June 29th, 2022

Finger Lakes Vineyard Update

In this Issue:

IPM

Berry resistance is still developing

We're well into the early stages of fruit development in most cultivars and locations, but not quite to the point where berries are no longer susceptible to infections from powdery and downy mildew and black rot. This point was brought home yesterday during a quick stop in a Riesling block on Seneca Lake, where we found powdery mildew infections developing on a number of clusters (see photo). In some cases the clusters were shielded by one or two leaves so post-bloom spray material may not have reached them, but plenty of others were out in the open as well. In a situation like this, it would probably be prudent to incorporate a material with anti-sporulant and/or eradicant activity against PM like Stylet Oil or one of the potassium-based materials like Kaligreen, Armicarb or Nutrol. There are issues to consider with all of these materials (compatibility, effectiveness, application conditions, etc) so be sure to read about them in the Grape IPM Guidelines manual and on the label before deciding if they are worth using in your situation.

Berries develop resistance to new infections of PM, DM and BR after a certain period time following bloom. That length of time differs a bit for each of the diseases:

- Powdery mildew: 2-3 weeks after fruit set (about 3-4 weeks after bloom)
- Downy mildew: 4 weeks after bloom
- Black rot: 5 – 8 weeks after bloom

Natives and hybrids will tend to develop these resistances earlier in these windows that *vinifera* cultivars, so some early hybrids like Marquette or Geneva Red may be nearing the end of their susceptibility window for powdery and downy mildew. But in many other cases, we probably need to be keeping up with protecting clusters and berries for a week or two longer before they become fully immune.

Field sampling for disease resistance

We are still looking for growers who have concerns about powdery or downy mildew resistance developing on their farms, and would like to have those pathogens tested for resistance. We are wanting to test for powdery mildew resistance to the FRAC 11 fungicides (Flint, Abound, Sovran, Intuity, Reason, and portions of Luna Sensation, Rhyme/Topguard, Pristine) and for downy mildew resistance to FRAC 40 fungicides (Revus, Revus Top). We especially want to sample any potential populations earlier in the season (i.e., now) to better understand how stable this resistance might be in our region.

IPM (continued from page 1)

The Gold grape pathology lab is coordinating these collections again this year. If you would like your vines tested, a sample kit can be mailed to you and you can collect the samples yourself, or contact either Dave Combes (dbc10@cornell.edu) or myself to make arrangements to come collect the samples. The kits are easy to use and require just a small amount of information that will be listed in the instructions. Please email your physical mailing address to Dave Combs at dbc10@cornell.edu if you would like one. Kits will have to be shipped back or dropped off to Geneva for processing.

Grape Berry Moth model – June 29, 2022

In warmer portions of the Finger Lakes, the time for scouting for GBM presence is here. Growers with a history of GBM problems should be starting to scout, but based on some conversation at yesterday's Tailgate Meeting, it might be a good idea for all growers to keep an eye out for signs of GBM activity. A couple of growers mentioned that they had seen more evidence of GBM activity – mostly webbing in clusters at this state of the season – than they have in many years. Feeding injury by GBM larvae is an important entry for other pests and pathogens to enter the berry, including botrytis and sour rot. Based on the forecasts in the model, these warmer sites will reach 810 GDDs, the beginning of the window for GBM management sprays, sometime this weekend. Be sure to keep an eye on the model over the next several days so the scouting and spray application windows don't blow by you. On warm days when we can accumulate 20+ GDDs in one day, the 810-900 GDD window can open and close quickly, so it's good to have an idea of when that timing will arrive.

Status of GBM model at selected Finger Lakes NEWA locations (6/29/22)

Location	Biofix Date	GDDs	GBM Status & Management
Dresden	5/25/22	761	**
Geneva	5/30/22	622	*
South Bristol	5/31/22	590	*
Romulus	5/28/22	654	**
Branchport	5/29/22	641	*
Lodi	5/26/22	732	**
Williamson	6/1/22	548	*

	Pest Status	Pest Management
*	Fee	The time for treatment of first-generation grape
**	Start of flight of first-generation grape berry	Prepare to scout low and intermediate risk vine-

Herbicide Resistant Horseweed in New York and Possible Implications for Perennial Crop Systems

Lynn M. Sosnoskie, Horticulture Section – School of Integrative Plant Sciences, Cornell AgriTech

Horseweed rosette with long and linear, irregularly toothed leaves.

