

Muscadines: Problems and Research

Mark Hoffmann, NCSU,
Department of Horticulture



Email: mark.hoffmann@ncsu.edu
Phone: (919) 352-8006

- **Grape Trunk Diseases (GTDs)**
- **Current Production Research at NC State**

Grape Trunk Diseases (GTDs)

- **Can cause serious long-term damage**
- **Often related to cold-damage, old wounds, cracks, insufficient pruning!!!**

	Trunk Diseases
<i>Type of Pathogen</i>	Fungal
<i>Lethal to vine</i>	Yes
<i>Plant Age</i>	Mature; young (ESCA)
<i>Resistance/Tolerance</i>	Not found
<i>Can come with nursery stock?</i>	Yes
<i>Transmitted?</i>	Open wounds, Rain, Pruning Tools
<i>Systemic</i>	No
<i>Severity in NC</i>	?

Trunk disease is NOT Crown Gall



Trunk disease is NOT Crown Gall



Both are related to physical damage



Trunk Diseases = Complex Diseases

- Eutypa Dieback
- Esca Disease Complex ('Petri Disease')
- **Botryosphaeria Dieback**





Botryodiplodia theobromae
Botryosphaeria dothidia
Greeneria species (found in NC)

Some can also cause Macrophoma rot on berries!!!



Grapevine Trunk Diseases

Bortyosphaeria Dieback

- 21 different species of *Bortyosphaeria*

Many other fungi as well.

- Wood Symptoms
- Sudden death
- Apoplexy!







