

The State of the Art in Muscadine Disease Management

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2013 Southeast Regional Muscadine Grape Integrated Management Guide

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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 supercedes any information contained in this guide, and it is the legal document referenced for application standards.

Primary Southeastern Muscadine Diseases that Require Fungicide Applications

- ❖ Bitter Rot (*Greeneria uvicola*; syn. *Melanconium fuliginum*)
- ❖ Ripe Rot (*Glomerella cingulata*)
- ❖ Macrophoma Rot (*Botryosphaeria dothidea*)
- ❖ Black Rot (*Guignardia bidwellii* f. *muscadini*)
- ❖ Powdery Mildew (*Uncinula necator*)
- ❖ Angular Leaf Spot (*Mycosphaerella angulata*)

Though muscadines are not generally as susceptible to diseases as *Vinifera* grapes, disease control is very important. Producers often “get by” with minimal spray programs in dry years, only to be “hammered” in wet years. Preventive spray programs are necessary.

Percent Infected Leaves or Fruit (Carlos Variety)

	Angular Leaf Spot	Bitter Rot	Powdery Mildew (fruit)	Macrophoma Rot	Black Rot (fruit)	Black Rot (leaf)
UTC	35	10	26	1	12	22
Sprayed	11	<1	<1	<1	<1	0

W. O. Cline and B. Bloodworth; 2001 Muscadine Disease Survey

Percent Infected Leaves or Fruit (Carlos vs. Noble Varieties)

	Angular Leaf Spot	Bitter Rot	Powdery Mildew (fruit)	Macrophoma Rot	Black Rot (fruit)	Black Rot (leaf)
UTC Noble	5	3	23	0	0	0
UTC Carlos	50	8	45	<1	21	32

W. O. Cline and B. Bloodworth; 2001 Muscadine Disease Survey





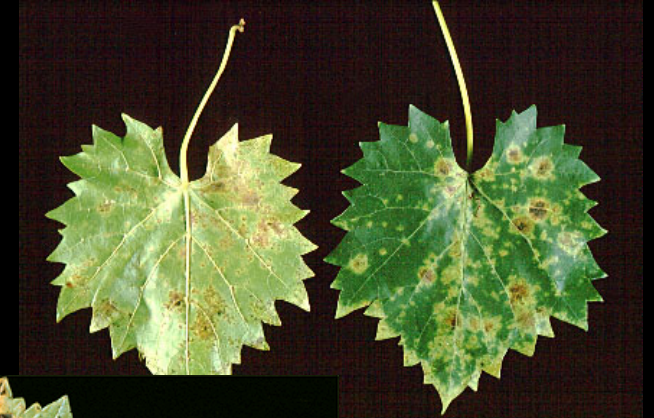




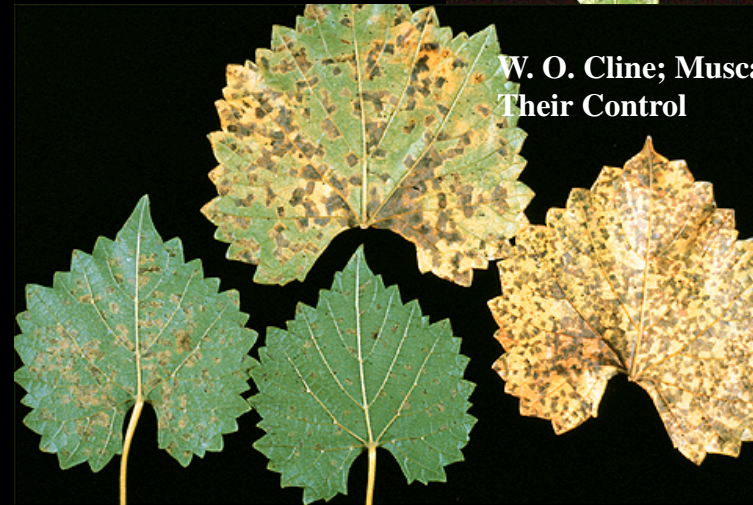
Angular Leaf Spot

(Mycosphaerella angulata or Cercospora brachypus)

- ❖ Great potential to limit yield in muscadine – not *Vinifera*.
- ❖ Defoliates the vine, and fruit development ceases (poor yield and quality).
- ❖ Mancozeb and Captan offer effective control.
- ❖ Applications made pre bloom (budbreak; some references say shoot extension) and on a 14-day schedule till late August.



W. O. Cline; Muscadine Grape Diseases and Their Control



APS Press; Diseases of Small Fruits

Bitter Rot

(*Greeneria uvicola*)

- ❖ Infection occurs at shoot extension, during or shortly after bloom in the pedicel – latent infection.
- ❖ Any tissue can be invaded, but mature, ripened fruit is most susceptible to full disease expression.
- ❖ Late season (bloom through preharvest) sprays are important. Major muscadine disease.



