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[extension.psu.edu](https://extension.psu.edu)



PennState Extension

**We believe that all people should have  
access to science-based education.**



IMAGE CREDIT:

# Who We Are

The Penn State Extension team consists of a collection of educators, associates, and faculty that come together when their expertise is needed. Since team members live and work alongside you, they have a vested interest in ensuring our products and services better their communities.



**Our extension educators meet your needs online or on-site.**

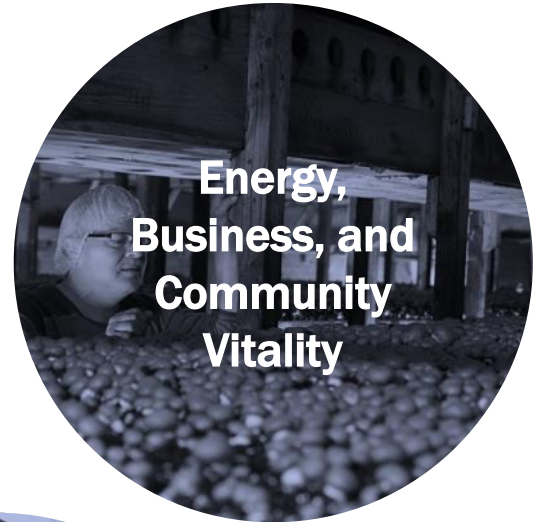
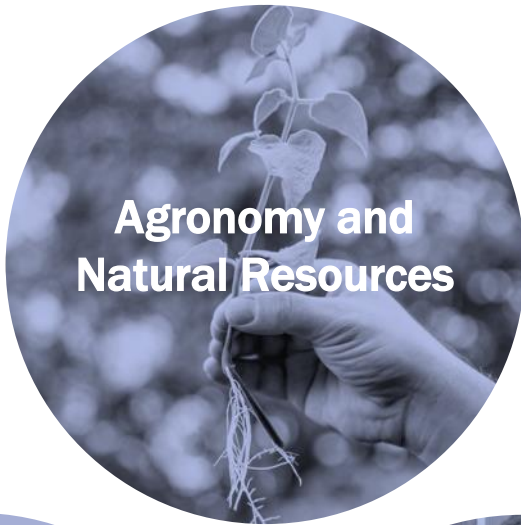


**Our team members live and work alongside you.**



**Pennsylvania residents are our customers and our advisers.**

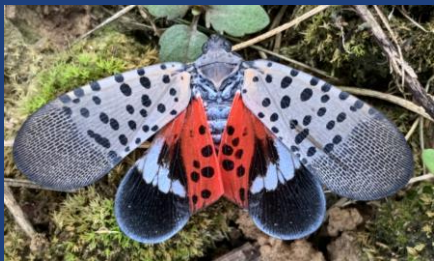
# Areas We Cover



# Spotted lanternflies in vineyards: field observations, research findings, growers' perspectives, and management scenarios



PennState Extension



**Cain Hickey**

Michela Centinari, Flor Acevedo, Claudia Schmidt

2023 MGGG / UMD Summer Meeting

July 29, 2023

# PSU Extension fact sheet – SLF in vineyards



The screenshot shows a web browser window with the URL [extension.psu.edu](https://extension.psu.edu). The page header includes the PennState Extension logo, a menu dropdown, a search bar, and links for 'Account' and 'Cart'. The breadcrumb trail reads 'Home / Spotted Lanternfly Management in Vineyards'. The article title is 'Spotted Lanternfly Management in Vineyards', categorized under 'ARTICLES'. A brief description states: 'This article provides identification, damage, quarantine, and management information for the spotted lanternfly, an invasive sap-feeding planthopper that feeds on the vine trunk, shoots, and leaves of grape plants, among other crops.' Below the text are icons for 'Download', 'Save for later', 'Print', and 'Purchase', along with an 'Updated: April 20, 2021' timestamp. The main content area features a photograph of a spotted lanternfly on a grapevine branch. To the right of the photo, the text describes the insect as *Lycorma delicatula*, an invasive planthopper native to Asia first detected in 2014 in Pennsylvania. It notes that as of April 2021, SLF is found in Pennsylvania, New Jersey, Virginia, West Virginia, Maryland, Connecticut, Delaware, New York, and Ohio. It also mentions that SLF has been reported in Maine, Massachusetts, Michigan, North Carolina, California, and Oregon, but is not yet known in these states. The text explains that SLF feeds on many plants, including economically important crops like grapevines, cucumbers, hardwoods, and ornamentals, and that significant damage has been reported from SLF feeding on grapevines, including increased susceptibility to winter injury, reduced starch concentration in vine roots, reduced yield in the subsequent year, and potential death of vines. The article concludes that this guide will update users on current information. On the right side of the page, there is a section titled 'You may also be interested in ...' which lists three related items: a 'Spotted Lanternfly Public Meeting' under 'WORKSHOPS', an article titled 'Tree-of-Heaven' under 'ARTICLES', and a 'Report a Spotted Lanternfly Sighting' link.

<https://extension.psu.edu/spotted-lanternfly-management-in-vineyards>

# Outline

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- Life cycle
- Field observations
- Research findings
- Growers' perspectives
- Management scenarios





# Life cycle

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# Life cycle

- Planthopper
- One cycle per season
- Eggs laid in the fall
- Nymphs hatch in the spring
- Four nymph stages



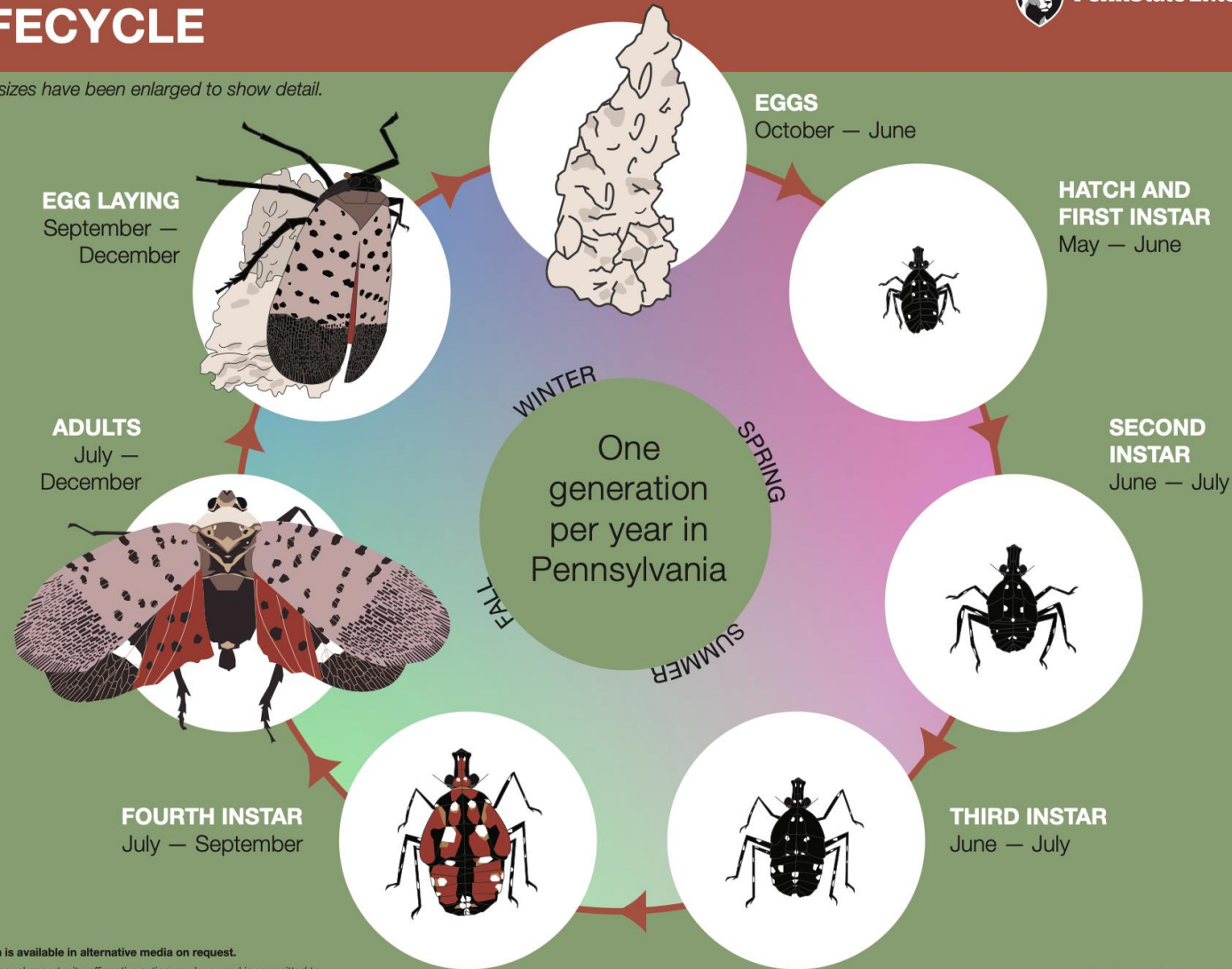
# Life cycle

- First three nymph stages –
  - Black and white
- Fourth nymph stage –
  - Red, black, and white
- Adult:
  - Approx. one inch-long
  - Colorful



# SPOTTED LANTERNFLY LIFECYCLE

*Insect sizes have been enlarged to show detail.*



This publication is available in alternative media on request.