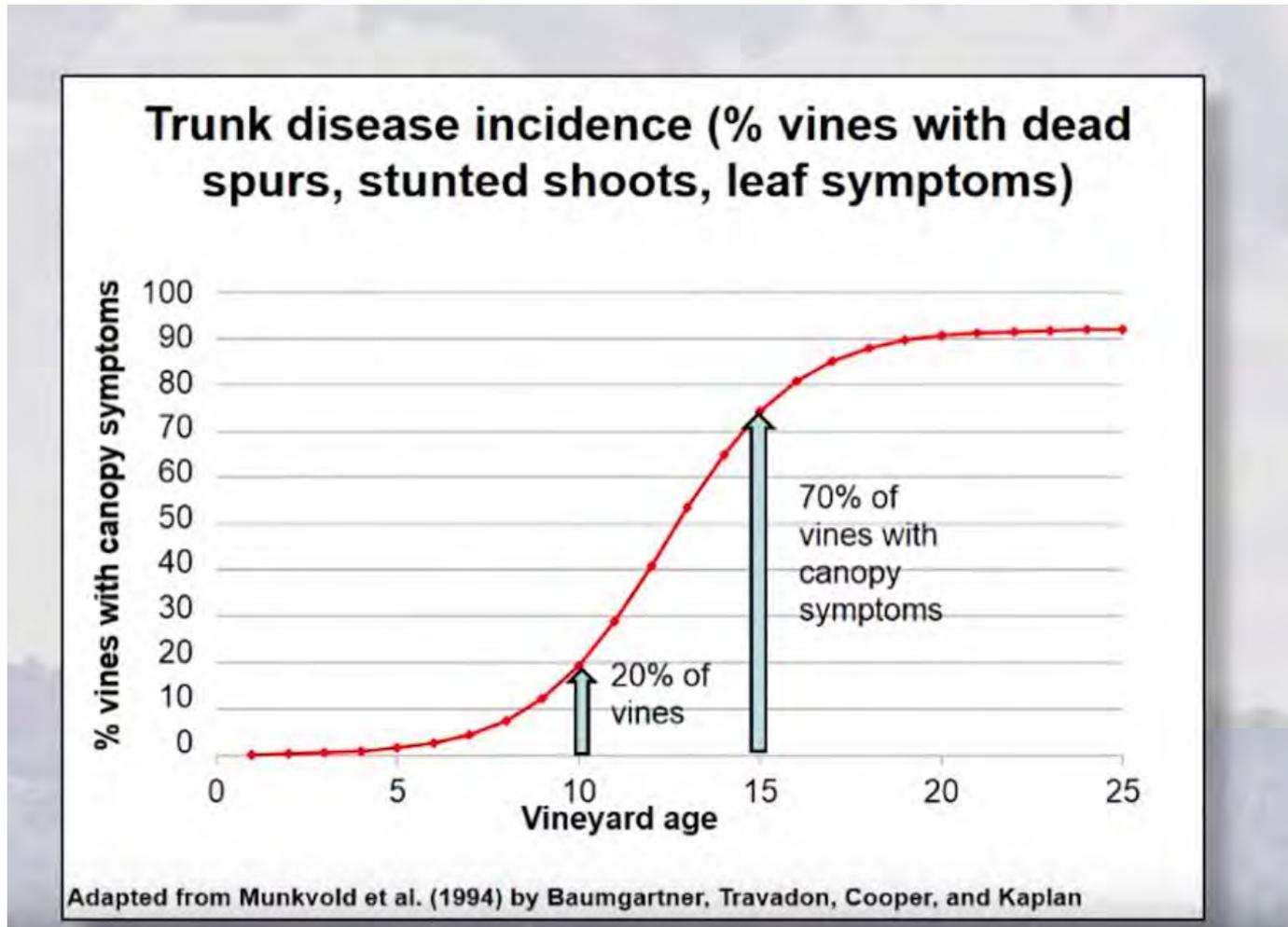


Grapevine Trunk Diseases

Effects

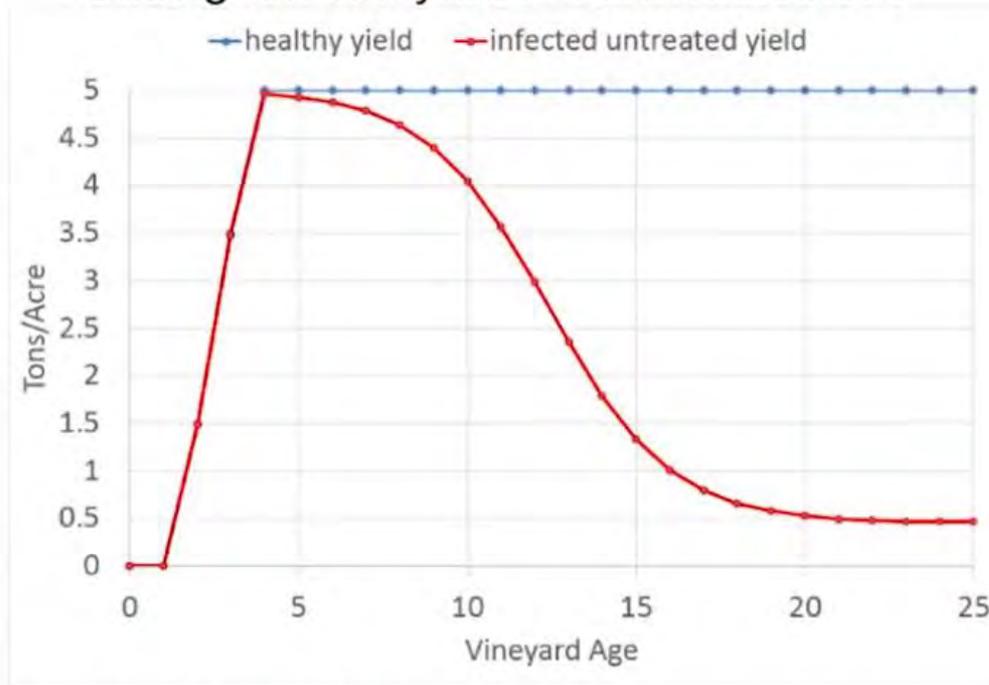
- Reduced Growth
- *Dieback / Death of Vine*
- **Reduces time span of a vineyard**
- **Dead Arm**
- **Reduced Yield**
- **COLD DAMAGE → PHYSICAL DAMAGE**

Often Dead Arm Disease Management starts too late!



Often Dead Arm Disease Management starts too late!

Annual yields for healthy vs. infected Cabernet Sauvignon vineyards in crush district 3



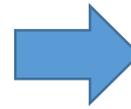
Baumgartner, Travadon, Cooper, Kaplan

Grapevine Trunk Diseases

Latency is a problem

vineyard:

Stress (drought, cold, nutrition) believed to be able to change from latent to pathogenetic?



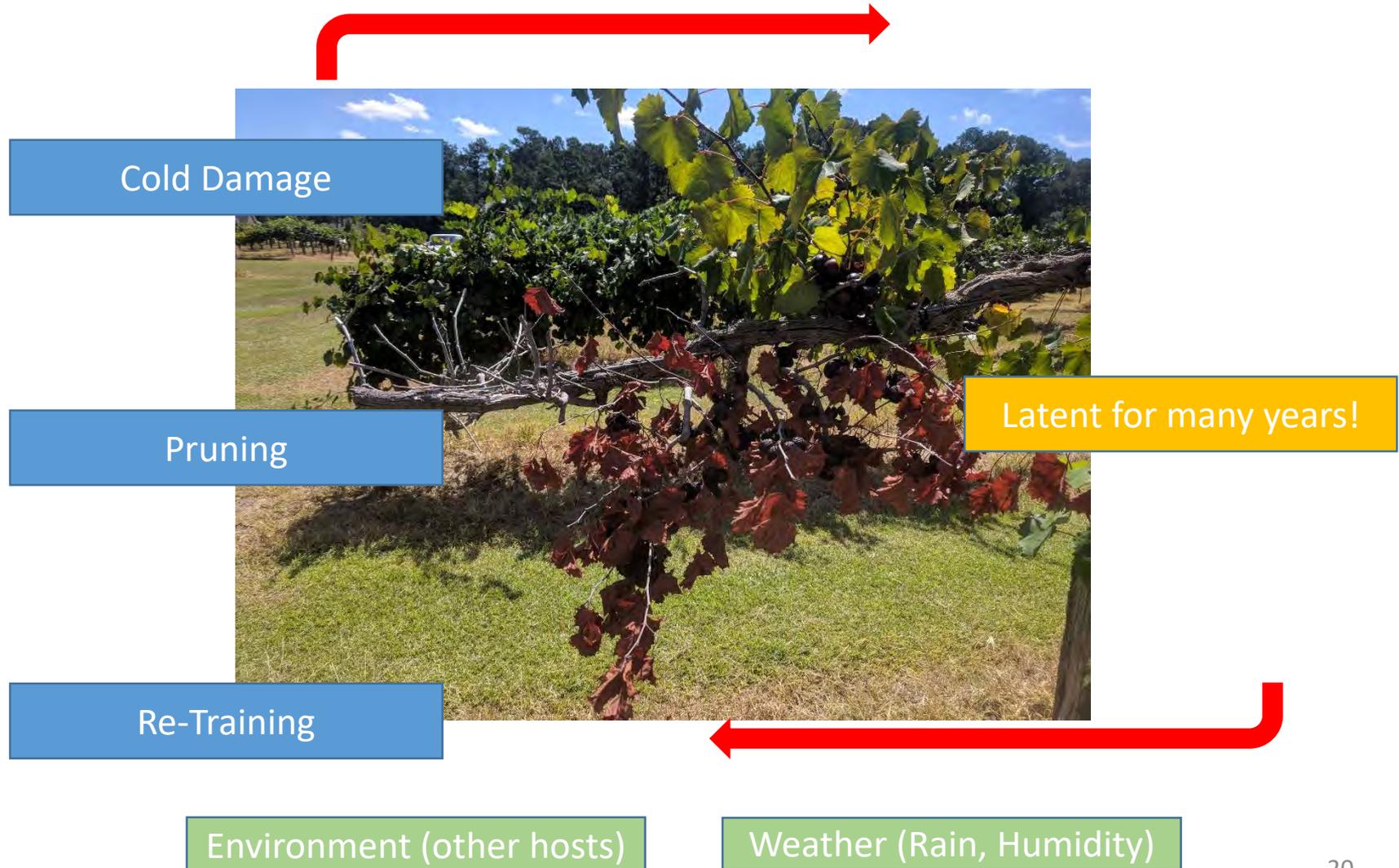
Unaware of GTD spread for a long time!

