

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!!!**

Topics

| | 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 *Bortyopsphaeria*

Many other fungi as well.

- Wood Symptoms
- Sudden death
- Apoplexy!







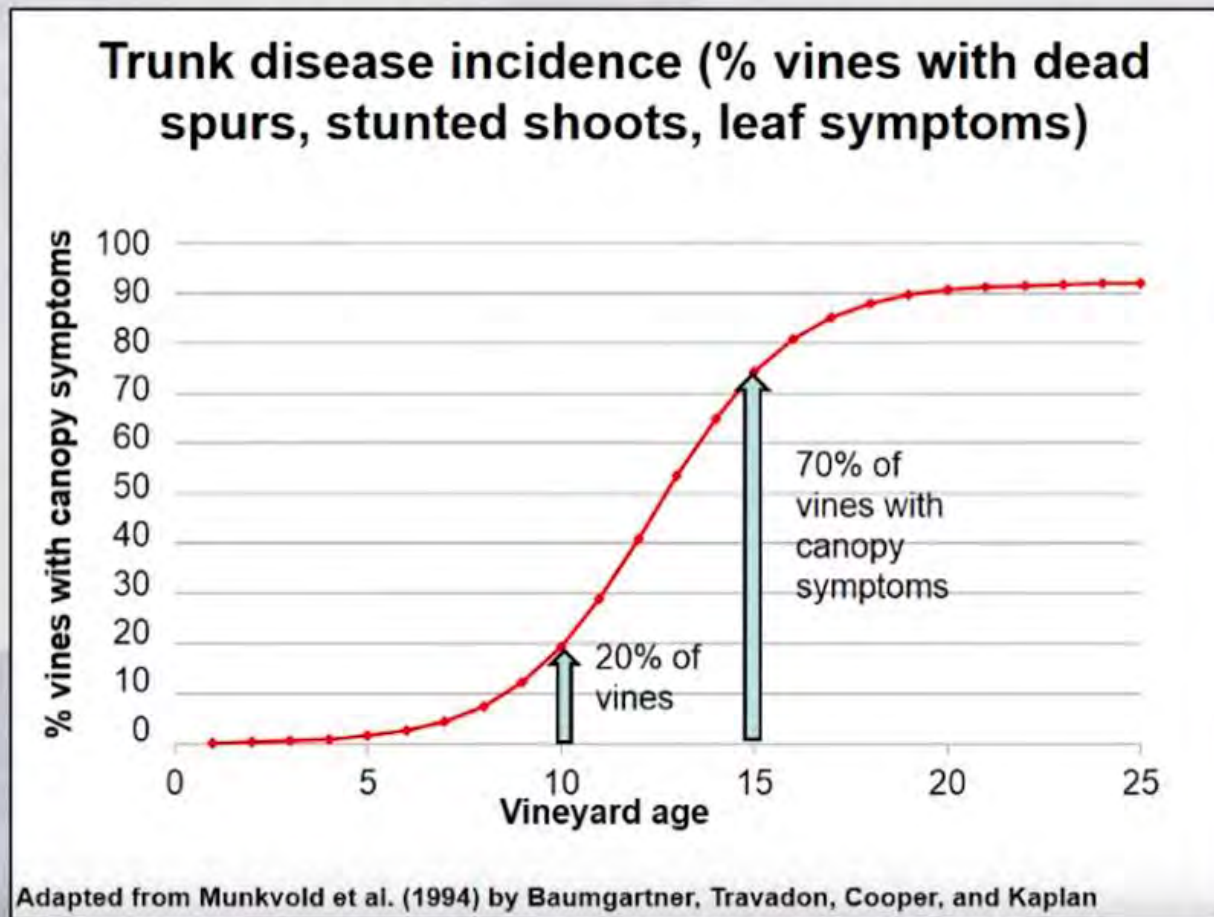


Grapevine Trunk Diseases

Effects

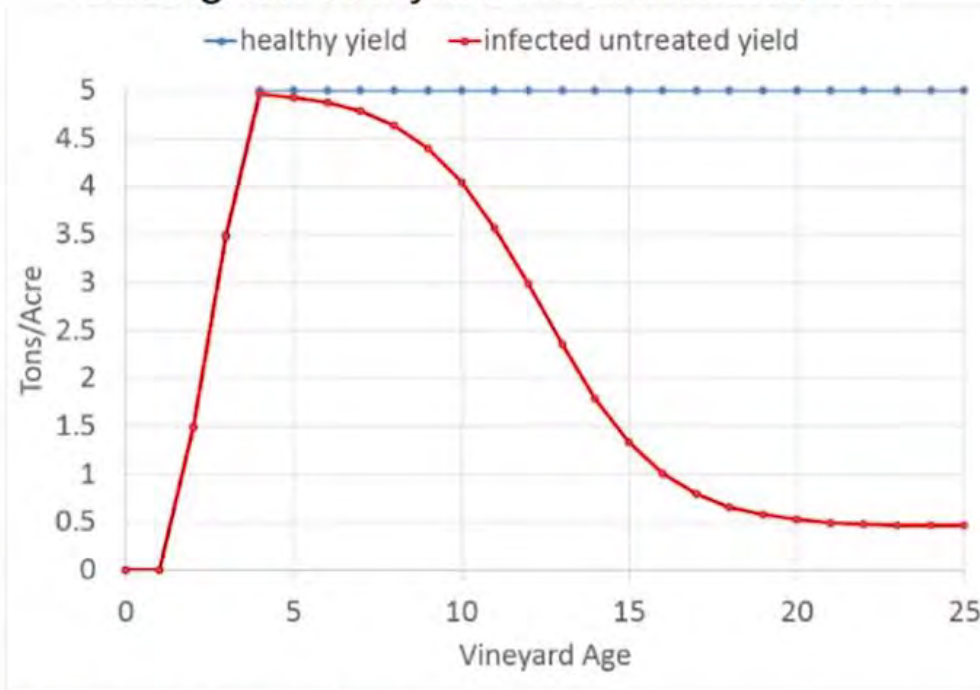
- Reduced Growth
- *Dieback / Death of Vine*
- Reduces time span of a vineyard
- Dead Arm
- Reduced Yield
- **COLD DAMAGE → PHYSICAL DAMAGE**

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



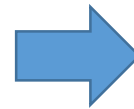
Baumgartner, Travadon, Cooper, Kaplan

Grapevine Trunk Diseases

Latency is a problem

vineyard:

