

# Viticulture Research Updates 2021



Mark Hoffmann, NC State University

Grapevine Viruses

Grapevine Trunk Diseases

# Grapevine Viruses in NC

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Maher alRhawini, UC Davis, FPS

Mysore Sudarshana, UC Davis & USDA-ARS

Mizuho Nita, Virginia Tech

# Objectives

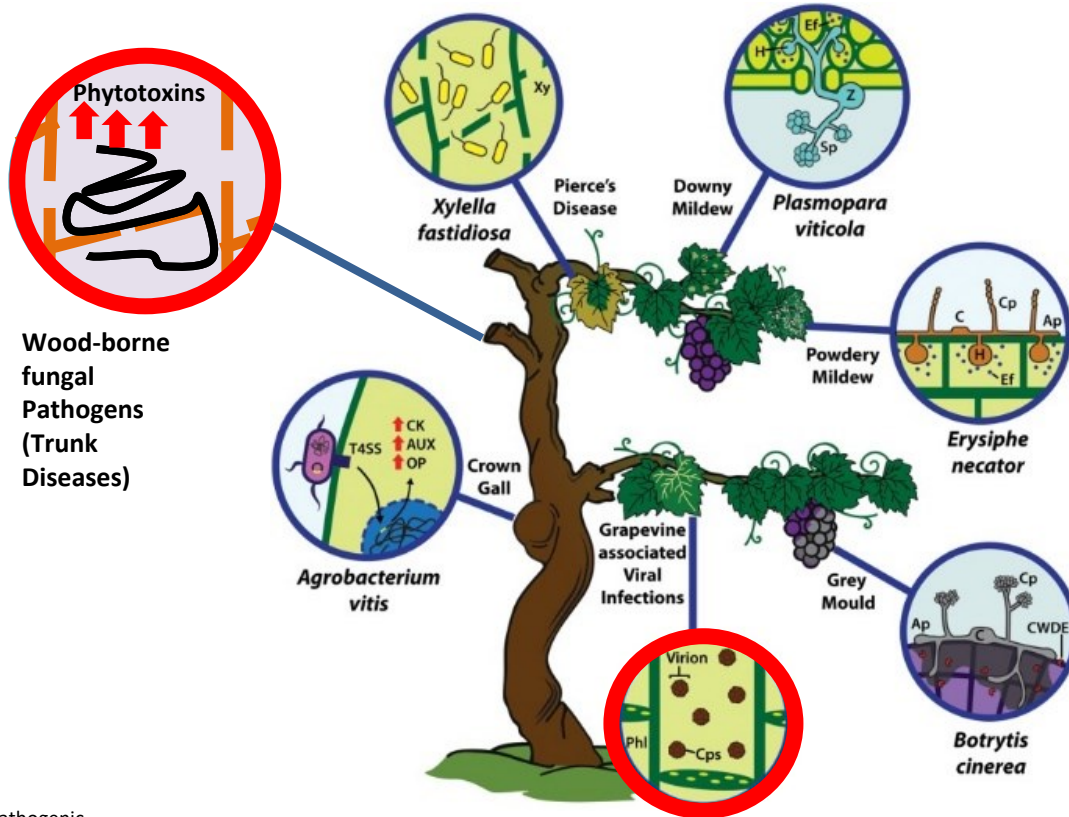
1. Identify the most common grapevine viruses in NC
2. Establish virus testing capacity at NC State University
3. Establish virus testing service for growers in NC

- *Vitis* can harbor more than 70 viruses
- Not all of them cause disease
- But some grapevine viruses are wide spread and can cause damage to vine and decrease fruit quality



# Most common viruses

- *Grapevine Leafroll associated Viruses (GLRaV 1-11)*
- *Grapevine Red Blotch Virus (GRBV)*
- *Grapevine Virus A*
- *Grapevine Virus B*