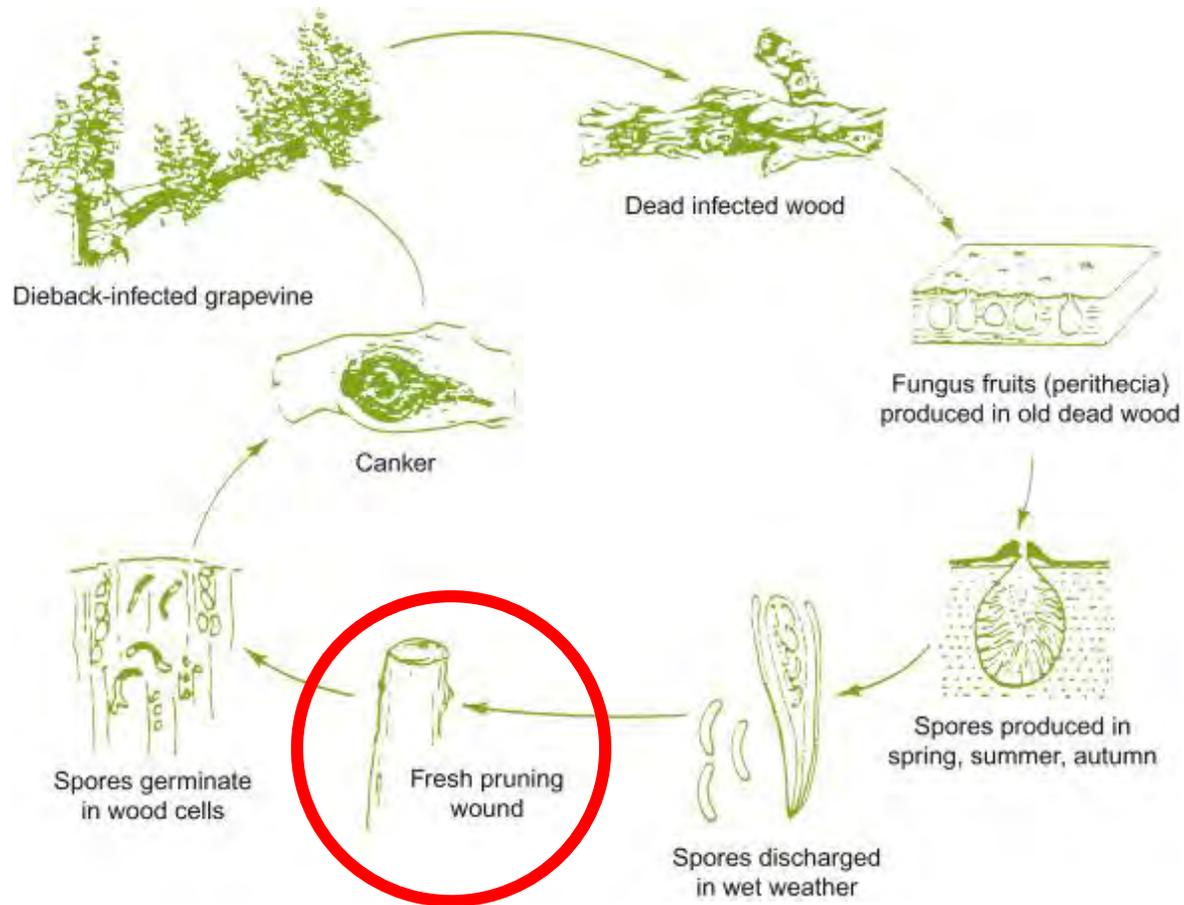
nursery:

High latency period
Asymptomatic plants in production process;
High contamination risk;

Grapevine Trunk Diseases

Problems: understand your enemy!