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Illustrations by Colleen Witkowski

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# Population dynamics within the vineyard

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# Population dynamics within vineyards – *timeframe*

- **First instar nymphs –**
  - Pre-bloom
- **Second-fourth instar nymphs –**
  - Fruit set through post-veraison\*\*
- **Adults –**
  - Pre-harvest – post-harvest



\*\* can be controlled by insecticides used for other insects (e.g. GBM, Japanese beetles)

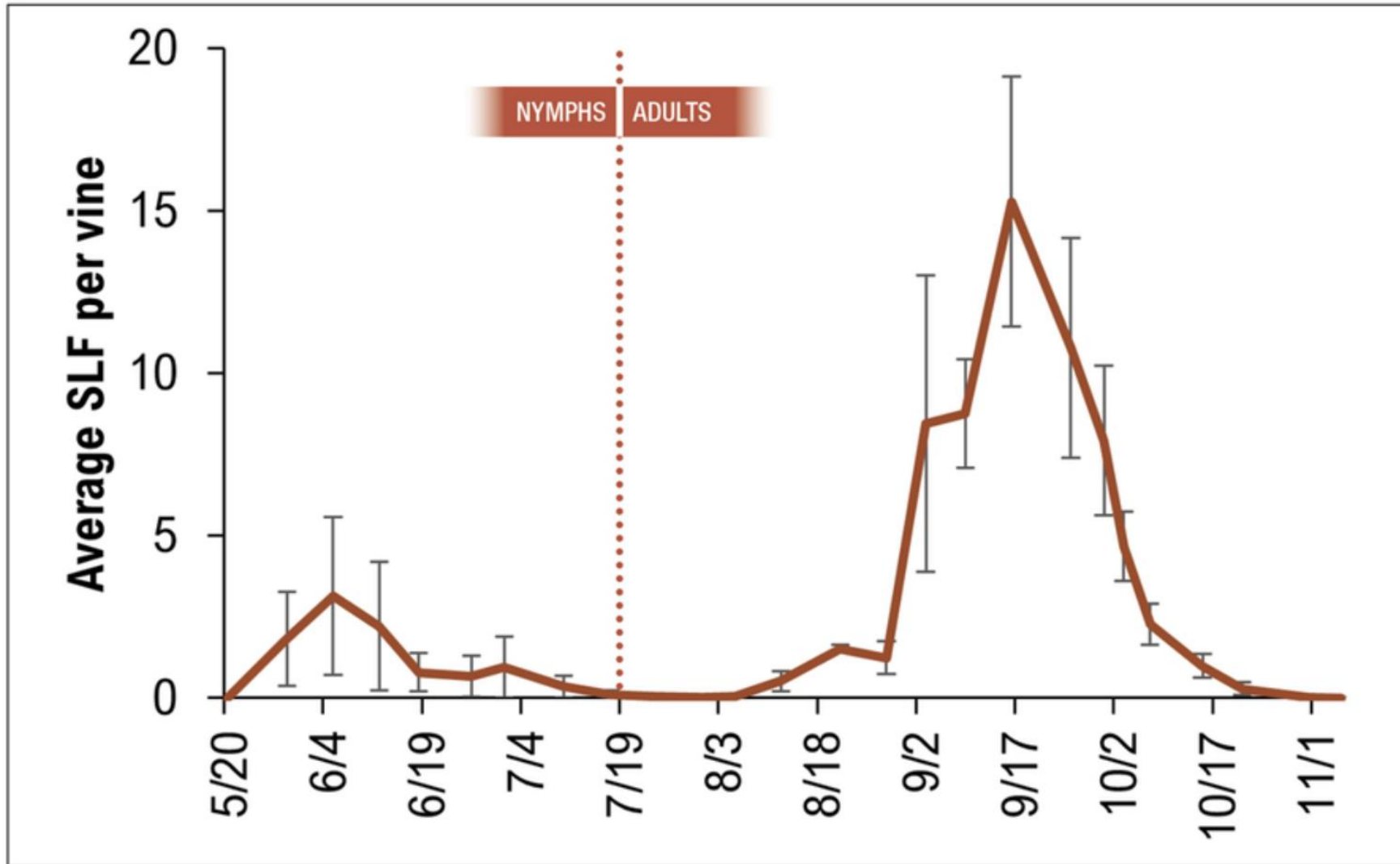


Figure 2. The average number of SLF per vine from 2018 to 2020 across eight different vineyards in Berks County, Pennsylvania

- <https://extension.psu.edu/spotted-lanternfly-management-in-vineyards>

# Population dynamics within vineyards – where are they?

- **Egg masses:**
  - Posts
  - Trunks





Heather Leach

- <https://extension.psu.edu/spotted-lanternfly-management-in-vineyards>



# Population dynamics within vineyards – where are they?

- **First instar nymphs –**
  - Hatch from egg masses on posts and under cordons
  - Found on underside of foliage



# Population dynamics within vineyards – where are they?

- **Second through fourth instar nymphs –**
  - Found on vegetation



Heather Leach

- <https://extension.psu.edu/spotted-lanternfly-management-in-vineyards>

# Population dynamics within vineyards – where are they?

- **Adults**
  - Found on trunks and cordons



## Edges are most infested with SLF adults / eggs - approx. 40-60'

“54 percent of the SLF population is within the first 50 feet of the vineyard edge”



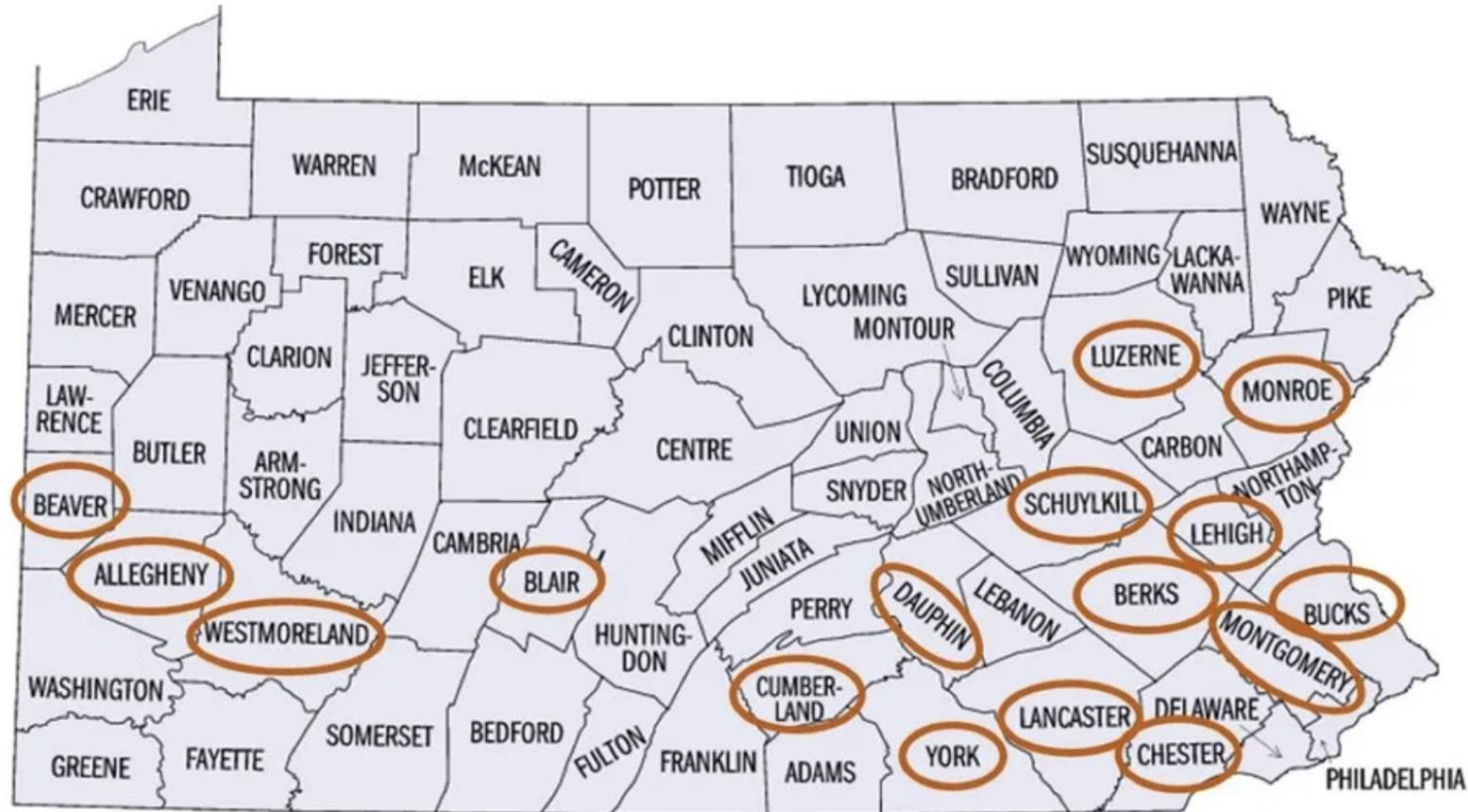
- <https://extension.psu.edu/spotted-lanternfly-management-in-vineyards>