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



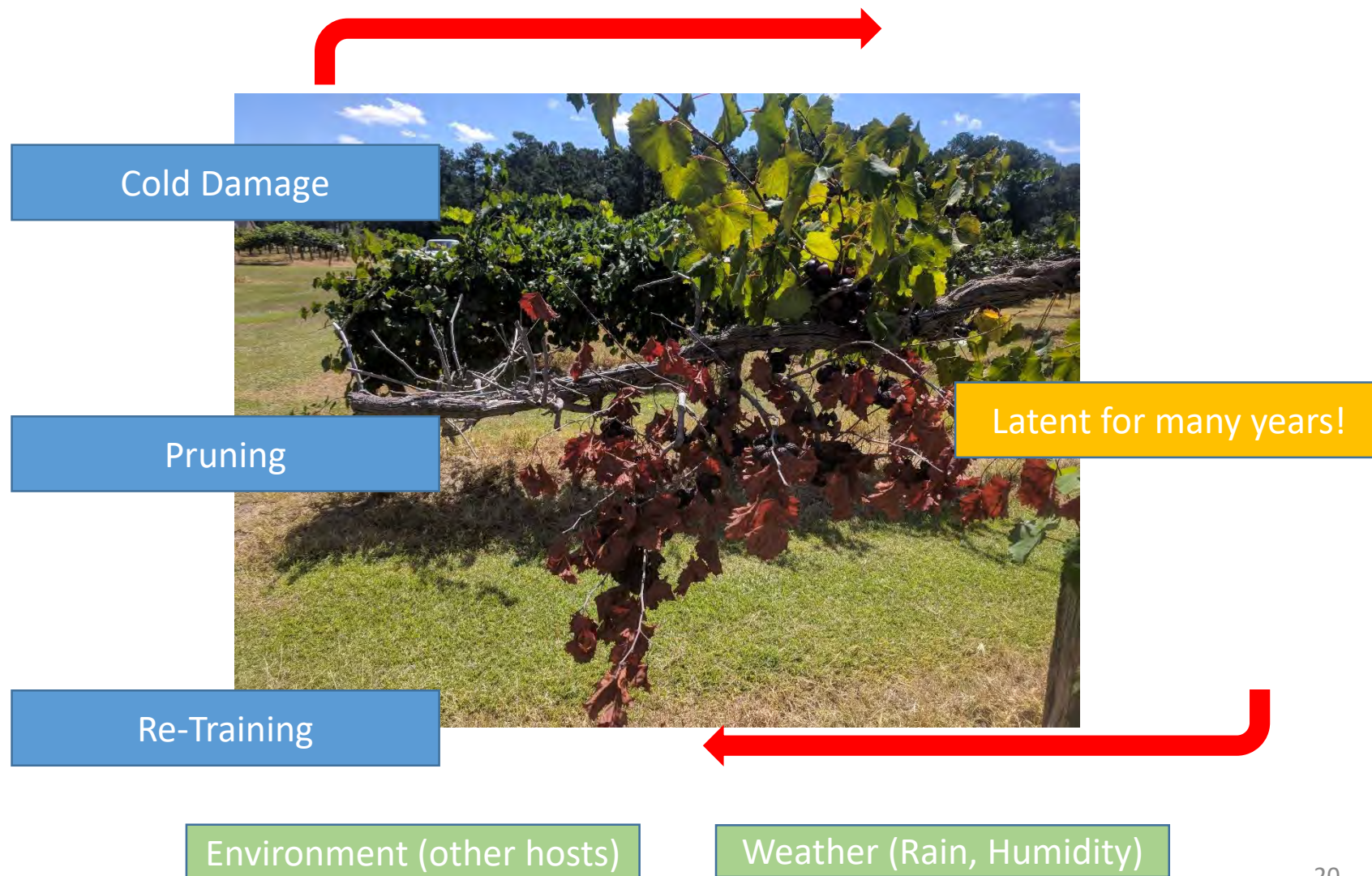
Unaware of GTD spread for a long
time!