Jackson 2014. Vineyard Practice, Wine Science (Fourth Edition).

Grapevine Trunk Diseases Prevention and Management

General rule:

Dead Arm Disease Management should
start early!!

Grapevine Trunk Diseases Prevention and Management

General rule:

The more pruning wounds, cuts, cold damage wounds etc., the higher the chance for infection!

Grapevine Trunk Diseases Prevention and Management

Integrated Management Practices:

Prevention

Sanitation

Pruning!!!!

Control (Chemical)

Grapevine Trunk Diseases Prevention and Management

- Having good soil drainage
- **Sanitize, remove infected wood after pruning**
 - **Pruning wound protectants**







MOTHER FIELD

Rootstock



Scion



- Pruning wound protection: chemicals and/or BCA*
- Cultural practices: irrigation & trellising
- Weed control
- Sanitation: removal of trimming debris
- Correct treatment and handling of harvested cuttings

NURSERY PROCESS

Hydration



- Cleaning of hydration tanks: frequently during the season, and at the start and end of the season.
- Reduction of the cutting hydration period
- Application of chemicals and/or BCA

Cold storage



- Cleaning of bins, boxes or crates before use in this phase
- Cleaning of cold storage room/s
- Application of chemicals and/or BCA: as a dip for cuttings before storage

Disbudding



- Disinfect pruning shears regularly
- Application of chemicals and/or BCA: as a dip for cuttings after disbudding

Grafting



- HWT* prior to grafting
- Disinfect grafting machines regularly
- Application of chemicals and/or BCA: as a dip for vines after grafting

Callusing



- Use moderate temperature for callusing and rooting
- Disinfect callusing rooms regularly
- Application of chemicals and/or BCA

NURSERY FIELD

Root and shoot development



- Application of BCA directly to soil
- Weed control

Uprooting and distribution



- Application of chemicals and/or BCA: as a dip for one-year-old vines before storage as well as before dispatch
- HWT of dormant nursery plants prior to dispatch

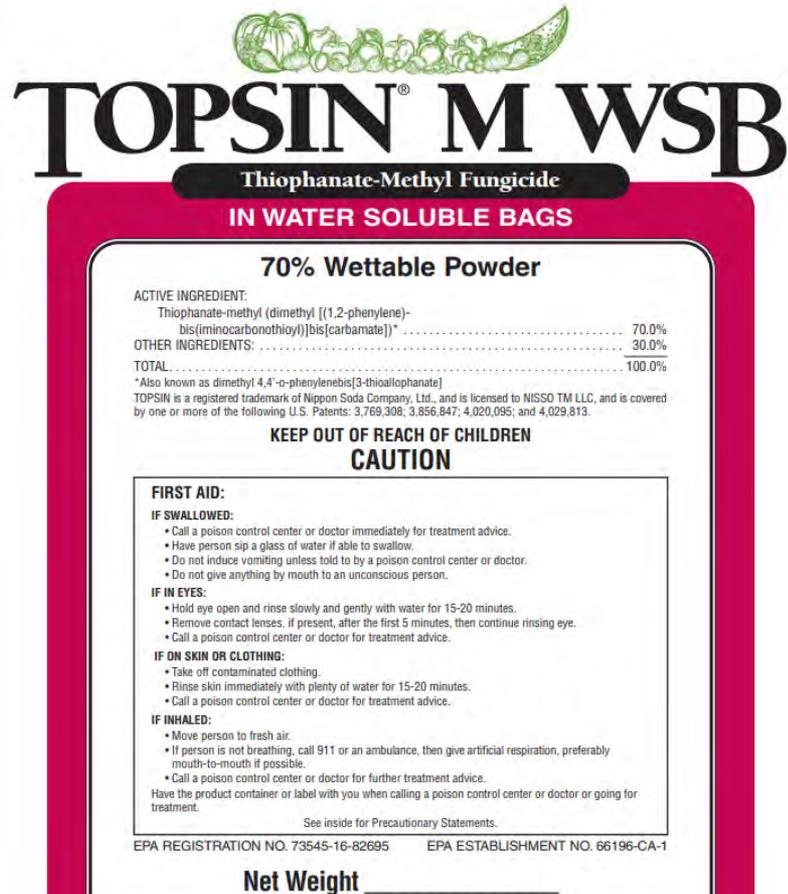
Gramaje et al. (2018): Managing Grapevine Trunk Diseases With Respect to Etiology and Epidemiology: Current Strategies and Future Prospects: Plant Disease 102:12-39.

*BCA: Biological Control Agent; HWT: Hot-Water Treatment



Grapevine Trunk Diseases Prevention and Management

Pruning Wound Protectants!