Population dynamics within vineyards – *how long do adult SLF persist across vineyard?*

- Survey sent out weekly in September, October, November
- Asked growers to report adult SLF presence and estimated density

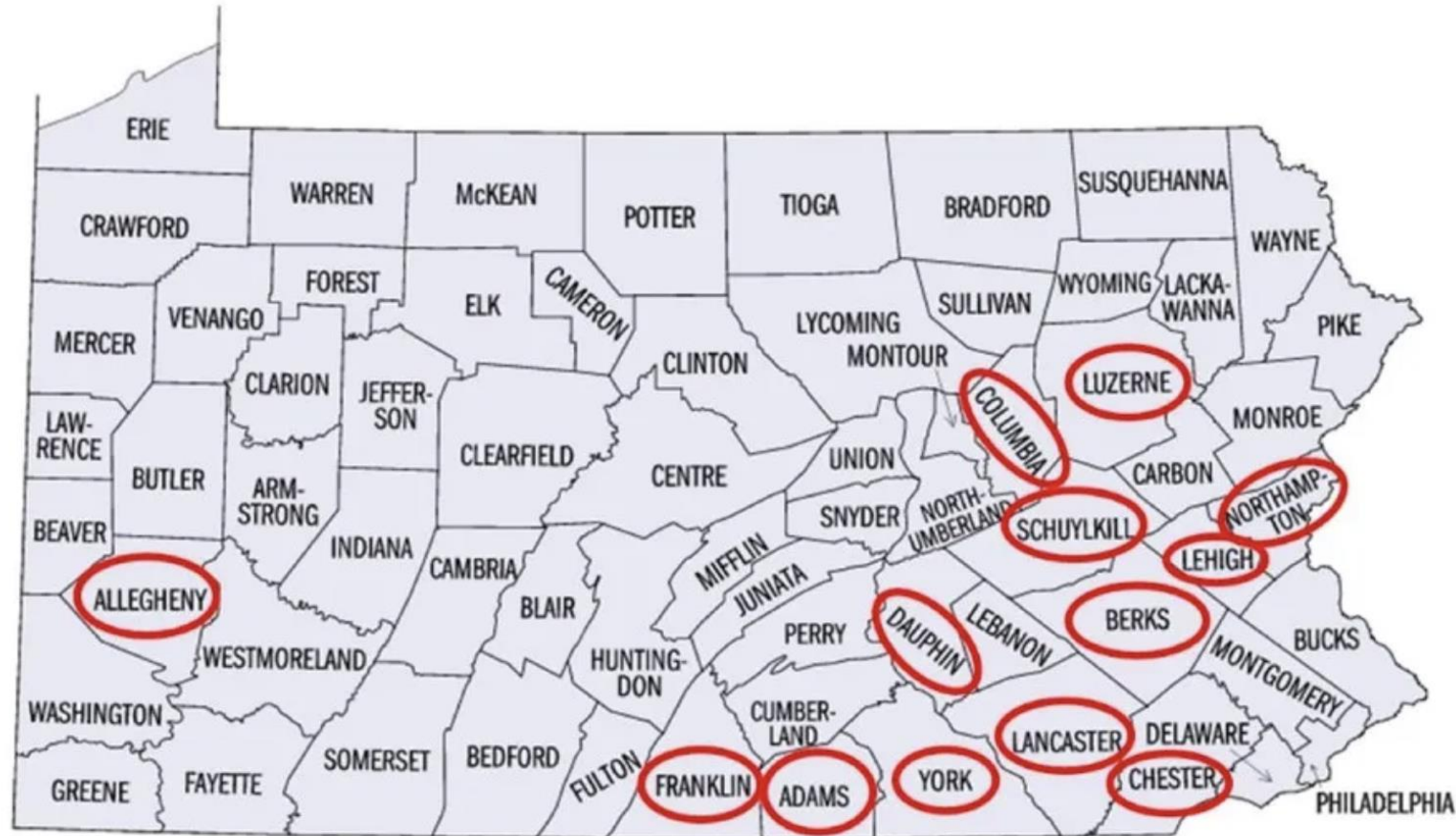


# September 23<sup>rd</sup> report – survey of adult SLF in PA vineyards



Map source: [www.fedstats.gov](http://www.fedstats.gov)

# November 11<sup>th</sup> report – survey of adult SLF in PA vineyards



Map source: [www.fedstats.gov](http://www.fedstats.gov)

<https://extension.psu.edu/2022-adult-spotted-lanternfly-status-in-pa-vineyards-november-11>

# Population dynamics outside of vineyards... *less clear*

Host	Nymphs			Adults		
	May	June	July	August	September	October
Rose						
Grape						
Tree-of-heaven						
Black walnut						
River birch						
Willow						
Sumac						
Sycamore						
Silver/red maple						

**Table 1.** Key Plant Hosts of SLF and the Times They Can Be Found on These Hosts

- <https://extension.psu.edu/spotted-lanternfly-management-in-vineyards>





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# Research findings

**Dr. Michela Centinari and Dr. Flor Acevedo**

# SLF research in vineyards

- Feeding patterns based on grapevine genetics and host dynamics (Flor)
- Feeding density effects (Michela)\*\*
  - Adults only
- Feeding density effects (Michela and Flor)\*\*
  - Adults and nymphs



Michela Centinari

\*\* needed to develop action thresholds

# Understand the damage to provide targeted management recommendations

Can grapevines withstand a specific population density without incurring negative effects for vine health and wine composition?