Horseweed (also called marestail) is a frequently occurring species in where it can be found growing in a variety of habitats including along roadsides, in field crop and vegetable operations, and in berries, grapes, and tree fruit. Often considered a winter annual, horseweed has a wide germination window and seedlings can emerge in the spring, summer, and fall. Herbicide resistance, particularly to glyphosate, is widespread in the US and has recently been identified in New York (see the 2022 summer issue of Fruit Quarterly https://nyshs.org/fruit-quarterly/). Many of these populations were collected from soybean systems where glyphosate is frequently used for managing unwanted vegetation. Two New York populations, collected from a vineyard and an apple orchard in the Finger Lakes Region, were found to be susceptible to glyphosate but resistant to labeled rates of paraquat. Paraquat resistance in horseweed has been formally confirmed, previously, in Belgium (nurseries), Canada (peaches), Japan (orchards, grapes, roadsides, railways), California (almonds), Delaware (soybeans) and Mississippi (soybeans) (https://weedscience.org/Home.aspx).

Because of this finding, the Specialty Crop Weed Science lab at Cornell AgriTech in Geneva is interested in collecting seed, this summer and fall, from horseweed plants that escape weed control in tree fruit, berry, grape, and Christmas tree systems to better understand the distribution and degree of herbicide resistance in perennial crop production environments. Horseweed seed is wind-dispersed and resistance traits can be easily disseminated across the landscape. Growers should contact their local CCE specialist or Lynn Sosnoskie in Geneva (lms438@cornell.edu) for assistance if they believe they have resistant horseweed on their farms. For more information about horseweed identification, please see: https://blogs.cornell.edu/weedid/field-crops/horseweed/.

This research was supported by Federal Capacity Funds awarded by the National Institute of Food and Agriculture, U.S. Department of Agriculture and managed by the New York State Agricultural Experiment Station (NYSAES), Cornell University, Geneva, New York, USA.

Herbicide Resistant Horseweed in New York and Possible Implications for Perennial Crop Systems

Lynn M. Sosnoskie, Horticulture Section – School of Integrative Plant Sciences, Cornell AgriTech

Horseweed seedlings growing in the green-

Bolting horseweed plant

Suspected paraquat-resistant horseweed in

Digging into the Data: Biopesticides for Grape Disease Control

By Katie Gold and Dave Combs
With data contributions from Wayne Wilcox

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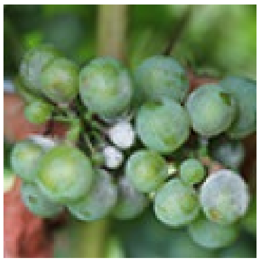


"Biopesticides" are moving into the mainstream. While earlier versions gained a reputation for only modest efficacy in comparison with conventional synthetic fungicides, new products are proliferating – and offer comparable performance that sometimes rivals the 'gold standards' that growers rely upon. In disease management spray trials at Cornell, we have been evaluating biopesticides for the past nine years. So, how well do they work? Where do they fit into a disease management program?

However, before we get into performance, we must first discuss the performers.

Biopesticides have fundamentally different modes of action from traditional chemistries. Understanding this difference is key to understanding how biopesticides can fit into an integrated grape disease management program. This article will introduce the different types of biopesticides, discuss considerations for their use, and delve into the Cornell Grape Pathology archives to see how biopesticides have performed over the years for grape disease control.

What's a biopesticide?