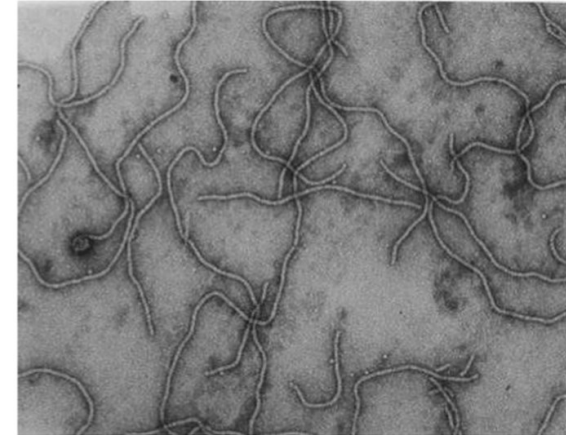
Armijo et al. (2016): Grapevine Pathogenic Microorganisms: Understanding Infection Strategies and Host Response Scenarios. Front. Plant Sci. 2016, 7:382.



	Trunk Diseases	Virus Diseases
<i>Type of Pathogen</i>	Fungal	Virus (RNA/DNA)
<i>Lethal to vine</i>	Yes	No
<i>Plant Age</i>	Mature; young (ESCA)	Mature and young
<i>Resistance/Tolerance</i>	Not found	Maybe
<i>Can come with planting stock?</i>	Yes	Yes
<i>Transmitted?</i>	Open wounds, Rain, Pruning Tools	Insect Vectors
<i>Systemic</i>	No	Yes
<i>Severity in NC</i>	High	High-moderate



- GLRaV 1-11 (11 variants)
- Viruses associated with **Grapevine Leafroll Disease**
- RNA viruses with a protein hull
- 13-19k nucleotides large
- Seems to be originally from Europe
- Transmitted by scale insects/mealybugs
- Most common: GLRaV-2,3,4,7