# Study design (2019-2022)

Slide: Michela Centinari

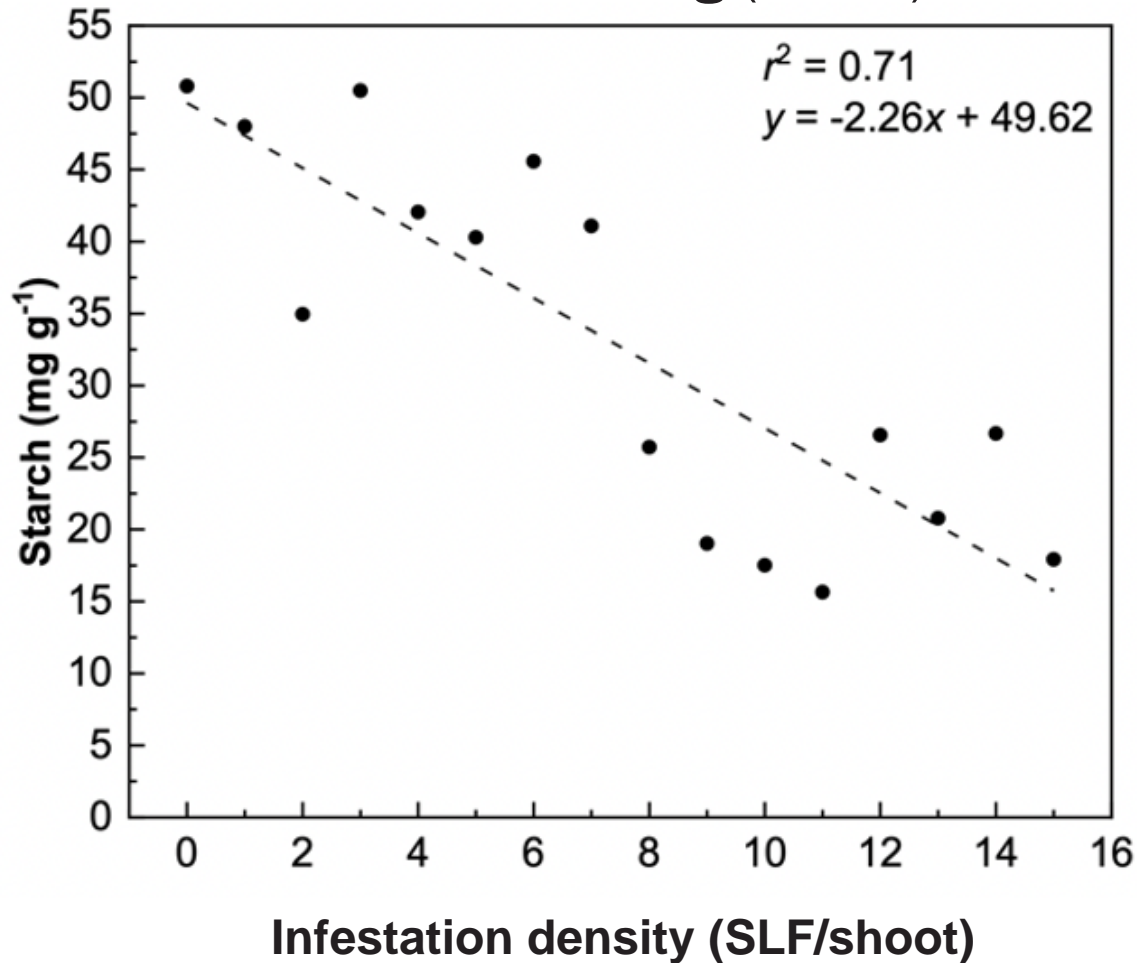


Treatments: 0-15 adult SLF/shoot (0-200 SLF/vine)

Adult SLF infestation: Mid/end of August -> Mid-October

# Prolonged SLF phloem feeding deprived roots of starch

Roots - Riesling (2020)



Range: 0 → 200 SLF / vine

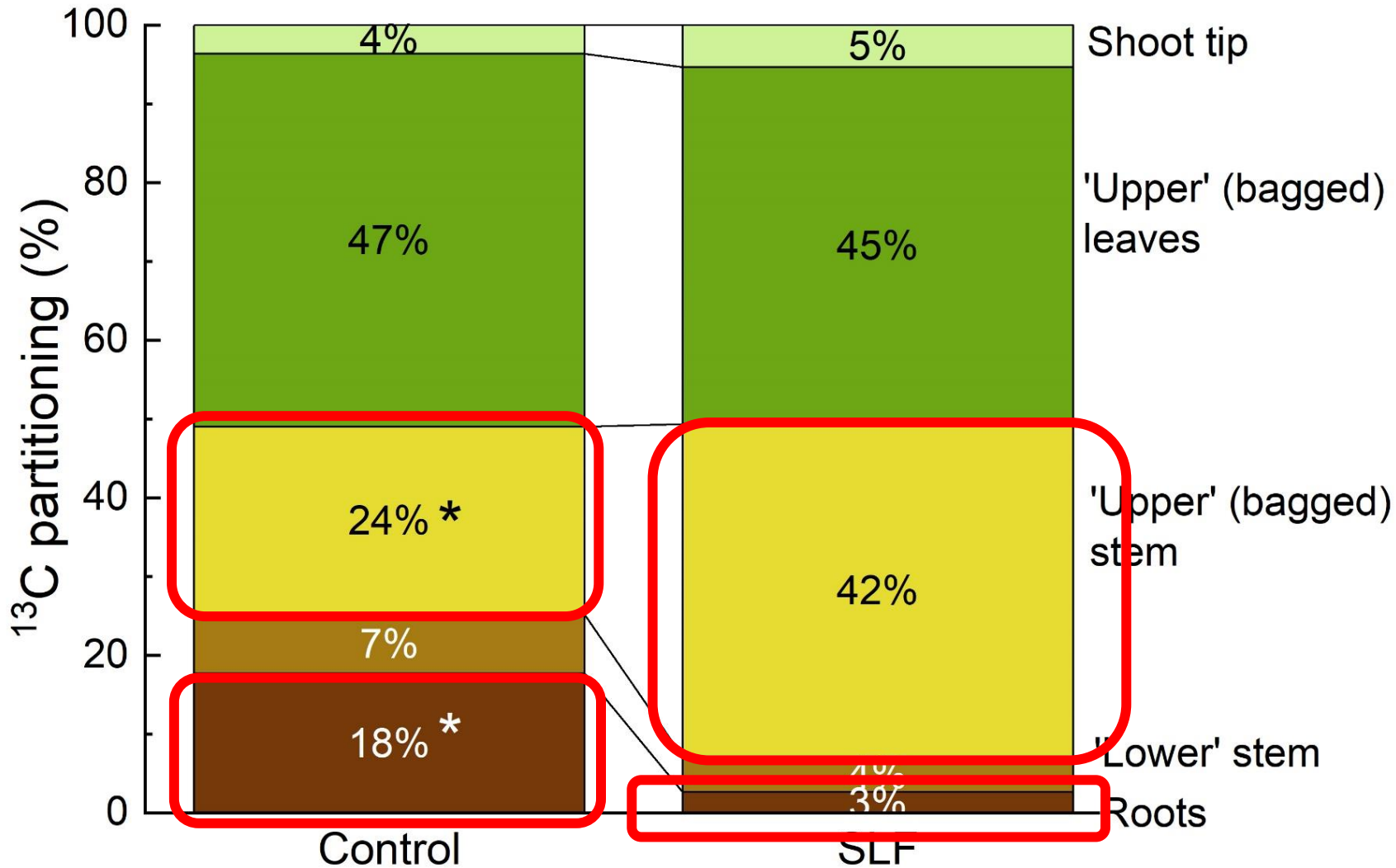
- Vines exposed to adult SLF for 28 days
- Similar trends across studies

Slide: Michela Centinari

Harner et al. 2022, Plant Direct

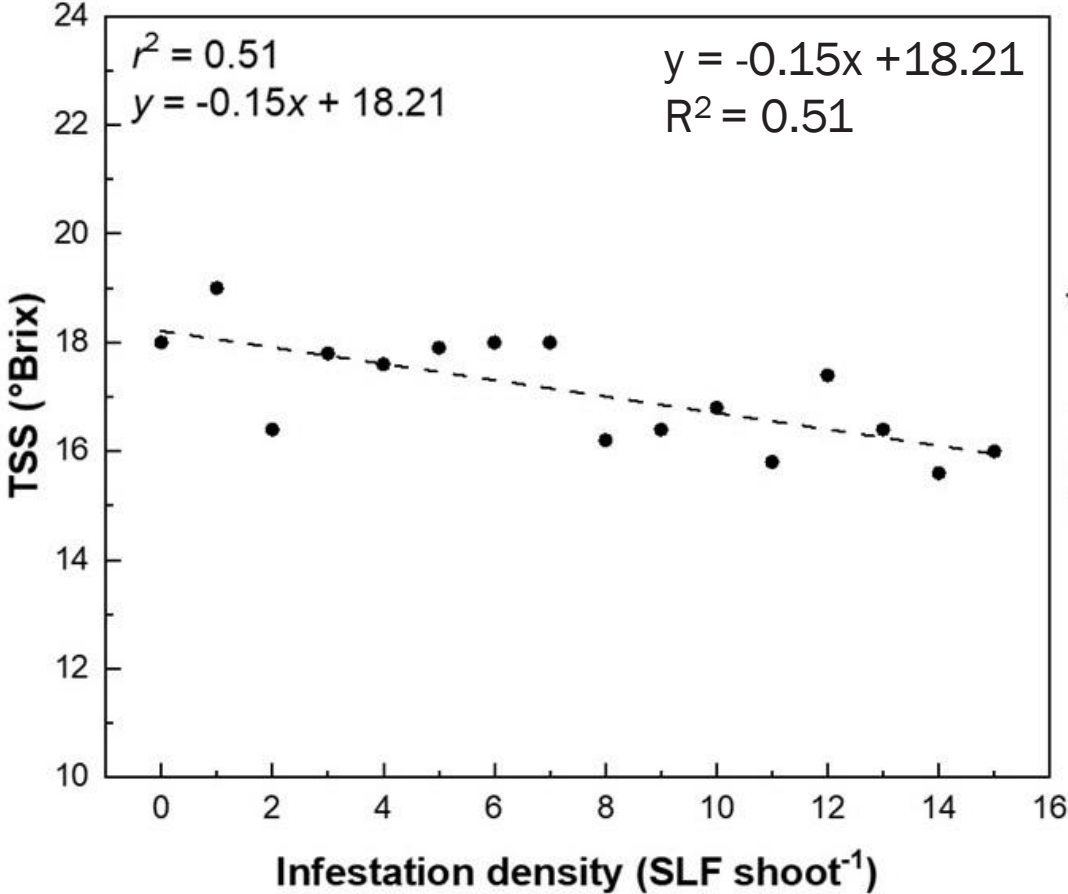
# SLF prolonged feeding affected C distribution between above and belowground tissues