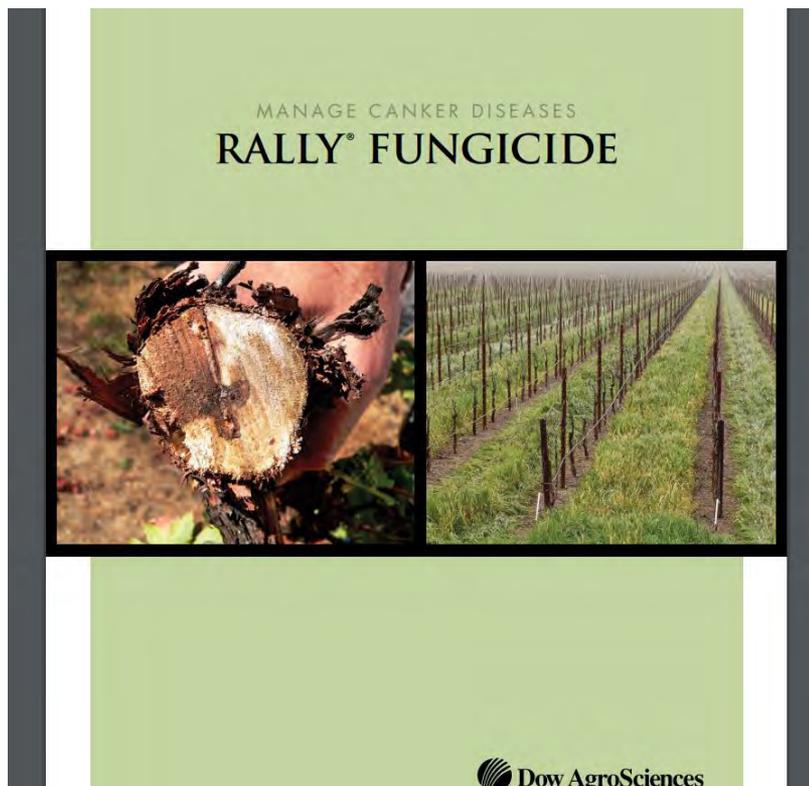
- 0.75-1.5 lbs/A
- Requires a 24c label for your state! (Special Local Need). VA has it

Grapevine Trunk Diseases Prevention and Management

Pruning Wound Protectants!

- 4 oz/A in 33 gpa
- 5 oz/A in 42 gpa
- 6 oz/A in 50 gpa

- Spray soon after pruning.
- 1-2 weeks of protection (if it doesn't rain!!!)
- REI 24hrs.
- Can be sprayed with standard vineyard sprayer



Grapevine Trunk Diseases Prevention and Management

Pruning Wound Protectants!

- **B-Lock**
- Paint!
- 5% Boric Acid
- Apply on fresh pruning wounds
- NOT a Fungicide!
- Physical Barrier



Grapevine Trunk Diseases Prevention and Management

Pruning Wound Protectants!



- **VitiSeal**
- Is also a barrier
- Is organic
- **Can be applied with a back-pack sprayer**

Contact Viti Seal Corporate
3251 Third Street
San Diego, CA 92103
619-239-0321,
info@vitiseal.com

Grapevine Trunk Diseases Prevention and Management

Pruning!

- Pune out dead wood!
- Retrain Cordons

Cordons should be retrained every 6-7 years.

Muscadine Fertilizer Study

Mark Hoffmann and Tekan Rana

- **Outside here 😊**
- Research to develop tissue sampling (collaboration with NCDA)
- Research to assess fertilizer needs

Muscadine Fertilizer Study

2 year study, started Spring 2019 at Cypress Bend vineyards, Scotland Co.

Objectives:

- (1) Optimal fertilizer rates for muscadines on sandy low nutrient soils
- (2) Optimize Tissue sampling for muscadines (collaboration with NCDA).



Muscadine Fertilizer Study

2 year study, started Spring 2019 at Cypress Bend vineyards, Scotland Co.

7 Treatments

- (1) 2.5 lbs/vine 10-10-10, April and July
- (2) 2.5 lbs/vine 6-6-18, April and July
- (3) 1 lbs/vine 10-10-10, April and July
- (4) 1 lbs/vine 6-6-18, April and July
- (5) 1 lbs/vine 10-10-10, April
- (6) 1 lbs/vine 6-6-18, April
- (7) No Fertilizer



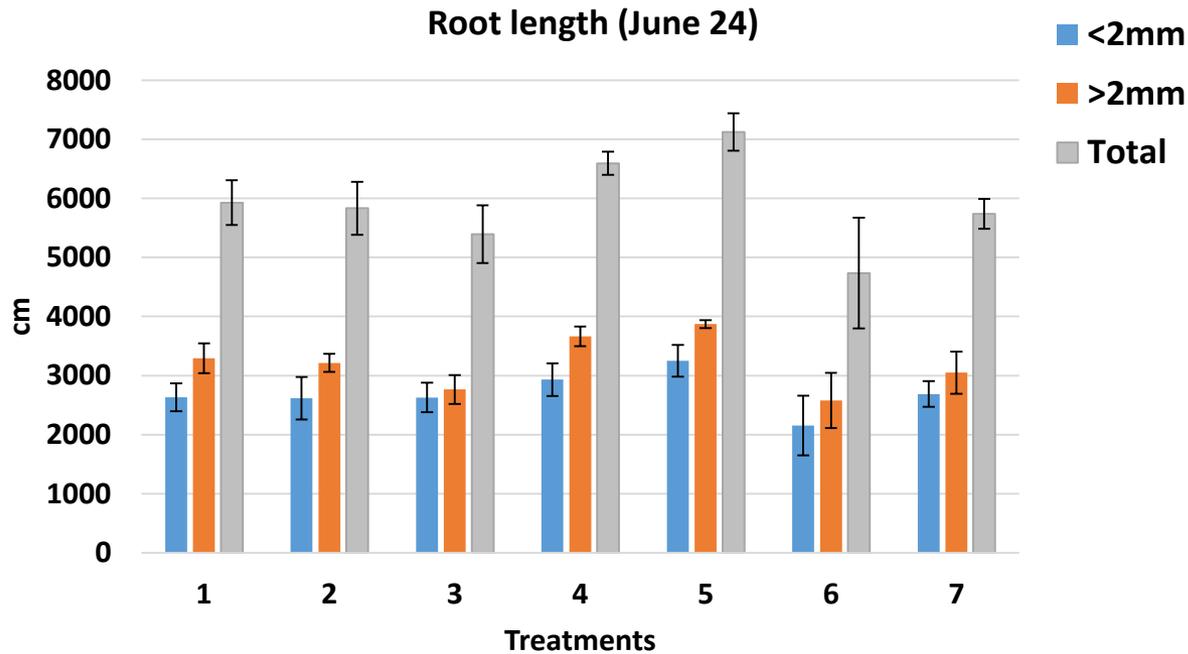
4 replicates per treatment/2 vines per replicate/randomized block design