Green veins



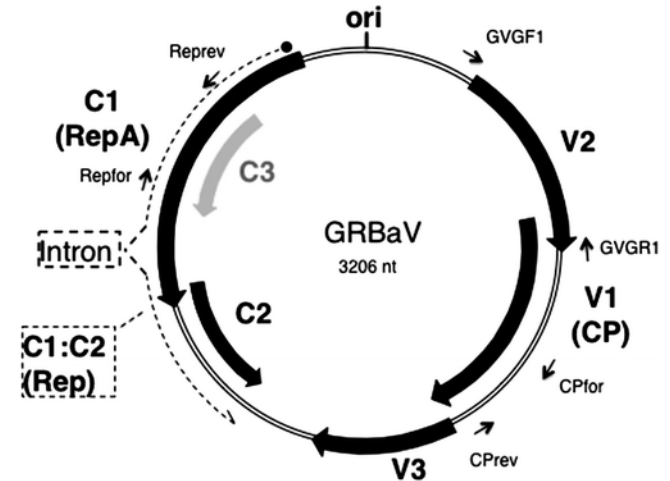
Red inter-veins



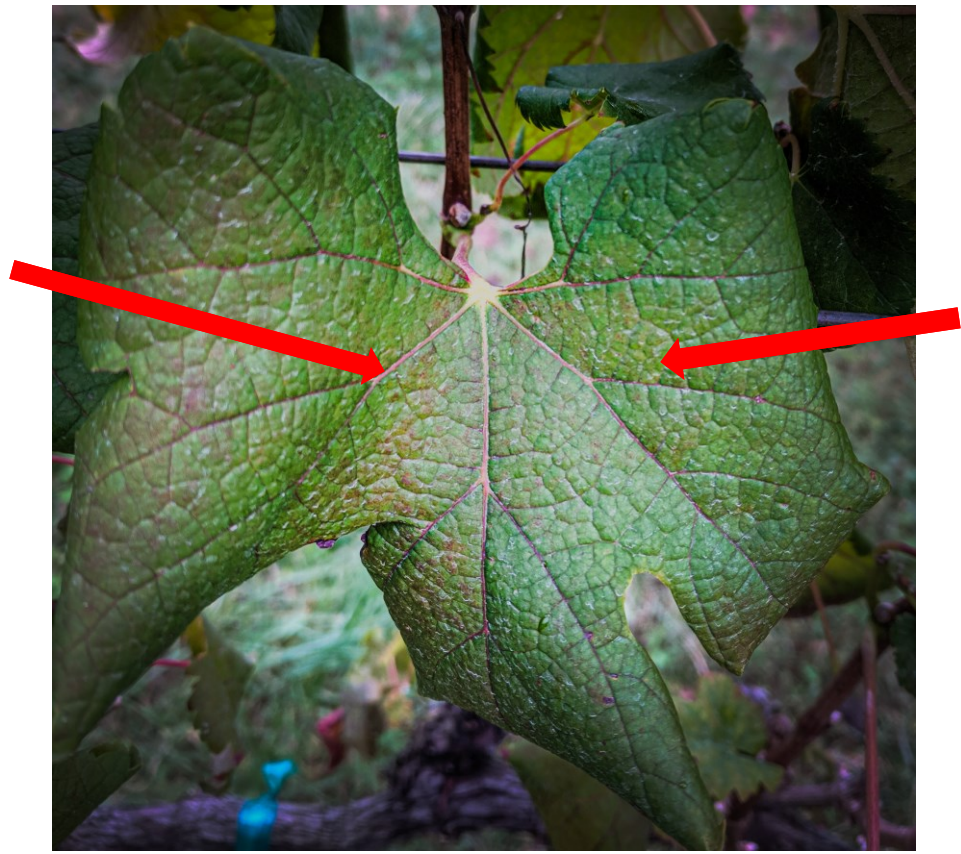
- Declined vine health
- Declined fruit quality
- Decline yield



- One Virus, two 'clades'
- Viruses that cause **Grapevine Redblotch Disease**
- Small DNA viruses
- 3,105 nucleotides small
- Discovered 2008 in California
- Three-cornered Alfalfa Hopper
- Transmitted by ??



Red veins



Green inter-veins,  
Sometimes blotchy

- Declined vine health
- Declined fruit quality
- Decline yield



# Grapevine Viruses

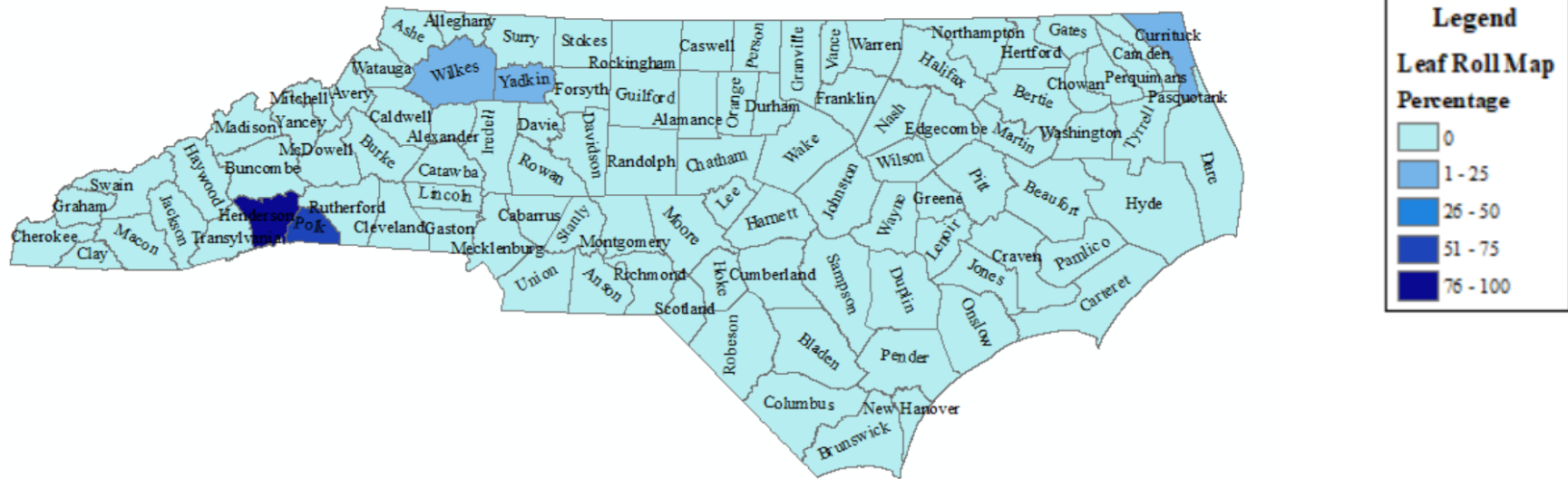
**Objective 1: Identify the most common grapevine viruses in NC**



