0	18.6	94.7	med
2023-07-16	21.6	25.6	20.5	94.0	low
2023-07-17	19.7	22.5	17.8	81.1	No Risk
2023-07-18	18.8	21.0	17.1	89.5	low

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

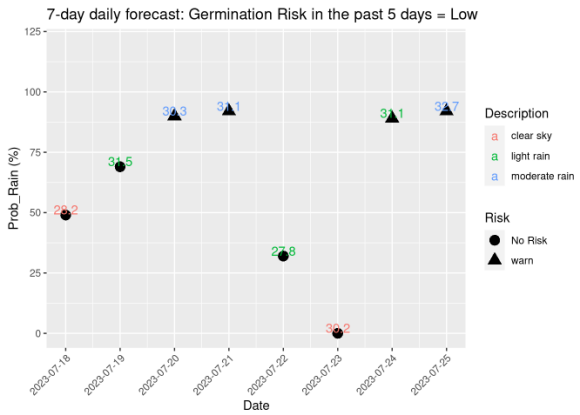
Time	AverageTemperature(℃)	MaxTemperature(℃)	MinTemperature(℃)	RainCount	RainPercent(%)	InfectionRisk
~24h	24.3	32.3	18.4	0	26	No Risk
25h~48h	24.9	32.9	18.8	2	83	warn

Downy mildew sporangiophore germination risk based on night time weather conditions (in 48 hour forecasted time)

Time	AverageNightTemperature(℃)	MaxNightTemperature(℃)	MinNightTemperature(℃)	AverageNightHumidity(%)	MaxNightHumidity(%)	MinNightHumidity(%)	Risk
~24h	19.9	22.5	18.4	74.5	80	63	No Risk
25h~48h	20.8	24.7	18.8	86.6	94	69	No Risk

Downy mildew infection risk based on a 7-day weather forecast

Date	Description	AverageTemperature(℃)	RainyPercent(%)	PrecipitationAmount(mm)	Risk
2023-07-18	clear sky	28.2	49	0.00	No Risk
2023-07-19	light rain	31.5	69	0.43	No Risk
2023-07-20	moderate rain	30.3	90	5.10	warn
2023-07-21	moderate rain	31.1	92	3.20	warn
2023-07-22	light rain	27.8	32	0.50	No Risk
2023-07-23	clear sky	30.2	0	0.00	No Risk
2023-07-24	light rain	31.1	89	2.58	warn
2023-07-25	moderate rain	32.7	92	7.66	warn



Updates on captan and iprodione

- The EPA will change the label language on these materials. The change will likely happen in 2024.
- For iprodione, use in grapes most likely be restricted to once a year.
- For captan, we may see other use restrictions, but it may change
- I.e., please keep an eye on news and announcements!

Biopesticides and alternative materials

- Biological control agents, plant derivatives, mineral oils, or plant defense activators
- The common attributes are A) they do not work as well or consistently as conventional materials, B) they need to be applied as a protective material (may need multiple applications to be effective), and C) they work on a specific disease better than the others. (i.e., we need to know which disease a particular product can control, regardless of the label.)
- Some use-case scenarios
    - Use them to bridge the gap between conventional materials, especially when the disease pressure is low.
        - Examples:
            - Use Double Nickel to cover for powdery mildew when the temperature hits 90F.
            - Use Lifeguard in the early season (say, 10-inch shoot with relatively dry weather) for downy mildew protection
            - Alternate biological control agents with conventional sprays with newer cultivars (e.g., Chardonel, Chamboucin, etc.)
    - Mix with conventional materials to reduce the risk of fungicide resistance development
        - Examples:
            - Mix Oso with Switch for Botrytis and ripe rot management
            - Use Double Nickel with a DMI fungicide for powdery mildew
    - Important note: Do not mix oil with captan or sulfur. Avoid using oil within 10 to 14 days of captan or sulfur applications.