Slide: Michela Centinari

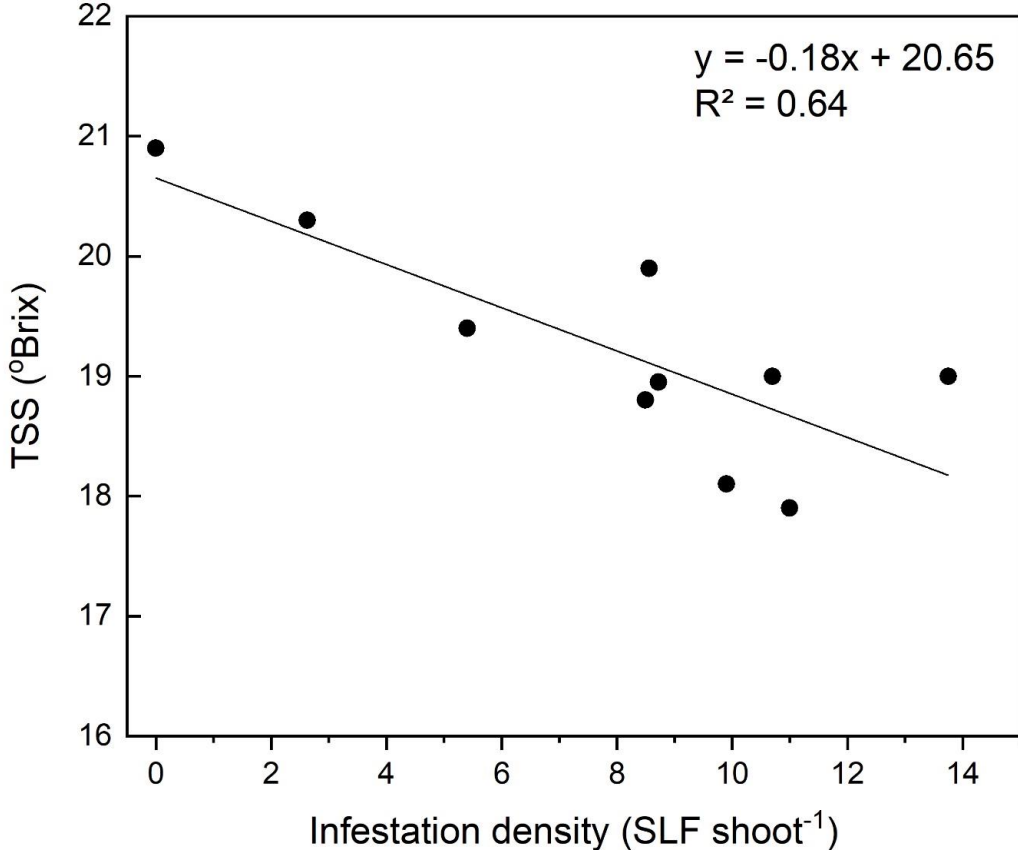


# SLF prolonged feeding can decrease sugar accumulation in grapes

Riesling (2020)



Cab Franc (2021)



# Cab franc – 2022 harvest



Vine (0 SLF)