Muscadine Fertilizer Study

2 year study, started Spring 2019 at Cypress Bend vineyards,
Scotland Co.

7 Treatments

- | | |
|---|------------------------|
| (1) 2.5 lbs/vine 10-10-10, April and July | → 110 lbs N /ac (CI) |
| (2) 2.5 lbs/vine 6-6-18, April and July | → 66 lbs N / ac (S) |
| (3) 1 lbs/vine 10-10-10, April and July | → 45 lbs N / ac (CI) |
| (4) 1 lbs/vine 6-6-18, April and July | → 27 lbs N / ac (S) |
| (5) 1 lbs/vine 10-10-10, April | → 22.5 lbs N / ac (CI) |
| (6) 1 lbs/vine 6-6-18, April | → 13.5 lbs N / ac (S) |
| (7) No Fertilizer | → 0 lbs N / ac |



- (1) 2.5 lbs/vine 10-10-10, April and July
- (2) 2.5 lbs/vine 6-6-18, April and July
- (3) 1 lbs/vine 10-10-10, April and July
- (4) 1 lbs/vine 6-6-18, April and July
- (5) 1 lbs/vine 10-10-10, April
- (6) 1 lbs/vine 6-6-18, April
- (7) No Fertilizer

Treatment	NITROGEN							
	6-Jun				24-Jul			
	ML	CL	MP	CP	ML	CL	MP	CP
1	2.57	2.74	1.23	1.04	2.00	2.05	1.00	0.94
2	2.39	2.42	1.17	1.05	2.09	2.05	0.96	1.03
3	2.41	2.63	1.14	1.07	2.03	2.05	0.97	1.00
4	2.38	2.64	1.13	1.02	1.89	1.98	1.05	0.96
5	2.51	2.55	1.18	1.08	2.02	2.09	0.93	0.98
6	2.35	2.56	1.21	1.03	2.08	2.00	0.95	0.91
7	2.36	2.56	1.19	1.05	1.89	1.96	1.00	0.93

- (1) 2.5. lbs/vine 10-10-10, April and July
- (2) 2.5 lbs/vine 6-6-18, April and July
- (3) 1 lbs/vine 10-10-10, April and July
- (4) 1 lbs/vine 6-6-18, April and July
- (5) 1 lbs/vine 10-10-10, April
- (6) 1 lbs/vine 6-6-18, April
- (7) No Fertilizer

Viticulture Extension and Outreach



Available Resources

Resources: How to find my Agent?

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

The screenshot shows the website's navigation bar with 'NC STATE UNIVERSITY' on the left and 'RESOURCES' on the right. A red circle highlights the 'COUNTY CENTERS' link in the main navigation menu. Below the navigation is a large banner image of a man and a boy looking at a book together. On the left side of the banner is a red sidebar menu with categories like 'Events', 'Extension Administration', '4-H Youth Development', 'Agriculture & Food', 'Community', 'Forest Resources', 'Health & Nutrition', 'Home & Family', and 'Lawn & Garden'. On the right side of the banner is a search box. Below the banner is an 'Events' section with a table of upcoming events.

DATE	EVENT	LOCATION	STATUS
FEB 2 2019	PSSI 2019 Applications Available!	Poultry 4-H & Youth	Started 1 month ago
FEB 2 2019	4-H Member & 4-H Volunteer Annual 4HOnline	Moore County Center	Started 1 month ago
FEB 2 2019	Moore County 4-H Embryology Program	Moore County Center	Started 2 weeks ago
FEB 2 2019	Sessic Raleigh	Executi	Sun 1/2 PM Started

We Grow North Carolina through Education and Research

AGRICULTURE & FOOD HEALTH & NUTRITION 4-H YOUTH DEVELOPMENT

Resources: Petiole and Leaf Sample?



<http://www.ncagr.gov/agronomi/>

NC Department of Agriculture – Agronomic Division

Soil Tests: Apr 1 – Dec 14: free/ other dates: \$4

Plant Tissue: \$5

Detailed costs: <https://www.ncagr.gov/agronomi/fees.htm>

Resources: Petiole and Leaf Sample?