Biopesticides are products derived from such natural materials as animals, plants, bacteria, and certain minerals. For example, kitchen products such as canola oil and baking soda have antimicrobial applications and are considered biopesticides. Because it is often difficult to determine whether a substance meets the criteria for classification as a biopesticides, the Environmental Protection Agency (EPA) has a special committee dedicated to making these decisions.

Biopesticides are the fastest growing market sector of pesticides despite only representing 5% of the global pesticide market. As of August 31, 2020, the EPA has 390 biopesticide active ingredients registered. In the 5-year period between 2015 to 2020, almost 100 new biopesticide active ingredients were registered with the EPA.

Since biopesticides tend to pose fewer risks than conventional pesticides, EPA generally requires much less data to register a biopesticide than to register a conventional pesticide. In fact, new biopesticides are often registered in less than a year, compared with an average of more than three years for conventional pesticides.

How do biopesticides work?

Just like how we separate traditional chemistries by their modes of actions, there are different types of biopesticides. The EPA defines three types of biopesticides, however these can be broken down further.

Biochemical pesticides. A biochemical pesticide is a naturally occurring substance that controls pests and/or pathogens by non-toxic mechanisms. Biochemical pesticides can have plant, animal, microbial, or mineral origins. In terms of grape disease control, the most common biochemical pesticides are plant extracts and microbial extracts.

1. *Plant Extracts*. Before people came along, plants had to save themselves from pathogen and pest threats. You're likely more familiar with these sorts of compounds than you realize, as

many naturally occurring compounds, such as caffeine and nicotine, have been harnessed for eons for non-agricultural, human use. An example of a plant extract biopesticide is Regalia.

2. *Microbial extracts*. Microbes have been fighting each other for far longer than they've been fighting plants. Microbial extracts, such as penicillin, the first antibiotic, are the foundation of much of modern human medicine. An example of a microbial extract biopesticide is Oso.
3. *Mineral & misc. compounds.* Oils and mineral compounds are considered biochemical pesticides under the EPA's definition. This category includes a variety of commonly used pesticides including oil (JMS Stylet Oil), silicon (Sil-Matrix), copper (Cueva), phosphorus acid (Phostrol), and hydrogen peroxide (Oxidate).

Microbial pesticides. A microbial pesticide consists of a living microorganism (e.g., a bacterium, fungus, virus, or protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests and pathogens, although each separate active ingredient is relatively specific for its target. For example, there are fungi that control certain weeds and other fungi that kill specific insects.

The subcategory of *biofungicides* describes formulations of living organisms used to specifically control the activity of plant pathogenic fungi. The idea behind biofungicides is based upon decades of scientific study demonstrating that some beneficial microorganisms, usually isolated from soil, can hinder the activity of plant pathogens. There are four main ways that biofungicides work.

1. *Competition.* The idea behind this mechanism is that a plant pathogen can't take hold if there isn't any room for it grab on! These biofungicides compete with plant pathogens for nutrients, infection sites, and general space (a "niche") without harming the plant. For example, they may colonize the entire root surface, leaving no room for a root pathogen to attack. Additionally, some biofungicide organisms can metabolize plant exudates that would normally attract plant pathogens or stimulate their growth. An example of this type of biofungicide labeled for grape disease control is Double Nickel.
2. *Parasitism and antibiosis.* These biofungicides take a more direct approach to plant disease control by harnessing microbe-microbe warfare. They directly attack, consume, or produce compounds that destroy plant pathogens. An example of this type of biofungicide labeled for grape disease control is Howler.
3. *Defense induction.* These biofungicides don't act upon other microbes, but instead activate the plant's own defense system so that it can better protect itself against plant pathogens. By turning on Systemic Acquired Resistance (SAR), these biofungicides improve the plant's response to pathogen attack by priming the production of plant defense compounds at the site of active invasion as well as throughout the plant (systemically). An example of this type of biofungicide labeled for grape disease control is Lifegard.
4. *Plant growth promotion.* The biofungicides also act upon the plant, however they do not engage the plant's defense system. They instead promote plant health and growth, thereby improving the plant's ability to turn on its own defenses and fight off plant pathogens.