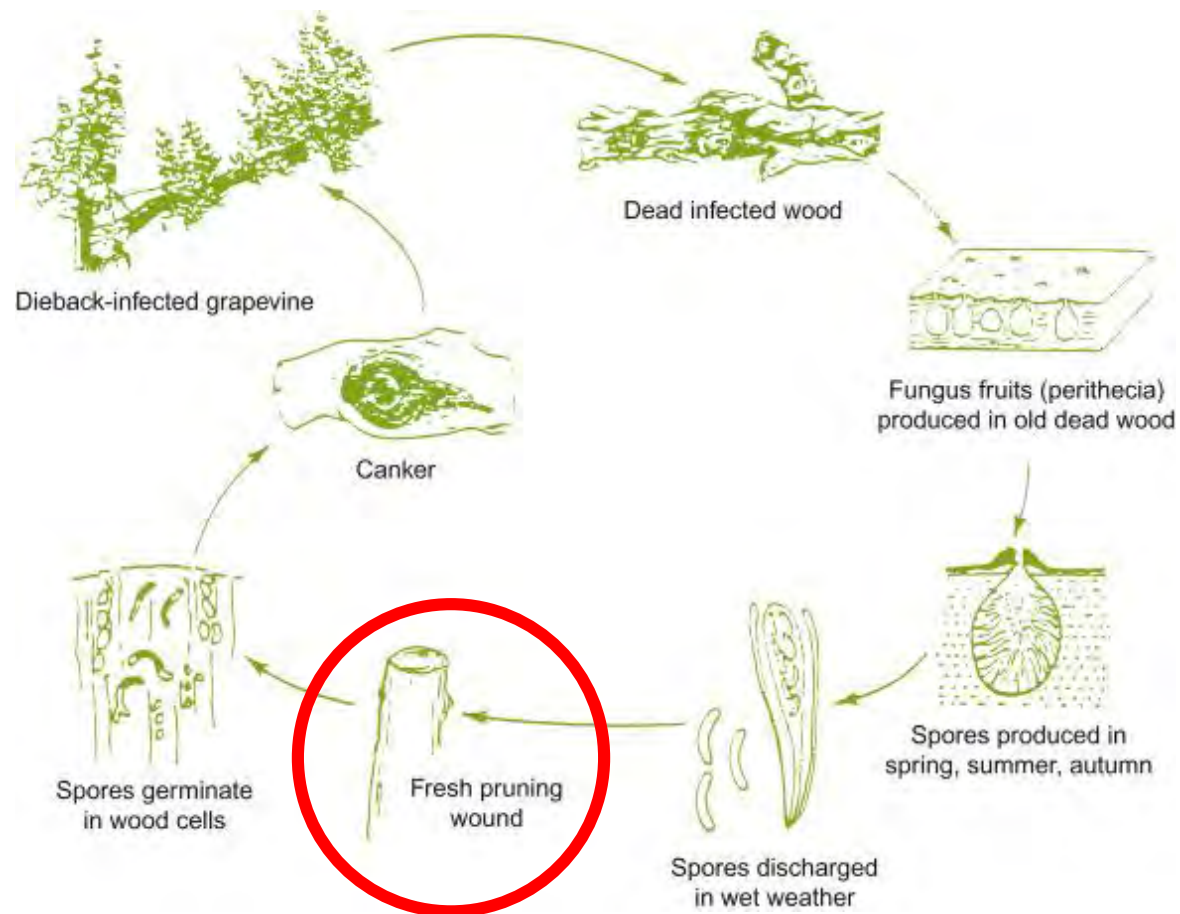
nursery:

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**







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

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



Cold storage



Disbudding




Grafting




Callusing

- 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
- 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
- Disinfect pruning shears regularly
- Application of chemicals and/or BCA: as a dip for cuttings after disbudding
- HWT* prior to grafting
- Disinfect grafting machines regularly
- Application of chemicals and/or BCA: as a dip for vines after grafting
- Use moderate temperature for callusing and rooting
- Disinfect callusing rooms regularly
- Application of chemicals and/or BCA