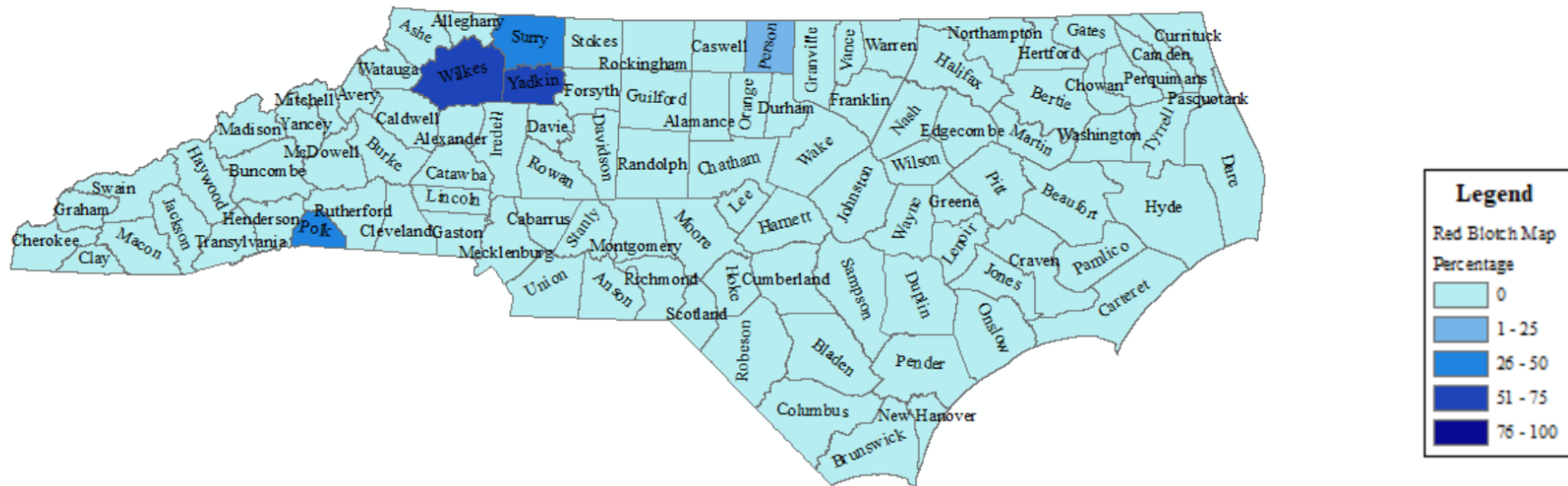
Abbreviation	Name
GLRaV-2	Grapevine leafroll associated virus 2
GLRaV-3	Grapevine leafroll associated virus 3
GLRaV-4	Grapevine leafroll associated virus 4
GLRaV-7	Grapevine leafroll associated virus 7
GRBV	Grape Red Blotch associated virus
GVA	Grapevine Virus A
GVB	Grapevine Virus B