The third category of biopesticide, *plant-incorporated protectants (PIPs)* are uncommon in grape disease control. These are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists have produced maize varieties that are resistant to the European corn borer by incorporating the gene for the Bt pesticidal protein into the plant's own genetic material. Then the plant, instead of the Bt bacterium, manufactures the substance that destroys the pest. The protein and its genetic material, but not the plant itself, are regulated by EPA.

Special considerations

When considering using biopesticides, it is important to remember that they act like a lock on a door. A good lock will stop opportunistic, weak thieves, but determined, strong thieves, or thieves in sufficient numbers, can still break through with enough force. And most importantly, biopesticides can't stop a thief that is already inside the house when the door is locked. For most effective use, a biopesticide must be in place ***before*** pathogen infection begins as their action is majorly protective. The key exception to this is Stylet Oil, which is a highly effective powdery mildew eradicant.

Biopesticides, therefore, must be reapplied frequently both to protect new growth and to ensure that effective populations of the microorganisms are present in the case of live microbe biofungicides. Additionally, because some biofungicides consist of living organisms, they often have different storage, shelf life, and handling requirements than conventional fungicides.

How do the different types of biopesticides perform for grape disease control?

Over the years, Cornell Grape Pathology, under both its current and former captains Gold and Wilcox, has evaluated a number of different types of biopesticides in our seasonal spray trials. While there's many ways we could delve into the data, we sought to summarize our findings simply to provide general insights into how biopesticides perform for grape downy and powdery mildew control. The graphs and table that follow below present average percent incidence control across all years studied. Percent (%) control compares treatment performance to the total amount of disease in the untreated control in a given year. For both powdery and downy mildew, we evaluated percent control on leaves and on grape clusters separately.

Figure 1: *For powdery mildew, we've seen that microbial extracts and miscellaneous compounds (cluster control only) tend to provide the best incidence control. Live microbe biofungicides and plant extracts perform fairly similarly for both leaf and cluster control.*