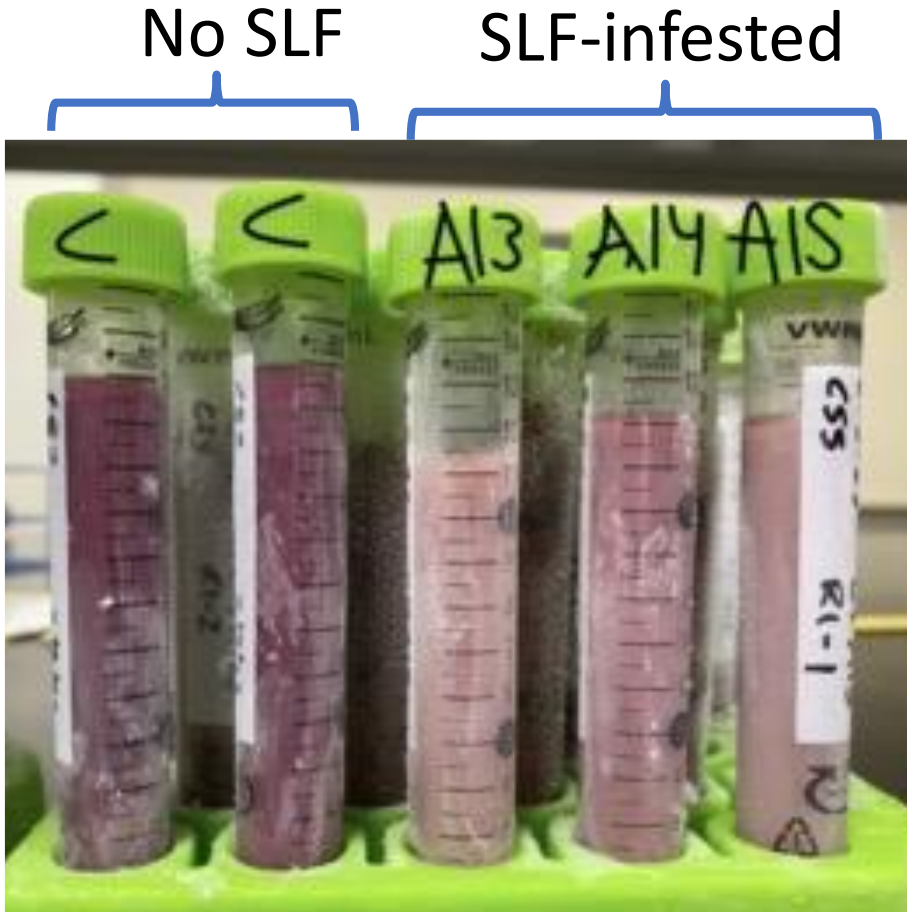
Vine with ~ 200 adult SLF



# Does SLF phloem-feeding affect wine composition?



Cabernet Franc



Finished Cab Franc wines



Misha Kwasniewski

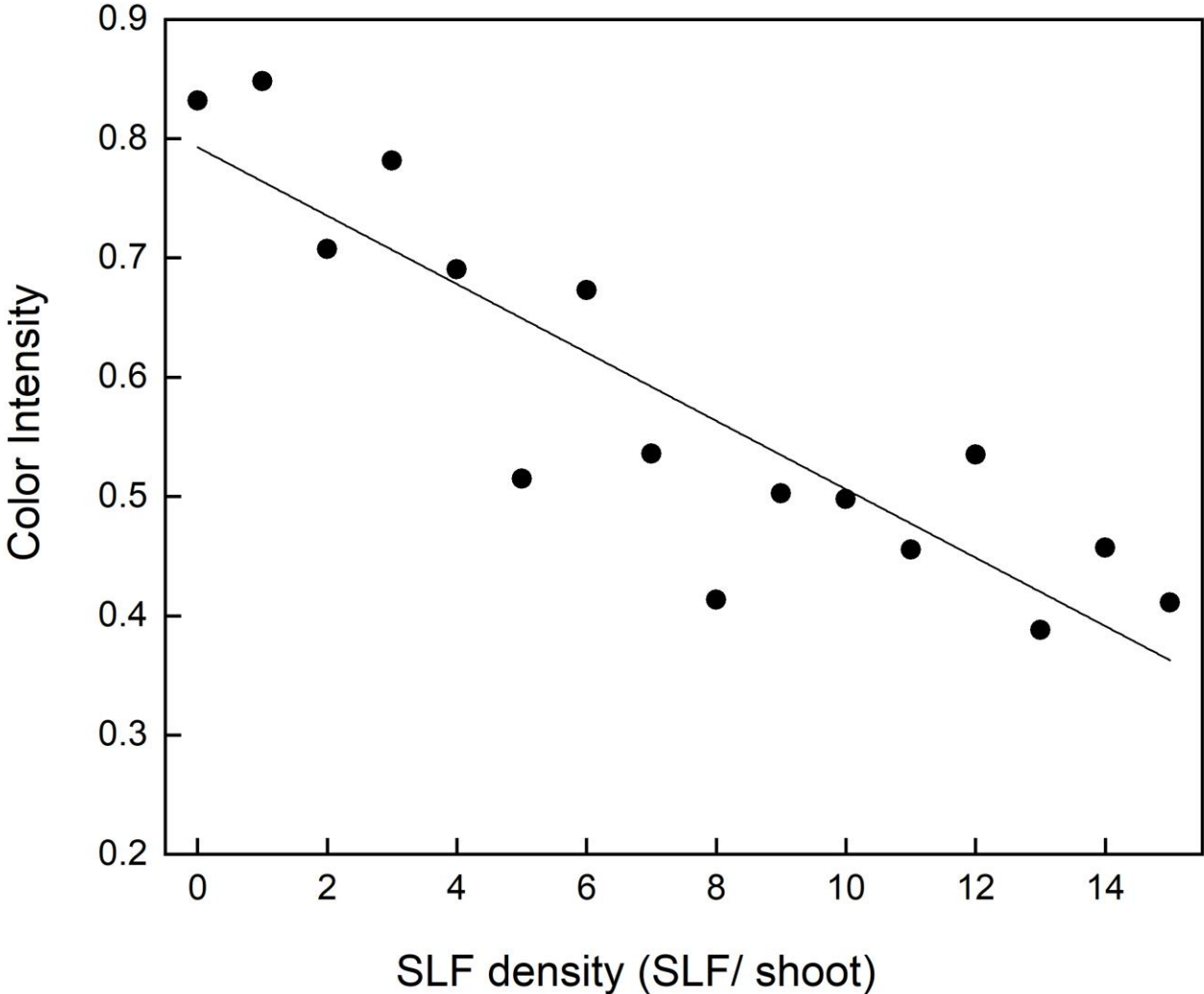


Drew Harner

Slide: Michela Centinari

# SLF prolonged feeding can decrease wine color intensity

Cabernet Franc 2022



Slide: Michela Centinari

# Development and mortality of spotted lanternfly feeding on grape and tree of heaven

Research questions:

- 1) Are spotted lanternflies able to complete their development when feeding exclusively on cultivated grape?
- 2) Do single (grape or TOH) and mixed (grape + TOH) diets affect spotted lanternfly development, survival and reproduction?

Laveaga et al. 2023

# Methods



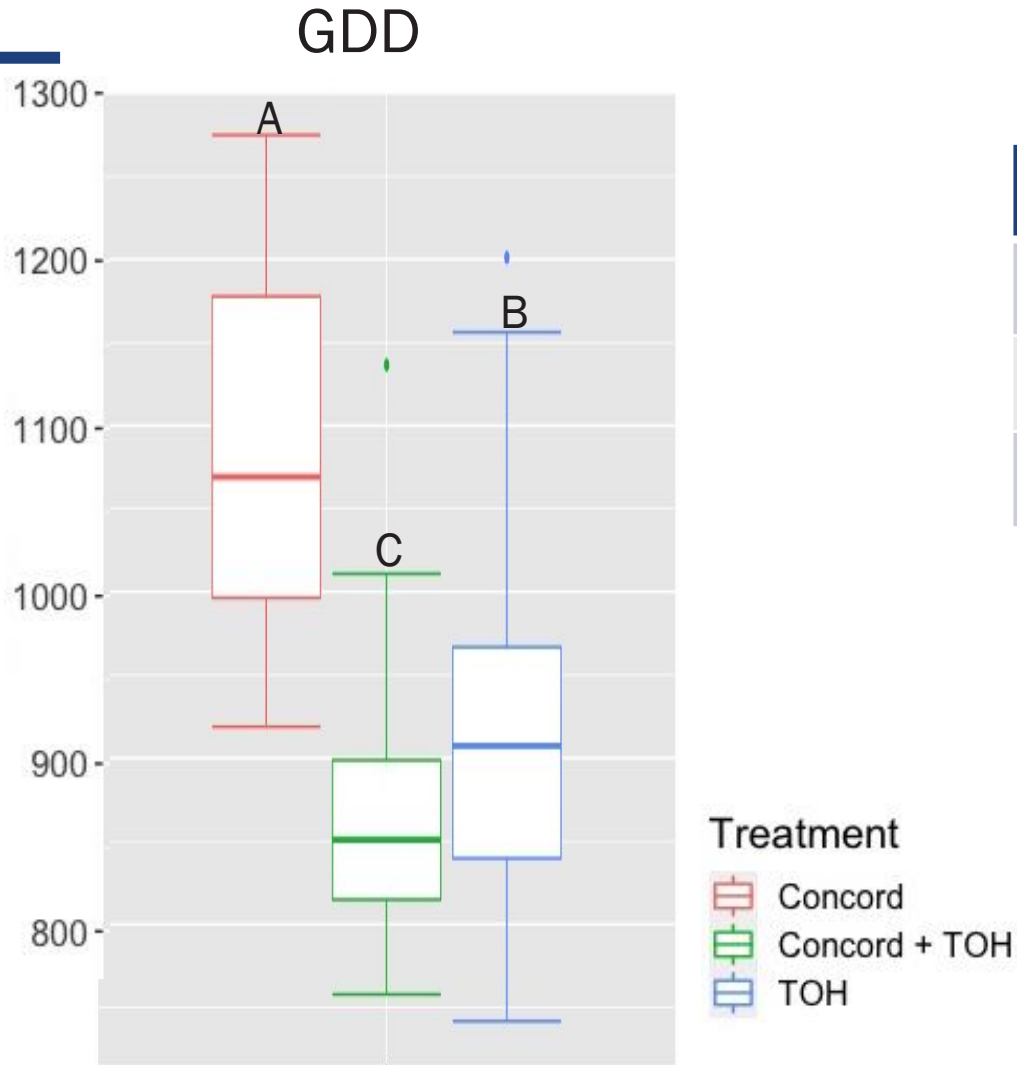
## Treatments:

- Concord grape
- TOH
- Concord + TOH

## Recorded:

- Development
- Survival
- Adult oviposition
- Adult dry weight
- Temperature

# Results (Development)



Number of days from first instar nymph to adult

Treatment	Mean	St. Deviation
Concord grape	90.8	14.2 <sup>a</sup>
TOH	77.4	11 <sup>b</sup>
Concord + TOH	70.5	7.9 <sup>c</sup>

- Spotted lanternflies developed faster when feeding on a mixed diet of Concord grape plus TOH.
- Spotted lanternflies developed slower when feeding on Concord grape compared with other diets.

# Results (Survival)

Treatment	Initial No. of nymphs	Survival to adulthood (%)
Concord grape	251	6.3 <sup>b</sup>
TOH	255	37.7 <sup>a</sup>
Concord + TOH	132	50.6 <sup>a</sup>

- Spotted lanternflies had higher survival when feeding on the mixed diet of Concord and TOH, and on the single diet of TOH than when feeding exclusively on Concord.

# Results (Reproduction)

Treatment	Initial No. of SLF couples	Couples that oviposited (%)	Egg masses	Total eggs	Egg hatch (%)
Concord grape	11	9	1	45	0
TOH	49	45	38	1058	5.7
Concord + TOH	26	73	49	1803	10.2

- Spotted lanternflies fed on concord grape plus TOH laid more eggs and had a higher hatch rate than those fed on single host diets of either TOH or Concord grape



# Growers' perspectives

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## General sentiment – “another thing to do in the vineyard...”