- We sampled 280 vines across three AVAs (Yadkin Valley, Hendersonville, Upper Hiwassee Highlands)
- Samples were taken in late Oct/early Nov 2018, 19, 20.
- Only red and symptomatic cultivars were sampled
- Sampling was sterile
- Thank you to: Emma Volk, Karen Bleadow, Hannah Lepsch, Eli Snyder

## GLRaV-3 and GLRaV-2



## GRBV



Abbr.	Name	% of all tested vines
GLRaV-2	Grapevine leafroll associated virus 2	6.8 %
GLRaV-3	Grapevine leafroll associated virus 3	7.5 %
GLRaV-4	Grapevine leafroll associated virus 4	-
GLRaV-7	Grapevine leafroll associated virus 7	-
<b>GRBV</b>	<b>Grape Red Blotch associated virus</b>	<b>35.7%</b>
GVA	Grapevine Virus A	0.35%
GVB	Grapevine Virus B	-
<i>PD</i>	<i>Xylella fastidiosa</i>	<i>11%</i>

# Grapevine Viruses

**Objective 2: Establish virus testing capacity at NC State University**

- *Win Talton*, Research Assistant, NCSU Micropropagation and Repository Unit & Clean Plant Network (MPRU)
- *Christie Almeyda*, Director, NCSU MPRU
- *Maher alRhawini*, UC Davis FPS & Clean Plant Network

Only in-state samples:

\$80 per sample; \$15 per virus; + shipping (O/N on ice)

## Micropropagation and Repository Unit at NCSU

- Part of the Clean Plant Network for berries and grapes
- Core capacity is Virus Testing in plants
- GLRaVs, GRBV, GVA, GVB, Pierce's Disease