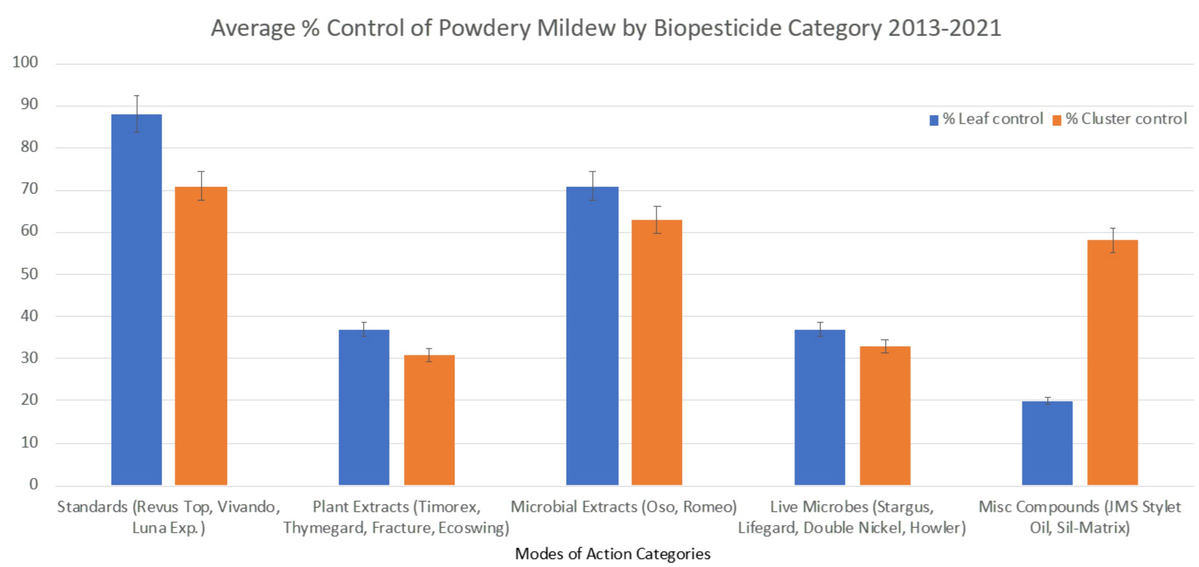
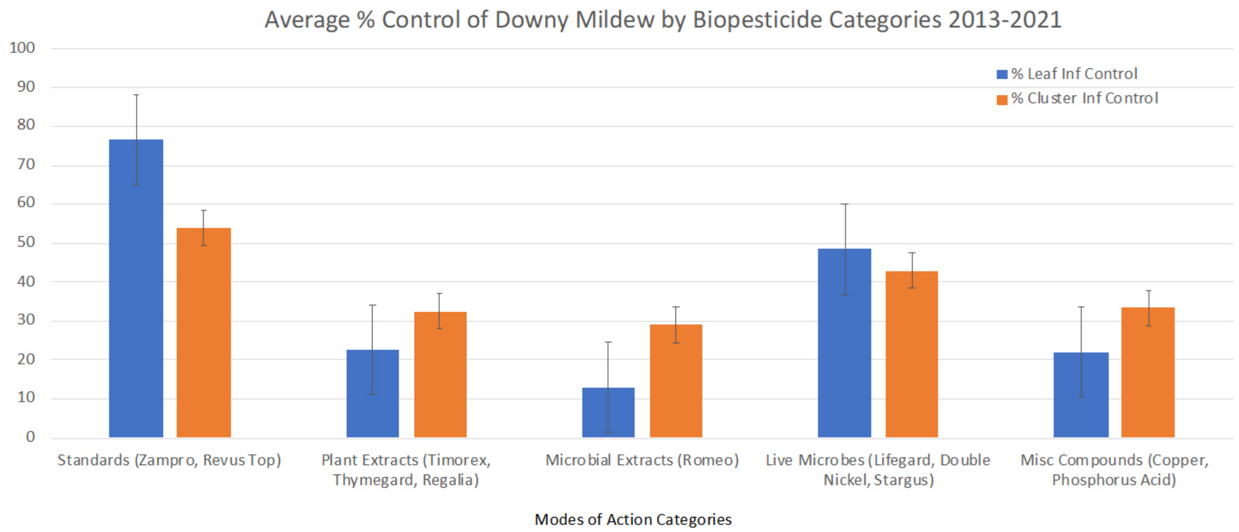


Figure 2. *For downy mildew, live microbes have performed the best. With the exception of live microbes, which provide fairly equivalent control, we've seen that biopesticides tend to provide better cluster control than foliar control.*



Why use biopesticides?

Biopesticides are usually inherently less toxic than conventional pesticides, as they generally affect only the target pathogens and closely related organisms. This is in contrast to broad spectrum, conventional pesticides that may affect organisms as different as birds, insects, and mammals.

Biopesticides often are effective in small quantities and often decompose quickly, resulting in lower exposures and largely avoiding environmental runoff issues. Additionally, most biofungicides have short reentry intervals (0-4 hours) and no pre-harvest interval restrictions, making it easier to coordinate vineyard logistics around their application.

Biopesticides do not carry the same risk of pathogen resistance development that more targeted conventional chemistries have given their diverse mechanisms of action. For example, it is impossible for pathogens to develop resistance to Lifegard, because Lifegard is a defense inducing biofungicide and does not directly act upon the pathogen.

Biopesticides complement traditional chemistries

Most importantly, when used as a component of integrated grape disease management, biopesticides can reduce the use of conventional pesticides while retaining crop quality and yield.