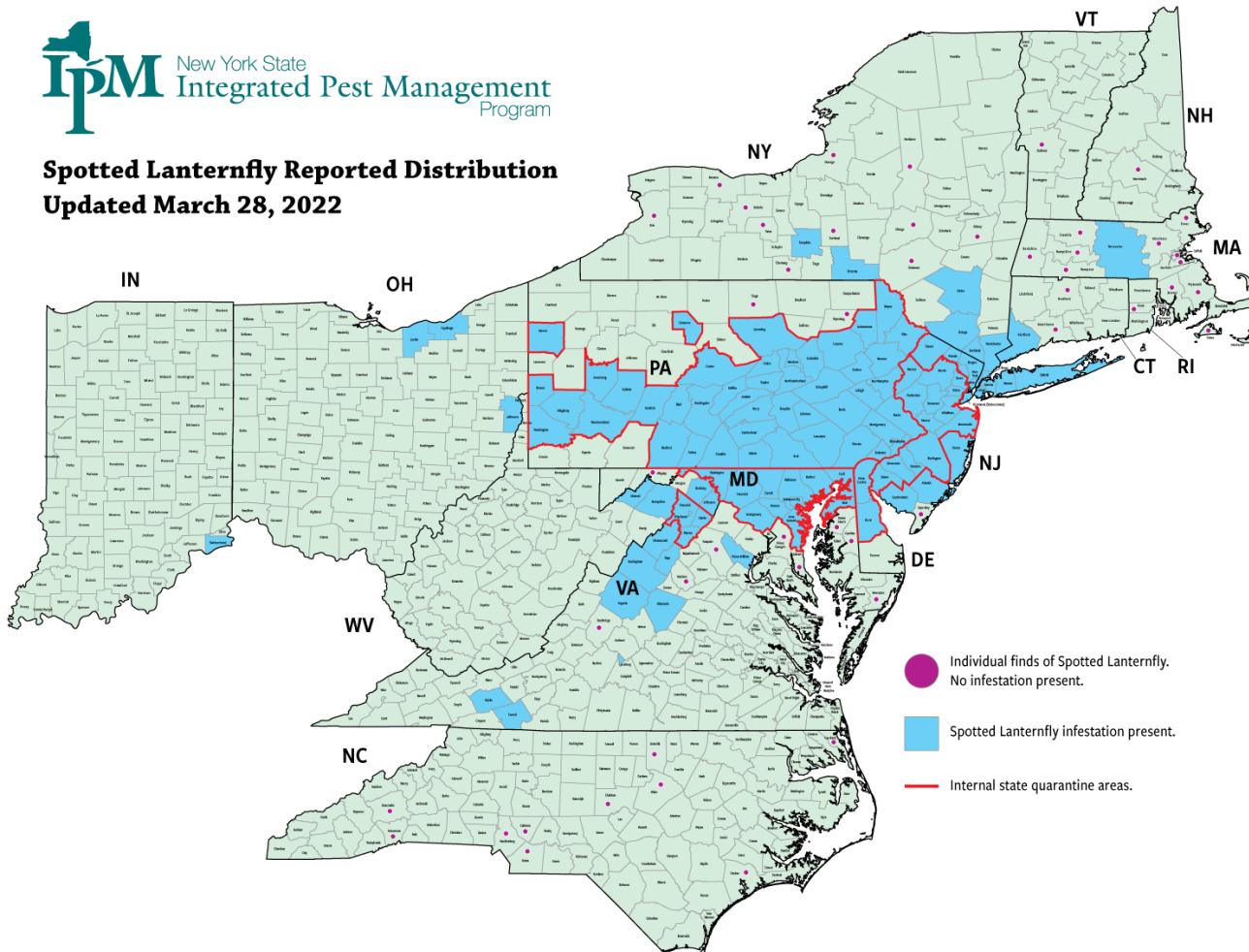
- **Nobody wants to spray more**
  - Time and money
- **Nobody wants to spray more insecticides**
  - Ecological philosophy
  - Insecticide class rotation
- **Nobody wants more to do near harvest**
  - It's kinda busy...
  - Pre-harvest intervals



# SLF Survey



**Spotted Lanternfly Reported Distribution**  
Updated March 28, 2022



Survey: March 10 – May 23

States	# of responses
Pennsylvania	50
Maryland	18
Ohio	18
New Jersey	10
Virginia	8
New York	4
PA&NY	3
West Virginia	2
Connecticut	2
Delaware	1
Michigan	1
	<b>117</b>

→ 46% detected SLF on their property

→ 32% stated severe impact of SLF

Data: Claudia Schmidt

# Planting / re-planting in the “SLF zone” ...

- **Growers have resumed planting vineyards**
  - **Since approx. 2020**
- *“SLF threat is moderate contributor to delay in small expansion. Major contributor is material/labor expense.”*
- *“Waiting to see how bad it’s going to be before expanding.”*
- *“I will not expand also concerned about crown gall I think it is partly due to SLF”*



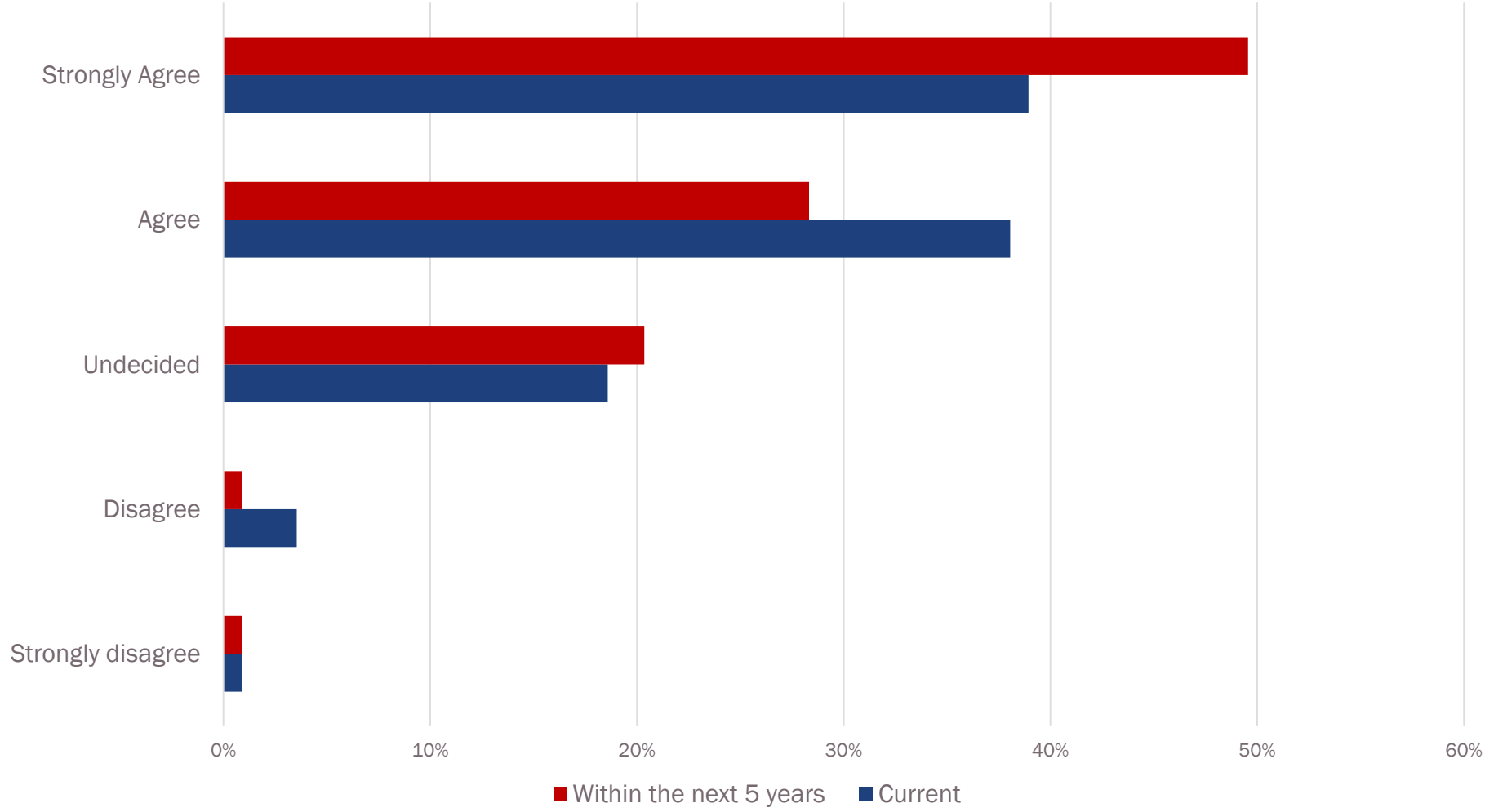
# Other stakeholder testimonials...