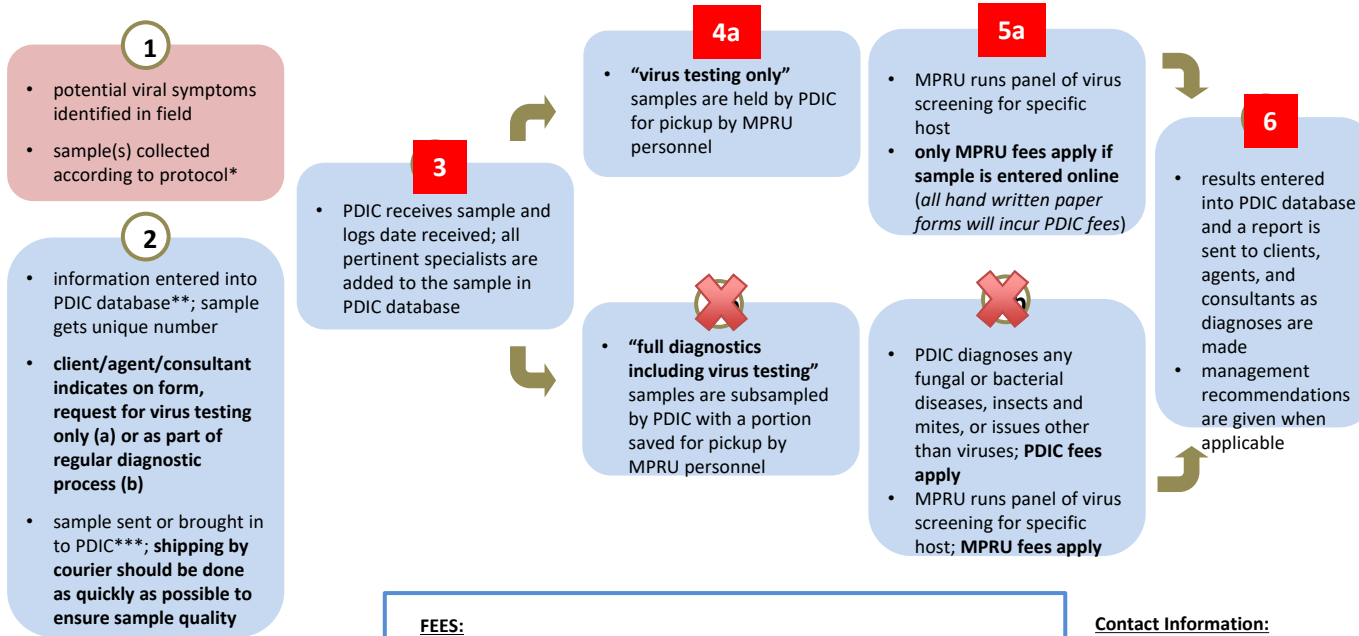
# Grapevine Viruses

**Objective 3: Establish virus testing service for growers  
in NC**

*Matt Bertone, Director, NCSU Plant Disease and Insect Clinic (PDIC)*

- Samples submitted must be either for virus OR for other pathogens
- Samples need to be entered online before shipping
- Samples need to be shipped on ice and over night
- Sample needs to be sterile and in separate plastic bag (no paper bags!!!)

crops: caneberries, grapes, strawberries, and blueberries



### FEES:

PDIC – in state, entered online, submitted by Cooperative Extension: \$20  
 PDIC – above, but entered otherwise: \$30  
 MPRU – in state: \$50 flat fee per sample + \$15 per virus per sample

### Contact Information:

PDIC  
 email: [plantclinic@ces.ncsu.edu](mailto:plantclinic@ces.ncsu.edu)  
 phone: 919-515-3619

MPRU  
 email: [cvalmeyd@ncsu.edu](mailto:cvalmeyd@ncsu.edu)  
 phone: 919-515-7250

\* [go.ncsu.edu/sampling4viruses](http://go.ncsu.edu/sampling4viruses)

\*\* [plantclinic.ces.ncsu.edu](http://plantclinic.ces.ncsu.edu)

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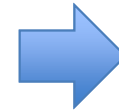
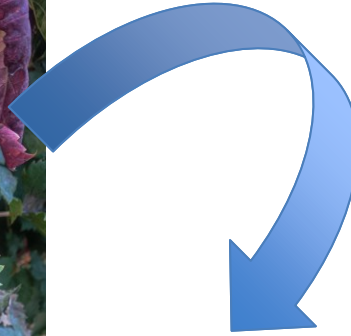
[go.ncsu.edu/pdic\\_submit\\_sample](http://go.ncsu.edu/pdic_submit_sample)

Position	Price
Sample Processing	\$50
GRBV	\$15
GLRaV-3	\$15
GLRaV-2	\$15
Pierces Disease	\$15
TOTAL	\$110 + tax + shipping