Figure 3. *For example, in the 2020 season, a moderate pressure year for both powdery and downy mildew, we saw that a rotation of Lifegard and Zampro provided nearly equivalent downy mildew control to a straight program of Zampro alone (Figure 4).*

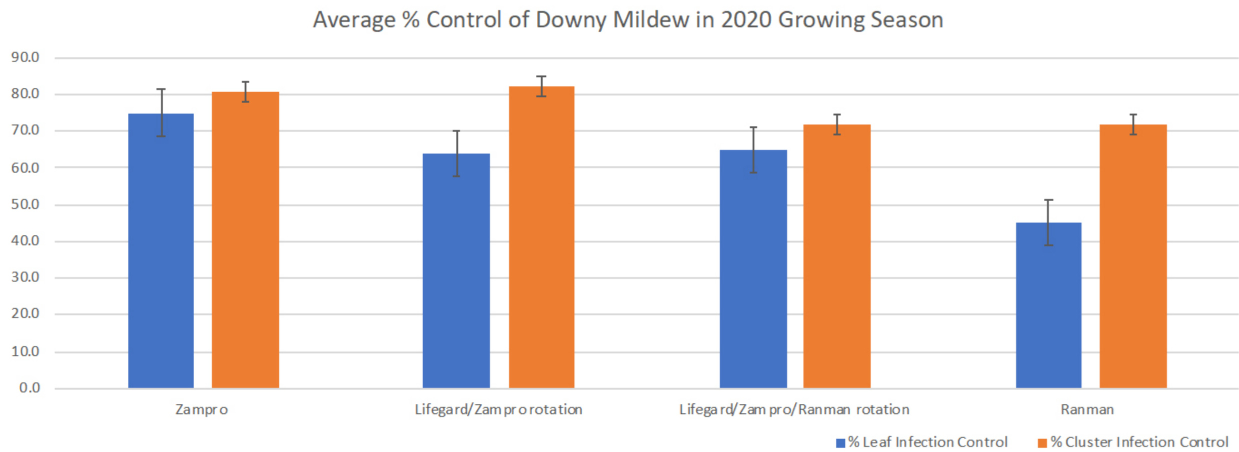
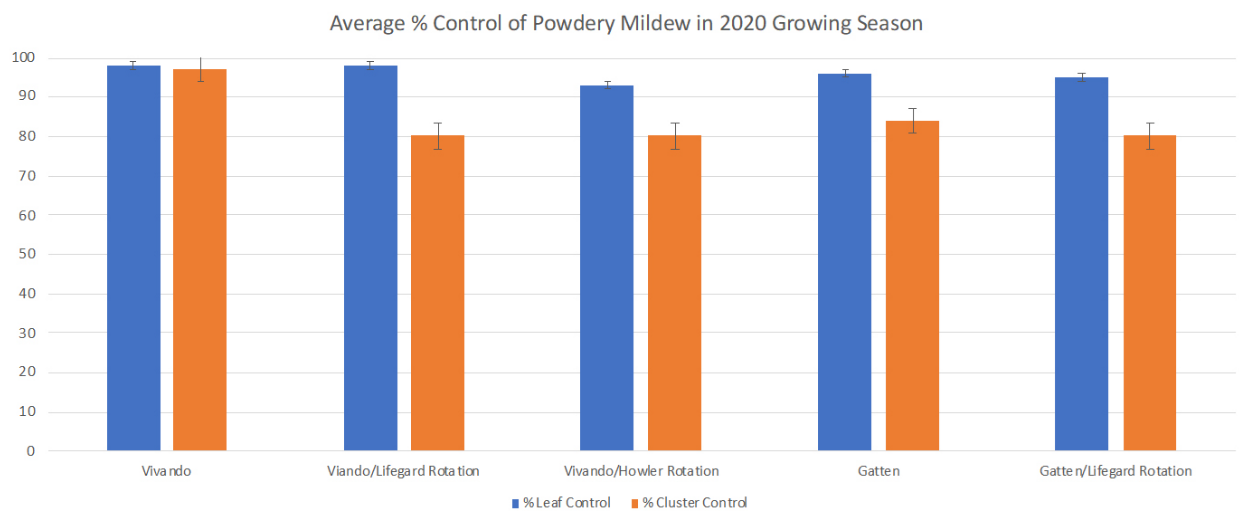


Figure 4. *For powdery mildew control in the 2020 season, (Figure 5) we saw those rotations of Vivando/Lifegard and Vivando/Howler provided nearly equivalent control to Vivando straight through. We saw the same repeated when a rotation of Lifegard/Gatten was compared directly to Gatten.*



In both these cases, we found that using a biopesticide in rotation reduced overall conventional chemistry usage by half while maintaining highly effective disease control!