- **Vineyard:**
- *“Peak SLF problem occurs at the same time as harvesting. Pickers hate being bombarded with SLF. Also difficult to time sprays during harvest due to both weather and PHI values.”*
  
- **Winery:**
- *“End of summer, when the adults are active, they jump on people land on food, faces, clothing; mostly verbal complaints about sitting outside on patio.”*



Claudia Schmidt

# I consider SLF a significant threat to grape production in my state – all responses

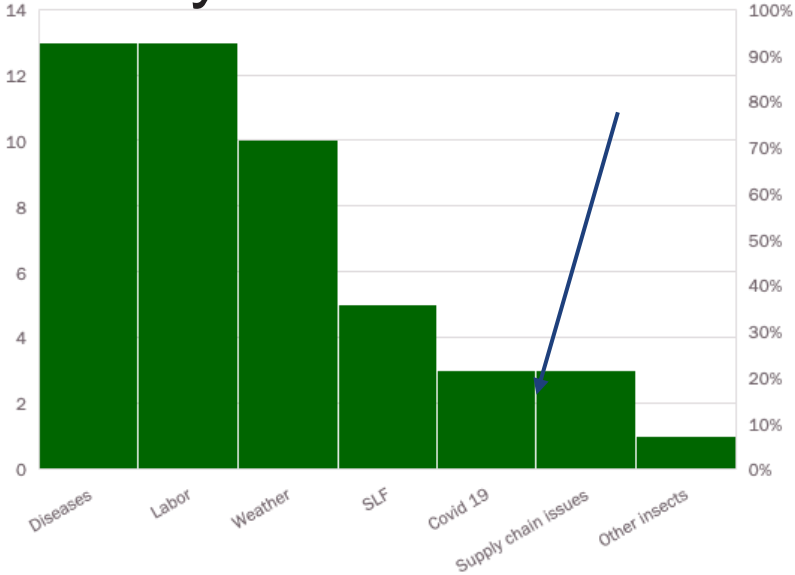


Data: Claudia Schmidt

N=113

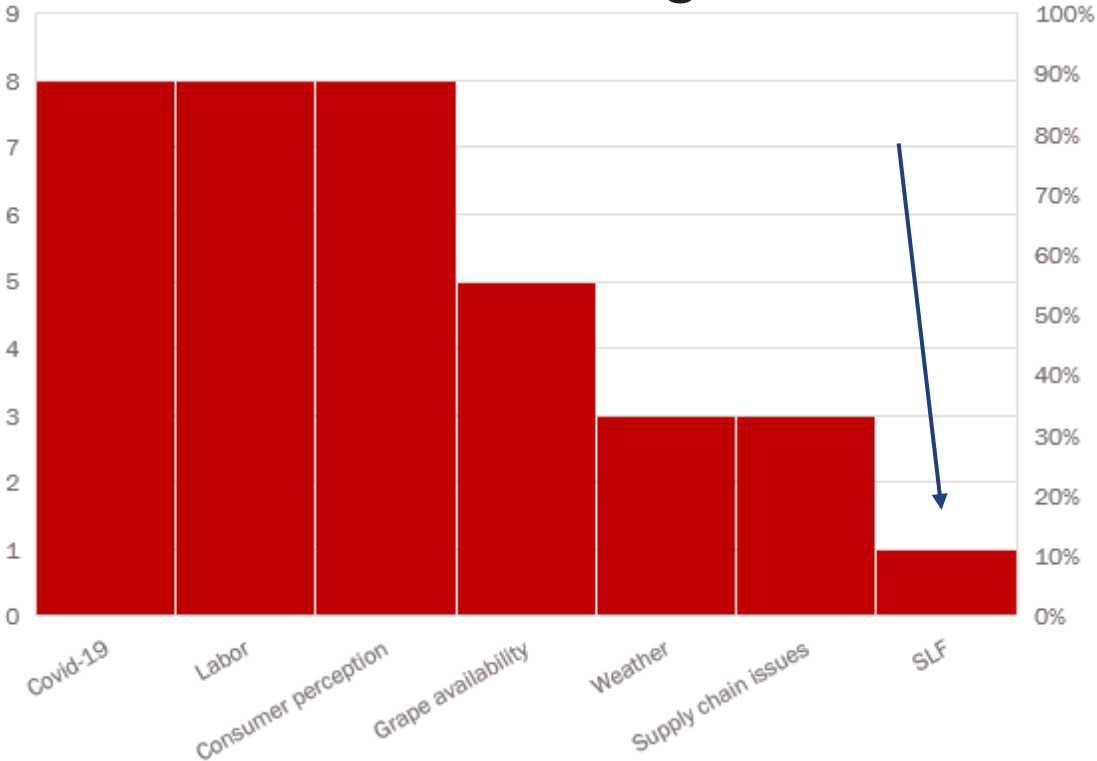
# Ranking of the most threatening industry issues (Pennsylvania)

## Vineyards



N=48

## Wineries and Tasting Rooms



N=36

Data: Claudia Schmidt



# Management scenarios

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# Cultural control methods – not widely adopted

- **Canopy exclusion netting**
- **“Netting wall / perimeter”**
- **Trapping**
- **Egg mass scraping**



[https://extension.psu.edu/media/wysiwyg//extensions/catalog\\_product/54e48a618a104d2f872eba997ca86a9c/s/l/slf-exclusion-netting.jpg](https://extension.psu.edu/media/wysiwyg//extensions/catalog_product/54e48a618a104d2f872eba997ca86a9c/s/l/slf-exclusion-netting.jpg)



# Exclusion Netting

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- Not used (only 3% of growers)
- “experimental”

*“I had 1 row of 3 year old Cab Franc that were completely covered in net I did not loose any vines. Uncovered row I lost about 20%” Pa Grower*



Source: [PSU Extension](#)

Data: Claudia Schmidt

# Many of the insecticides are “restricted use” in PA

Active Ingredient	Trade Name(s) Tested	Class (IRAC Group)	Toxicity to Bees	Rate Per Acre	PHI (days)	REI (hours)	Target Life Stage Tested	Longevity of Product (days)*	Efficacy Rating
Bifenthrin	Brigade 2EC/ Bifenture EC**	Pyrethroid (3)	High	6.4 oz	30	12	Adults	7–14	Excellent
Beta-cyfluthrin	Baythroid	Pyrethroid (3)	High	3.2 oz	3	12	Adults	7–14	Excellent
Fenpropathrin	Danitol	Pyrethroid (3)	High	21.33 oz	21	24	Adults	21	Excellent
Zeta-cypermethrin	Mustang Maxx 0.8EC	Pyrethroid (3)	High	4 oz	1	12	Nymphs, adults	0 (knockdown only)	Excellent
Dinotefuran	Venom/ Scorpion	Neonicotinoid (4A)	High	3 oz/ 5 oz	1	12	Nymphs, adults	3–5	Excellent
Thiamethoxam	Actara	Neonicotinoid (4A)	High	3.5 oz	5	12	Nymphs, adults	3–5	Excellent
Carbaryl	Sevin XLR Plus/ Carbaryl 4L	Carbamate (1A)	High	2qt	7	12	Nymphs, adults	0 (knockdown only)	Good to excellent
Malathion	Malathion 8F	Organophosphate (1B)	High	1.88 pt	3	12	Nymphs, adults	0 (knockdown only)	Excellent
Chlorpyrifos	Lorsban Advanced	Organophosphate (1B)	High	1 qt	35	24	Eggs	—	Excellent
Paraffinic oil	JMS Stylet Oil	Mineral oil (n/a)	Low	3%	14	4	Eggs	—	Good

<https://extension.psu.edu/spotted-lanternfly-management-in-vineyards>

# When and how to spray?

- **Some growers target all nymph stages**
- **Some growers wait until they spray for GBM and/or Japanese beetles**
  - use “cover spray” to control several insects
- **Most (all?) growers spray for adults**
- **Edge-based sprays**
  - Along vineyard end panels



## Far southeastern PA vineyard (near MD / DE border)

(NOTE: SLF primarily in border areas)

Vine Growth Stage	Disease Targeted	Material	Comment
10 inch	<u>SLF Nymphs</u>	Imidacloprid	
Post-bloom	<u>SLF Nymphs</u> Japanese Beetles	Bifenthrin	<i>30 day PHI</i>
Pre-harvest	<u>SLF Adults</u>	<i>Dinotefuran</i> <i>(targeted)</i>	3-4 times before harvest; <i>1 day PHI</i>
Post-harvest	<u>SLF Adults</u>	<i>Bifenthrin</i> <i>Zeta-cypermethrin</i>	Bifenthrin is the go-to, use the Mustang for what it doesn't get  1-2 times after harvest

# Effective Control of SLF

- What Works
  - **Vineyard:** Mustang Maxx, Danitol, Malathion, Leverage 360, Bifenture
  - Perimeter sprays outside of normal spray schedule
- What Doesn't Work (from my experience)
  - Beauveria bassiana (biopesticide)
  - Sevin (Carbaryl)
  - Delegate (Spinetoram)
  - Scraping Eggs
  - Removal of all *Ailanthus* trees

# Spraying

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- Compared to an average year, growers apply 2-6 (as high as 10 times) additional insecticide applications with the highest level of SLF infestation

*“The biggest loss is the money required to spray constantly to keep the population of SLF under control.”*

PA Grower



# Putting it together...

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# Some key points

- **SLF IS ANOTHER STRESSOR**
- **Healthy vines can more readily overcome stressors**
  - Textbook vineyard management is key
  - Young/unhealthy vines are more susceptible
- **Develop an action plan**
  - Scout
  - Manage nymph populations
  - **Reduce feeding time by adults**
    - Vineyard edge, full vineyard sprays
    - PHI / IRAC needs considered







# Interested in learning more?

<https://extension.psu.edu/grape-and-enology-team-sign-up>

<https://extension.psu.edu/food-safety-and-quality/grape-and-wine-production>



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# Thank you!



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