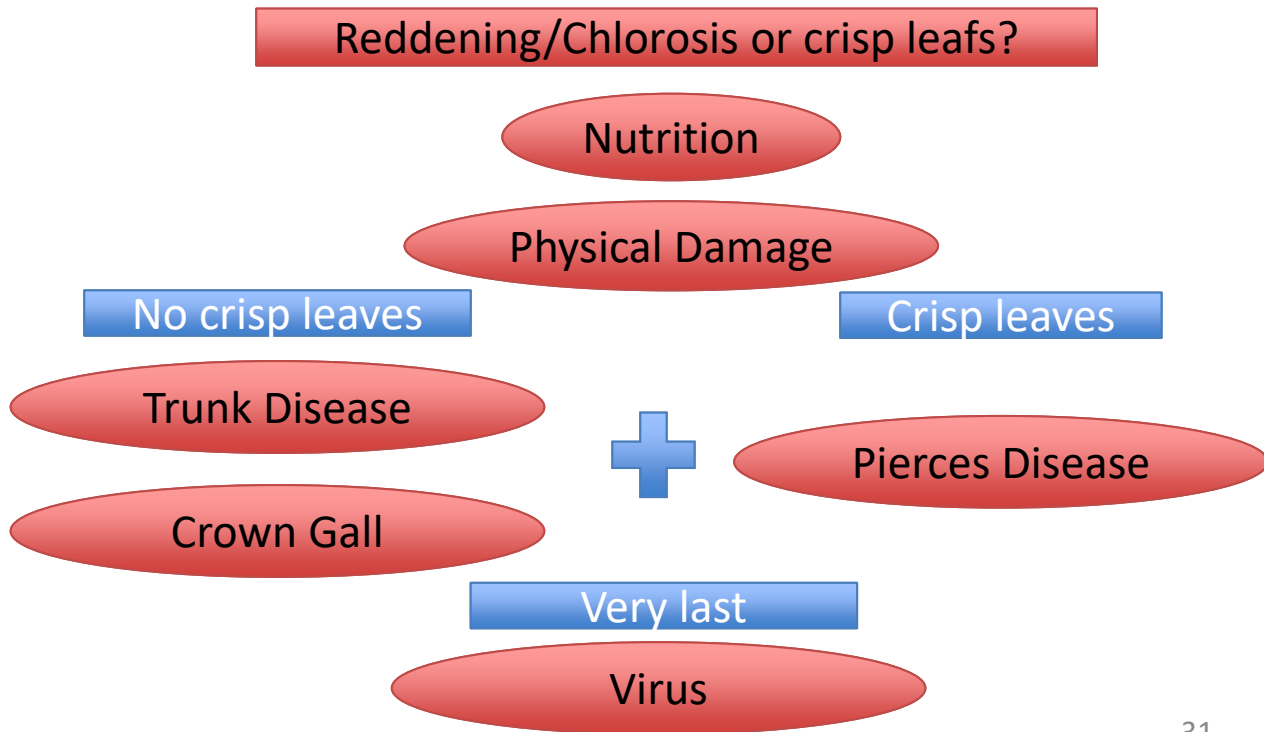




<https://pdic.ces.ncsu.edu/>



# If disease symptoms are unspecific



# Grapevine Trunk Diseases



# Grapevine Trunk Diseases

Mark Hoffmann, NC State University

Emma Volk, NC State University

Sara Villani, NC State University

Rachel Kreis, NC State University

Eric Case, Burntshirt Vineyards

Karen Bleadow, Henderson Co. Coop. Ext.

Many many more!

Grapevine Trunk Diseases are caused by a large variety of different fungal pathogens

1. *Eutypia Dieback* (caused by *Eutypia lata*).
2. *Esca Disease Complex* (associated with a range of pathogens)
3. *Botryosphaeria Dieback* (associated with *Botryosphaeria* species)

All pathogens enter through open wounds in the wood

- Pruning wounds
- Cold damage (freeze injury to trunk/cordon especially)
- Physical damage (tractor, trellis etc)

All pathogens can infect other plants as well

Inoculum assumed to be present in vineyards

Rain and wet conditions facilitate spread





- Cold damage:

Management through site and cultivar selection, replacement, retraining.

- Physical damage (tractor, trellis etc):

Management through training, site establishment and vineyard management

Pruning Wound Management?

We don't know what's the best method in NC

# Objectives

1. Identify the most common GTD pathogens in NC
2. Establish GTD identification capacity at NC State University PDIC
3. Investigate best practices for pruning wound management in NC

We have found mostly *Botryosphaeria* species in wood samples from plants with disease symptoms.