NURSERY FIELD



Root and shoot development



Uprooting and distribution

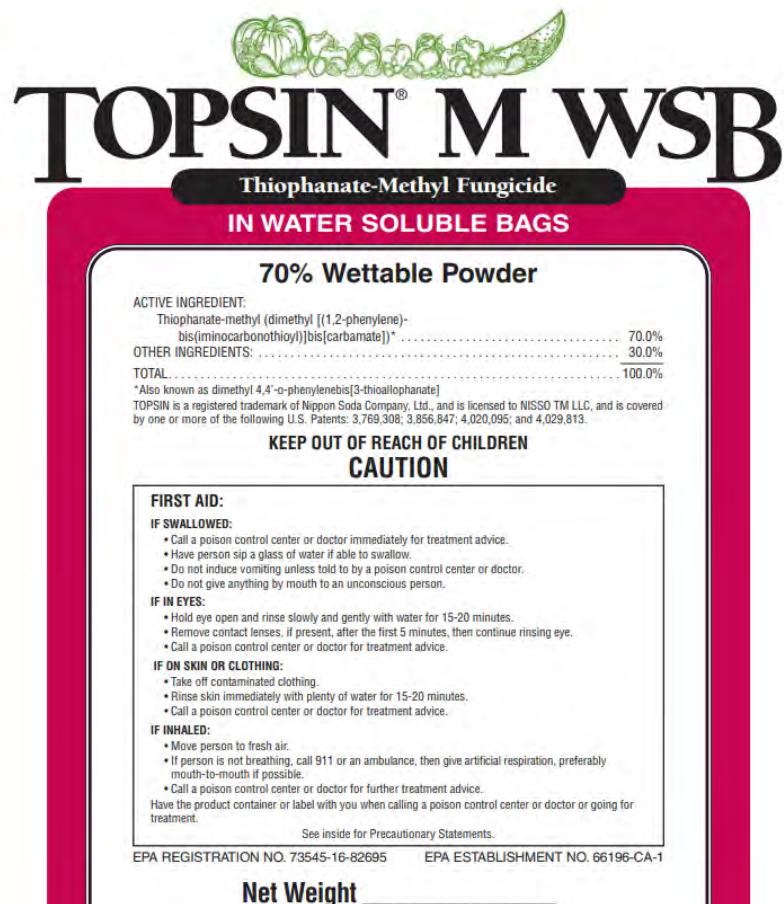
- Application of BCA directly to soil
- Weed control
- Application of chemicals and/or BCA: as a dip for one-year-old vines before storage as well as before dispatch
- HWT of dormant nursery plants prior to dispatch

*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

MANAGE CANKER DISEASES
RALLY® FUNGICIDE



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

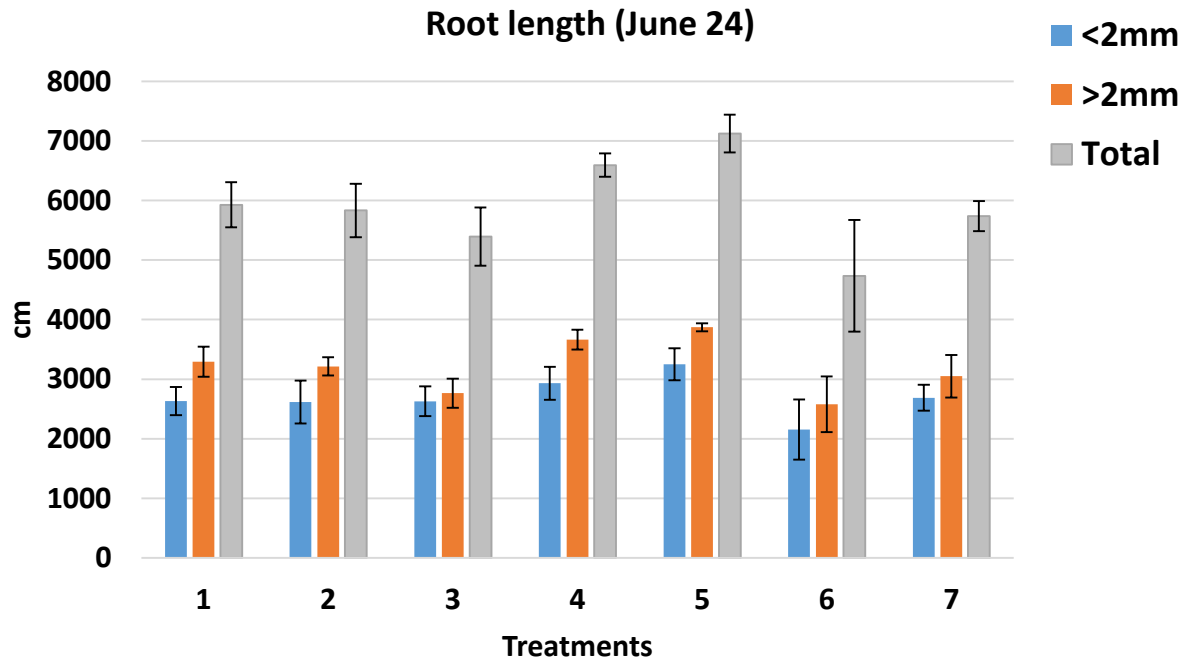


Muscadine Fertilizer Study

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

| | NITROGEN | | | | | | | |
|-----------|----------|------|------|------|--------|------|------|------|
| | 6-Jun | | | | 24-Jul | | | |
| Treatment | 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/>