Integrating biopesticides into a disease control program reduces the control pressure placed on conventional chemistries, slowing the development of fungicide resistance in target pathogen populations. Protecting the longevity of highly effective, conventional chemistries is essential for the long-term health and sustainability of the New York grape industry. **Using biopesticides in your early or late season disease control program will help ensure that the traditional chemistries we rely on for robust powdery mildew and downy mildew control during the critical period of pre- to post-bloom will be in our toolbox for years to come.**

***Table 1**: **Summary of biopesticides tested by Cornell Grape Pathology between 2013-2021**. This table presents average percent incidence control across all years studied. Percent (%) control compares treatment performance to the total amount of disease in the untreated control in a given year. For both*

powdery mildew (PM), downy mildew (DM), and black rot (BR), we evaluated percent control on leaves and on grape clusters separately. Only cluster control was evaluated for botrytis (BOT).

Type	Name	Disease	% Leaf Control	% Cluster Control	Years Tested
Live Microbe	Double Nickel *Competition*	DM	54	NA	2
		PM	31	15	4
		BOT	NA	35	4
	Stargus *Competition*	DM	43	NA	2
		PM	79	69	1
		BOT	NA	13	1
	Lifegard *Defense Activation*	DM	43	43	7
		PM	54	43	5
		BR	58	1	1
		BOT	NA	43	5
	Howler *Antibiosis & Competition*	BR	78	24.5	1
		BOT	NA	65	2
Plant Extract	Regalia	DM	12	NA	2
	Thymeguard	DM	21	40	1
		PM	0	0	1
		BOT	NA	24	1
	Timorex	DM	56	25	1
		PM	35	25	2
		BOT	NA	31	1
	Ecoswing	PM	11	39	1
		BOT	NA	100	1
	Fracture/ProBlad Verde	PM	100	61	2
		BOT	NA	35	7
Microbial Extract	Oso	PM	88	72	1
		BR	45	0	1
		BOT	NA	0	1
	Romeo	DM	13	29	2
		PM	53	53	2
		BR	16	6	1
Misc.	Cueva	DM	16	36	1
	Phostrol	DM	28	31	1
	Stylet Oil	PM	40	30	2
		BOT	NA	30	1
	Silmatrix	PM	0.3	87	1

Key Takeaways

- After many years of development and progress, biopesticides have become a more practical and useful tool for managing grape disease in New York. Newly released products are the result of decades of innovation and discovery in selection pipelines, and have the efficacy rates to prove it!
- Biopesticides have fundamentally different modes of action to conventional chemistries. While they function in diverse ways, they universally act as **protectants**. The exception to this is Stylet Oil, which is an excellent powdery mildew eradicant.
- In moderate pressure years, many newly released biopesticides are able to provide comparable protection to conventional products. However, they struggle in high pressure years.
- Overall, our data shows that biopesticides add the most value when used in **rotation** with conventional products. Using biopesticides as rotational partners can help relieve use pressure on highly effective conventional products, thus reducing the likelihood of fungicide resistance emerging.

Sources:

What are biopesticides? Environmental Protection Agency website.

Biopesticides. University of Massachusetts Greenhouse Crops & Floriculture Program.

Acknowledgements:
We would be remiss to not thank Wayne Wilcox, whose data is referenced extensively throughout this article. Additionally, we would like to thank Tim Martinson for his helpful edits and feedback, and for being a fantastic colleague. Congratulations on your well-deserved retirement Tim! Thank you for providing us the opportunity to contribute to your last official *Appellation Cornell*.