Afternoon session

Spotted Lanternfly: Observation at Winchester, VA, and our actions so far

- Egg hatches mid-April in Northern VA
- They move into leaves in early-May
    - We waited until they moved from posts and surrounding habitats to leaves (15th May) to apply dinotefuran (Scorpion)
    - This application doubled as mealybug management
    - This spray took care of ~95% of the population in the vineyard
- In 2022, the first observation of adults was late July (25th)
- They slowly came in for a while, and then in August, mass invasions started
    - We waited until mid-August (13th) and applied Scorpion (dinotefuran)
    - Then we hit our vines again on 9/26/22 with Mustang MAXX
        - This doubled as sour rot (fruit fly) control
    - The last clean-up spray was done on 10/19/22 with Mustang MAXX
- What we may change:
    - Hit them with carbaryl (double as brown marmorated stinkbug and yellow jacket management) in early/mid-August to save Scorpion for later.
        - The decision depends on the mealybug population.
    - Alternate Mustang MAXX and carbaryl in mid to late September to control both SLF and fruit flies (sour rot management)
    - Use Scorpion for a post-harvest spray to control both SLF and mealybug.
- Take home messages
    - No need to panic: materials work!
    - They will come in from outside of the vineyard. A perimeter spray works if you have a large enough vineyard block.
    - They are less likely to become an adult on grapevines. Hit them once in the spring will keep them off for a while.
    - You may need to be more protective if you have vines planted this year.
    - You can hit two or more species with one spray: be organized and refer to the PMG.
    - Alternate modes of action!

Spray #	Dormant	0	1	2	2.5*	3	4	5	6	7	8	9	10	11	12	13
Growth Stage		Bud break	3"	10"-12"	14"-18"	Prebloom	Bloom	Fruit set (1st cover)	BB-Pea (2nd cover)	Pea (3rd cover)	Berry touch		Veraison	Preharvest	Preharvest	Postharvest
																
Week		Week 0	Week 1	Week 2	Week3	Week 4	Week 5	Week 6	Week 8	Week 10	Week 12	Week 14	Week 16	Week 18	Week 20	Week 22
Example Date (**Chardonnay @ northern VA**)		4/14/19	4/20/19	4/30/19		5/10/19	5/15/19	5/26/19	5/31/19	6/15/19	7/13/19		8/10/19	8/25/19		
Materials			**Phomopsis**													
Best: M3, M4, Good (but not preferred): 11, 1, 7, Fair: M1, M2			Mancozeb	Mancozeb		Mancozeb	Mancozeb	Mancozeb								
			Powdery Mildew				**Critical Period for Clusters**									
Best: M2, Good: M1, 3, 13, 50, 7, U6 (M works too, but check the label)			Sulfur	Sulfur		Sulfur +DMI	Sulfur + Quintec (or Vivando)	sulfur +DMI	Sulfur (+Quintec or Vivando)	Sulfur	Sulfur	Sulfur	Sulfur	Sulfur	Potassium salt	Sulfur
				**Downy Mildew**			**Critical Period for Clusters**									
Best: M3, M4, M1, P07, 21, 40, 40+45, 4 (Note: resistance issue with 40 and 4)				Mancozeb		Mancozeb	Mancozeb or Ridomil MZ or Revus or Ranman	Mancozeb or Ridomil MZ or Revus or Ranman	Mancozeb	Copper or Captan or Phos acid	Copper or Captan or Phos acid	Copper or Captan or Phos acid	Copper or Captan or Phos acid (or Revus or Ranman)	Copper or Captan or Phos acid (or Revus or Ranman)	Phos acid	Copper
				**Black Rot**			**Critical Period for Clusters**									
Best: M3, 3, 7 (see label), 11, (note: M1 and M4 do not work)				Mancozeb		Mancozeb +DMI	mancozeb	Mancozeb + DMI	Mancozeb	Mancozeb						
							Botrytis				**Botrytis**		**Botrytis**			
Good: 2, 7, 9, 12+9, 17, OK: 19, fair: M1, M4 (Best to combine M1 or M4 with another MOA due to resistance risks)							Vangard or a SDHI (depends on the pressure)				Elevate		Vangard			
							Ripe rot						**Ripe and bitter rot**		**Ripe and bitter rot**	
Use a combination of M3 or M4 PLUS 2, 3 (tebuconazole), 11, 9+12							mancozeb + QoI or + DMI or copper + others						copper + QoI or + iprodione, or + DMI		copper + QoI or + iprodione, or + DMI	
Spray example			Mancozeb	Mancozeb + sulfur	Copper (if necessary)	Mancozeb + Sulfur + DMI	Mancozeb + Sulfure + QoI + Vangard + Vivando	Mancozeb + Sulfure + DMI	Mancozeb + sulfur	Captan + Phos acid	Copper + Iprodione	Copper	Copper + Vangard + QoI	Revus + Quintec	Phos acid	Copper

Note: The fungicide listed above are examples. Week numbers are estimates.