ESCA related disease symptoms were detected as well

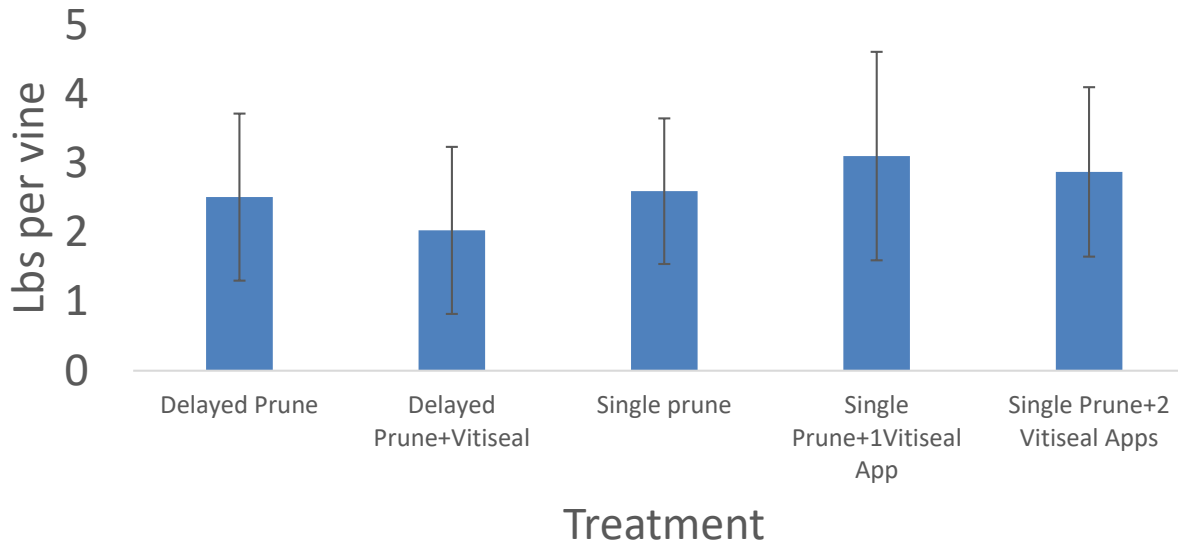


*Fusarium* sp.; *Fusarium graminearum*; *Colletotrichum fioriniae*; *Pestalotiopsis*; *Neopestalotiopsis clavispora*; *Epicoccum nigrum*; *Guignardia* sp.; *Botryosphaeria* sp

Pictures by Sara Villani



Treatment	TSS (%)	TA (g/100 ml)	pH
Delayed Pruning	17 ± 0.5	0.74 ± 0.03	3.4 ± 0.02
Delayed Pruning + VitiSeal	16.4 ± 0.8	0.73 ± 0.05	3.4 ± 0.08
Single Pruning	17.1 ± 0.6	0.7 ± 0.02	3.4 ± 0.03
Single Pruning + 1x VitiSeal	17.1 ± 0.6	0.71 ± 0.03	3.42 ± 0.04
Single Pruning + 2x VitiSeal	16.7 ± 1.3	0.7 ± 0.05	3.44 ± 0.09



# Specialty Crop Block Grant (2021-2022)

Same team (Mark Hoffmann, Sara Villani, Emma Volk, Rachel Kreis)

- (1) Comprehensive Survey of pathogens in NC
- (2) Develop pruning wound management strategies (including pruning training) for NC
- (3) Develop molecular identification tools for PDIC

# Other Research Project that is finished

Leaf Removal Strategies (Cain Hickey, Mark Hoffmann, Annie Vogel, Eric Case).

We wrote a publication and it should be out very soon!



# New Research Projects that will start 2021

- Pierce's Disease resistant cultivar trials (Mark Hoffmann, Emma Volk, Max Ferrell (Childress Vineyards))
- Optimize light impact on flower bud development (Mark Hoffmann, Kyle Freedman, Ricardo Hernandez, Daniel Tregeagle, Eric Case and many others).

<https://grapes.ces.ncsu.edu/>

[www.smallfruits.org](http://www.smallfruits.org)

<https://pdic.ces.ncsu.edu/>



**Thank You**

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