Upcoming Events

Don't forget to check out the calendar on our website (http://flgp.cce.cornell.edu/events.php) for more information about these and other events relevant to the Finger Lakes grape industry.

FLGP Virtual Tailgate Meeting

Tuesday, July 12 *4:30 – 6:00 PM*

Via Zoom

Our next virtual Tailgate Meeting of 2022 will be held on Tuesday, July 12. As always, the agenda for these meetings is very loose, so please come with your questions, observations, opinions about what's going on in the vineyard.

Participants will need to register before attending their first virtual meeting in order to receive the Zoom link. Registration for the online Tailgate Meetings is only required once – the link you receive when you register will work for all four online meetings this year.

Online Tailgate Meeting Registration: https://bit.ly/3M2peJp

The virtual and in-person Tailgate Meetings have been approved for 1.25 pesticide recertification credits. We will also need to receive an image or photocopy of your pesticide license before the first meeting that you attend. These images/copies can be sent to Brittany Griffin at bg393@cornell.edu. More information will be included in your confirmation email.

FLGP In-Person Tailgate Meeting

Tuesday, July 26 *4:30 – 6:00 PM*

Gene Pierre's Fox Vineyard

5895 Route 21S

Naples, NY

Our next in-person Tailgate Meeting for 2022 will be held on Tuesday, July 26 at Gene Stanbro's vineyard in Naples. The agenda for these meetings is very loose, so please come with your questions, observations, opinions about what's going on in the vineyard. The DEC has approved the meeting for 1.25 pesticide recertification credits (Categories 1a, 10, 22).

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2022 GDD & Precipitation

FLX Teaching & Demonstration Vineyard – Dresden, NY					
Date	**Hi Temp (F)**	**Lo Temp (F)**	**Rain (inches)**	**Daily GDDs**	**Total GDDs**
6/22/2022	91.6	67.8	0.42	29.7	820.9
6/23/2022	79.2	62.2	0.00	20.7	841.6
6/24/2022	81.7	59.7	0.00	20.7	862.3
6/25/2022	88.0	57.9	0.00	23.0	885.2
6/26/2022	90.7	69.1	0.27	29.9	915.1
6/27/2022	76.5	59.5	0.10	18.0	933.1
6/28/2022	73.0	54.3	0.00	13.7	946.8
Weekly Total			**0.79”**	**155.6**	
Season Total			**8.50”**	**946.8**	

GDDs as of June 28, 2021: 950.0

Rainfall as of June 28, 2021: 6.13

Seasonal Comparisons (at Geneva)

	2022 GDD [1]	Long-term Avg GDD [2]	Cumulative days ahead (+)/behind (-) [3]
April	58.3	62.9	-2
May	337.8	254.6	+7
June	473.1	484.1	+6
July		645.5	
August		595.7	
September		359.9	
October		112.8	
TOTAL	869.1	2515.5	

[1] Accumulated GDDs for each month.

[2] The long-term average (1973-2021) GDD accumulation for that month.

[3] Numbers at the end of each month represent where this year’s GDD accumulation stands relative to the long-term average. The most recent number represents the current status.

2022 GDD & Precipitation

Precipitation

	2022 Rain [4]	Long-term Avg Rain [5]	Monthly deviation from avg [6]
April	2.00”	2.83”	-0.82”
May	1.66”	3.09”	-1.43”
June	5.18”	3.52”	
July		3.46”	
August		3.22”	
September		3.46”	
October		3.47”	
TOTAL	8.84”	23.05”	

[4] Monthly rainfall totals up to current date

[5] Long-term average rainfall for the month (total)

[6] Monthly deviation from average (calculated at the end of the month)

Additional Information

Become a fan of the Finger Lakes Grape Program on Facebook, or follow us on Twitter (@cceflgp) as well as YouTube. Also check out our website at http://flgp.cce.cornell.edu.

Got some grapes to sell? Looking to buy some equipment or bulk wine? List your ad on the NY Grape & Wine Classifieds website today!

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