Spray #3-#8 needs to be flexible. The spray schedule will depend on the growth stage and rainfall. You may need to combine two into one spray or an additional spray (e.g., spray #2.5). Around bloom, Ridomil would be a good choice, especially when there are significant rain events. Please limit the use of Ridomil. Alternatives are Revus, Ranman, or Phos acid.
If powdery mildew is a chronic issue for you, it is better to use DMI or other powdery material (mix with sulfur) at pre-bloom, rather than wait until bloom. (The same most likely apply to downy mildew and black rot. Ripe rot at bloom is optional, but if you have seen ripe rot in the past, it is probably a good insurance to have Aprovia or Switch.

Watch out for 66-d PHI for mancozeb!

#6 - whether to include Quintec or Vivando may depend on the PM level. #7 - You may need to repeat it based on the growth; e.g., #7 was repeated in 2010 and 2011.
We do not have many modes of action for downy. Use mancozeb, captan, and copper as a backbone, and mix and rotate with Revus and Ranman. Do not overuse Revus or Ranman (twice/a year is ideal). PLUS, both are protective materials that need to be applied before you see downy!
When nighttime temperature gets low (around #7), downy mildew can sneak up on you.
If you have an issue with ripe rot, make sure to mix Switch, QoI (Abound), or iprodione (e.g. Meteor) with mancozeb or copper and rotate!

Bird netting maybe needed. Last 3 applications will depends on the level of disease and weather

Spray #	Dormant	0	1	2	2.5	3	4	5	6	7	8	9	10	11	12	13
Growth Stage		Bud Break	3"	10"	12"	Prebloom	Bloom	Fruit set (1st cover)	BB-Pea (2nd cover)	Pea (3rd cover)	Berry touch		Veraison	Preharvest	Preharvest	Postharvest
Week		Week 0	Week 1	Week 2	Week3	Week 4	Week 5	Week 6	Week 8	Week 10	Week 12	Week 14	Week 16	Week 18	Week 20	Week 22
Date in 2021																
Spray plan			Phomopsis	Phomopsis	Ph	Phomopsis	Phomopsis									

Spray #	Dormant	0	1	2	2.5*	3	4	5	6	7	8	9	10	11	12	13
Growth Stage		Bud break	3"	10"-12"	14"-18"	Prebloom	Bloom	Fruit set (1st cover)	BB-Pea (2nd cover)	Pea (3rd cover)	Berry touch		Veraison	Preharvest	Preharvest	Postharvest
			Powdery Mildew	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM	PM
				Downy Mildew	DM	DM	DM	DM	DM	DM	DM	DM	DM	DM	DM	DM
				Black Rot	BR	BR	BR	BR	BR							
							Botrytis				Botrytis		Botrytis			
							Ripe rot				Ripe rot		Ripe rot and bitter rot			
Your spray																
Weed Target																
Material																
Insect Target		Climbing cutworm		Yellow jackets Nesting? Mealybugs			Grape Berry Moth			Japanese beetle			Yellow jacket	Spotted lanternfly		
8LF		Egg	1st instar	1st and 2nd instar				3rd instar		4th instar (red one)	Adults may start to come in		Look for adult population			
																
Material (for 8LF)				dinotefuran - wait until they move into the canopy! (This will also cover mealybugs too!)									carbaryl, dinotefuran, Mustang MAXX, etc. See PMG to select a product that works on both SLF and fruit fly (for sour rot management)		carbaryl, dinotefuran, Mustang MAXX, etc. See PMG to select a product that works on both SLF and fruit fly (for sour rot management)	
Cultural Practice																

Note: This template was prepared as a supplemental material of my workshops and not meant to be used alone. The materials listed are examples, but not my recommendations. You need to develop your own program based on your site, cultivar, environmental conditions, and disease history. I am upgrading my guide into GrapeIPM.org. For more detailed information about disease management and other fungicide choices, please refer to the workbook or Pest Management Guide from VT (VCE).

Note 2: You can download this to your computer and open with Excel or other spreadsheet of your choice. Click on "File" --> "Download As..." OR choose "Add to My Drive" to copy to your account.

Note 3: Many thanks to Mr. Bob Ramsey (a grower in Wintergreen, VA) for the original template!