<http://www.ncagr.gov/agronomi/>

The screenshot shows the website for the North Carolina Department of Agriculture & Consumer Services. The header includes the department's logo, name, a search bar, and links for 'JOBS' and 'EMPLOYEE PORTAL'. A navigation bar contains links for 'Home', 'Programs', 'Services', 'Divisions', 'Newsroom', and 'Contact'. The main content area is titled 'Agronomic Services' and features a photograph of a brick building. To the left is a sidebar with 'Agronomic Services Highlights' and various links. To the right is a 'Browse Division' sidebar with a list of services. The central text area lists several resources under the PALS logo.

North Carolina Department of Agriculture & Consumer Services

Google Custom Search

JOBS EMPLOYEE PORTAL

Home Programs Services Divisions Newsroom Contact

Agronomic Services

Agronomic Services Highlights

- [Agronomic Lab Newsletter](#)
- [Soil Management Guidance After Hurricane Florence](#)
New!
- [Submitting Samples for Problem Diagnosis](#)
- [Fees & Sample Forms](#)
- [Online Sample Submission](#)
- [Sample Turnaround Times](#)
- [Bar-code Shipping Labels](#)
- Peak-season Soil Testing Fee, Dec. 15, 2018 - Mar. 31, 2019**

Browse Division

- [About the Division](#)
- [Find Your Report \(PALS\)](#)
- [Field Services](#)
- [Nematode Assay](#)
- [Plant Tissue Analysis](#)
- [Soil Testing](#)
- [Soilless Media Analysis](#)
- [Solution Analysis](#)
- [Waste/Compost Analysis](#)
- [Agrotips](#)
- [News Releases](#)
- [Publications](#)

PALS

- [How to Use PALS](#)
- [Instructions for Online Data Entry for Soil Samples](#)
- [Instructions for Pay Now Credit Card Payments](#)
- [Instructions for Online Data Entry for Predictive Nematology Samples](#)
- [Instructions for Online Data Entry for Pinewood Nematology Samples **New!**](#)
- [PALS Login](#)
- [Manage My PALS Account](#)

Resources: Petiole and Leaf Sample?



<http://www.ncagr.gov/agronomi/>

2 Petiole Sampling dates / year
(bloom/90-120 days after bloom)

1 soil sampling date per year (spring)

Resources: Disease/Pest Problems?



Resources: Disease/Pest Problems?



<https://projects.ncsu.edu/cals/plantpath/extension/clinic/>

NCSU – Plant Disease and Insect Clinic

Search Engine: 'NCSU plant disease and insect clinic'

Fees: \$20/sample. Sometimes covered by Agent/Specialist

Resources: Disease/Pest Problems?

<https://projects.ncsu.edu/cals/plantpath/extension/clinic/>

NC STATE UNIVERSITY | [CAMPUS DIRECTORY](#) | [LIBRARIES](#) | [MYPACK PORTAL](#) | [CAMPUS MAP](#) | [SEARCH NCSU.EDU](#)

North Carolina State University Plant Disease and Insect Clinic

[Home](#) [Login to Database](#) [New Users](#)

- About the Clinic
- Services and Fees
- How to Submit a Sample
- Directions to the Clinic
- Turf Diagnostics
- Plant Disease Fact Sheets
- Insect Information Notes
- Webinars and Training
- County Extension Centers and NCDA & CS

Welcome!

The Plant Disease and Insect Clinic diagnoses plant problems for farmers, growers, landscapers, homeowners, and gardeners. In consultation with expert faculty, we recommend ways to treat or prevent the problems we diagnose.

We work in partnership with the North Carolina Cooperative Extension Service, whose county offices can diagnose many common plant disease and insect problems. They can help you to properly collect and submit a sample to the PDIC, if necessary. Follow this link to find a North Carolina **County Extension Agent** or **Extension Master Gardener Volunteer** near you!

News & Alerts

Navigate to "How to Submit a Sample" if you need our help.

News about diseases and insects, information about current plant problems, and news about upcoming events:

WINTER REMINDERS



Happy New Year from the PDIC! Outdoor pests and pathogens are dormant, like this cedar-apple rust gall, but you may still have samples to send. If so, remember to package them well, especially if outdoor temperatures are below freezing. This is particularly important for greenhouse crops which could be damaged by cold in

Alerts, Updates and Information

- Plant Pathology Portal
- Entomology Portal
- Boxwood blight
- Thousand Cankers in Tennessee and Virginia
- Emerald Ash Borer in North Carolina

Click the yellow "see more" link below for archived News and Alerts

QUICK HELP

Disease Problems:
919.515.3619

Insect Related:
919.515.9530

General Questions:
plantclinic@ces.ncsu.edu

8am-5pm

Resources: Disease/Pest Problems?



<https://projects.ncsu.edu/cals/plantpath/extension/clinic/>

Contact local agent and/or specialist!!!!
Submit photos AND physical sample

- We have a team of 4 full-time people working only on samples
- We will contact all specialists in the state
- AND we will contact specialists out-of-state

Viticulture Extension and Outreach



Resources: Vineyard Management?

www.smallfruits.org

the Southern Region small fruit consortium



IPM/Production Guides

Last updated Friday 5 January 2018 8:9 GMT

Blueberries

- [Southeast Regional Blueberry Integrated Management Guide](#)
- [Southeast Regional Blueberry Horticulture and Growth Regulator Guide](#)
- [Southeast Regional Organic Blueberry Pest Management Guide](#)

Bunch Grapes

- [Southeast Regional Bunch Grape Integrated Management Guide](#)