NC STATE UNIVERSITY

RESOURCES search ncsu.edu

COUNTY CENTERS TOPICS CONTACT US GIVE NOW

NC State Extension

Events
All Events, Commodity Meetings, Field Days

Extension Administration

4-H Youth Development

Agriculture & Food
Animal Agriculture
Aquaculture
Commercial Horticulture, Nursery & Turf
Farm Health & Safety
Field Crops
Food Safety & Processing
Local Foods
Pest Management
Specialty Crops

Community

Forest Resources

Health & Nutrition

Home & Family

Lawn & Garden
Extension Master GardenerSM Volunteer

Search

Events < > **ALL EVENTS**

| FEB 2 2019 | TODAY | FEB 2 2019 | TODAY | FEB 2 2019 | TODAY | FEB 2 2019 |
|--|-------|---|-------|--|-------|-----------------------|
| PSSI 2019 Applications Available! | | 4-H Member & 4-H Volunteer Annual 4HOnline | | Moore County 4-H Embryology Program | | Sessic Raleigh |
| Poultry 4-H & Youth | | Moore County Center | | Moore County Center | | Executi |
| Fri Dec 21 - Thu Feb 28, 2019 | | Wed Jan 2 - Fri Mar 1 | | Tue 1/22 8 AM - Mon 2/18 4:45 PM | | Sun 1/2 PM |
| Started 1 month ago | | Started 1 month ago | | Started 2 weeks ago | | 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/>



North Carolina Department of
Agriculture & Consumer Services

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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**

Agronomic Services





- [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](#)

Browse Division

- [About the Division](#)
- [Find Your Report \(PALS\)](#)
- [Field Services](#)
- [Nematode Assay](#)
- [Plant Tissue Analysis](#)
- [Soil Testing](#)
- [Soilless Media Analysis](#)
- [Solution Analysis](#)
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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/>

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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



SRSFC Activities ▾

Crops ▾

Regional Expert ▾

IPM/Production Guides

County Agent Training

Weather

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 **NC Winegrower Association Conference** **TODAY**
2019
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 ...

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. ...
— 1 month ago

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 ...
— 2 months ago ... [Strawberry Growers Information](#)

ask an EXPERT

55

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

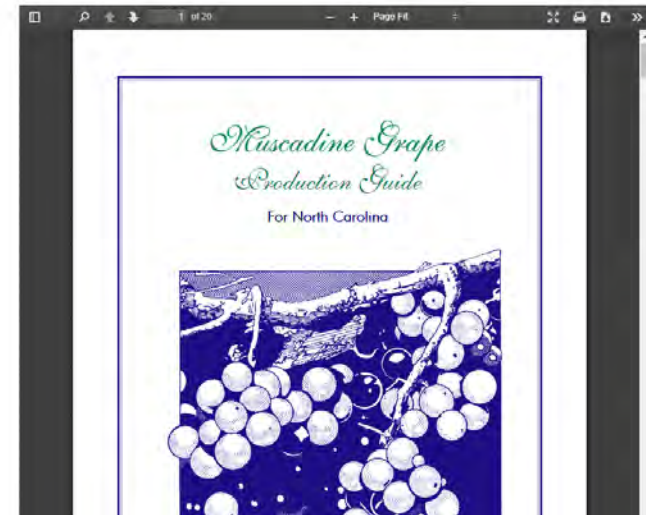
Editor in chief: Mark Hoffmann

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>