Caneberries

- [Southeast Regional Caneberries Integrated Management Guide](#)
- [Southeast Regional Caneberry Production Guide \(PDF\)](#)
- [Southeast Regional Caneberry Production Guide \(Online Version\)](#)

Muscadines

- [Southeast Regional Muscadine Grape Integrated Management Guide](#)

Strawberries

- [Southeast Regional Strawberry Integrated Pest Management Guide](#)
- [Southeast Regional Strawberry Plasticulture Production Guide](#)
- [Fungicide Selection for Botrytis and Anthracnose Fruit Rot Management 2017](#)

Resources: Vineyard Management?

www.smallfruits.org



2019 Southeast Regional Muscadine Grape Integrated Management Guide

Commodity Editor

Bill Cline (North Carolina State University)

Section Editors

Pathology; Bill Cline (North Carolina State University), Phil Brannen (University of Georgia)
Entomology; Brett Blaauw (University of Georgia), Frank Hale (University of Tennessee) and Hannah Burrack
(North Carolina State University)

Weed Science; Wayne Mitchem (North Carolina State University)
Vertebrate Management; David Lockwood (University of Tennessee)
Pesticide Stewardship and Safety: Ash Sial (University of Georgia)

Senior Editors

Phil Brannen (University of Georgia)
Bill Cline (North Carolina State University)

Contributions were also made by Ed Sikora (Auburn University), Rebecca Melanson (Mississippi State University).

Recommendations are based on information from the manufacturer's label and performance data from research and extension field tests. Because environmental conditions and grower application methods vary widely, suggested use does not imply that performance of the pesticide will always conform to the safety and pest control standards indicated by experimental data.

This publication is intended for use only as a guide. Specific rates and application methods are on the pesticide label, and these are subject to change at any time. Always refer to and read the pesticide label before making any application! The pesticide label supersedes any information contained in this guide, and it is the legal document referenced for application standards.

Resources: Information?

NCSU GRAPE PORTAL:
<https://grapes.ces.ncsu.edu/>

NC STATE EXTENSION

COUNTY CENTERS TOPICS GIVE NOW

Muscadine and Vinifera Grapes

Search

Meet Our Staff

Events

Production

Pest Management

Marketing

Freeze Damage

Cultivars
Cultivar Characteristics, Sources of Vines

Q & A

Activities for Kids

Resources

Departmental Extension Sites
Horticulture, Plant Pathology, Crop Science ...

Publications & Factsheets

Events

FEB 2 **TODAY**
2019
NC Winegrower Association Conference
Thu Jan 31 - Sat Feb 2
Started 2 days ago

News and Updates

AGENT TRAINING: Muscadine Pruning: Workshop Jan 26 in LEE COUNTY
Dear Agents, There will be two AGENT MUSCADINE PRUNING WORKSHOPS in January, followed by two more muscadine pruning workshops in ...
— 1 month ago

New Growers Grape Meeting in Asheville, NC
Dear grape community, Last week we did hold our New Growers Grape Meeting at Pleb Urban Winery in Asheville, NC. ...
— 2 months ago [Strawberry Growers Information](#)

IMPORTANT: Deadline Dec. 10 for Additional Hurricane Relief in NC
Dear Farming Community and Dear Horticulture Agents, Attached is a press release from the N.C. Department of Agriculture and Consumer ...

ask an EXPERT

Research and planned releases 2019

NEW Muscadine Production Guide

Collaborative effort:

Editors:

NCSU: Hannah Burrack, Wayne Mitchem, Mark Hoffmann,
Penelope Perkins, Bill Cline, Terry Bland

UGA: Erick Smith, Patrick Conner, Cain Hickey, Phil Brannen

Clemson: Andy Rollins

Cornell: Connie Fisk

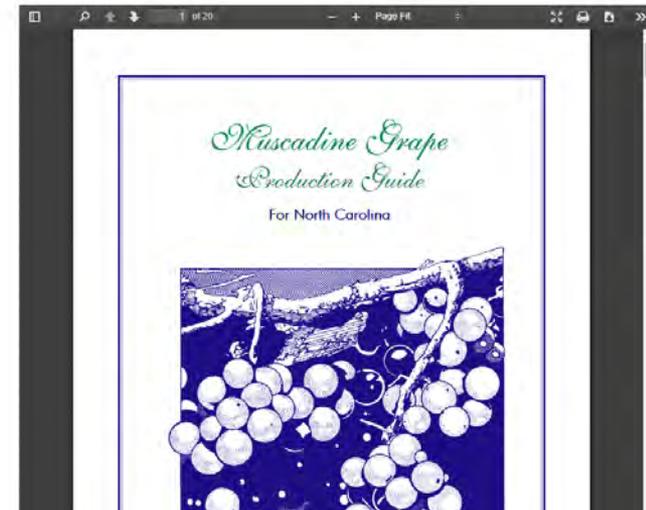
Editor in chief: Mark Hoffmann

Grower Editors:

Ervin Lineberger, Greg Ison, Whit Jones, William Yost

Submitted for approval!!!!

Muscadine Grape Production Guide for North Carolina









It's all about capacity building



Thank you!

Q+A

Thank you for your attention

NCSU
Department of Horticultural Science
2721 Founders Drive (Kilgore Hall), Room 258
Raleigh, 27695 NC

cell (919) 352 8006
Email: mark.hoffmann@ncsu.edu
<https://smallfruits.cals.ncsu.edu>