W. O. Cline; Muscadine Grape Diseases and Their Control



APS Press; Diseases of Small Fruits

Macrophoma Rot

(*Botryosphaeria dothidea*)

- ❖ Can be very destructive in muscadines.
- ❖ Not *Macrophoma* (*Fusicoccum aesculi*).
- ❖ Very little known about the epidemiology.
- ❖ Can be controlled by fungicide applications from bloom till harvest.



APS Press; Diseases of Small Fruits



W. O. Cline; Muscadine Grape Diseases and Their Control

Ripe Rot

(*Glomerella cingulata*)

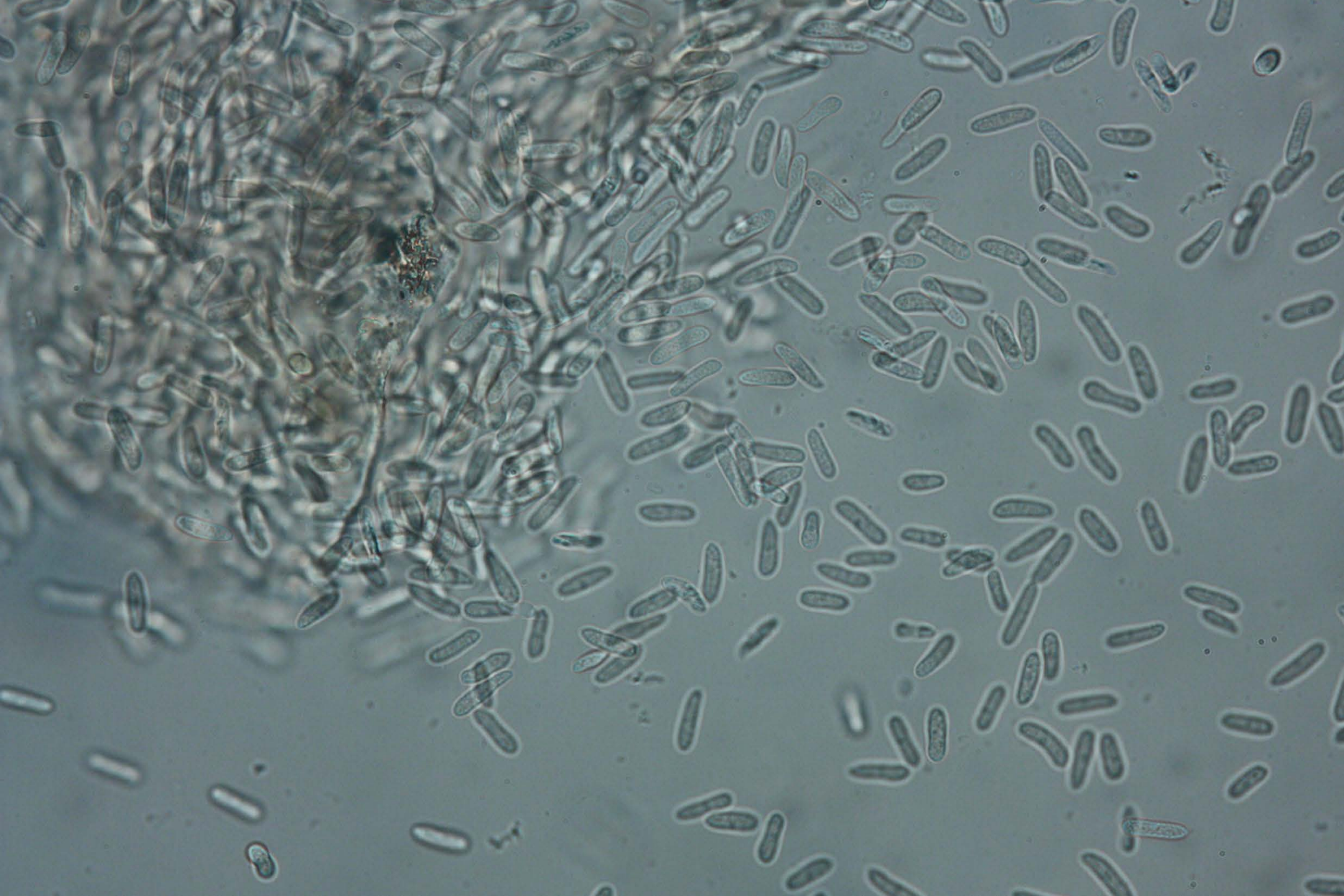
- ❖ Can infect at any stage of fruit development.
- ❖ Rots do not show up till fruit ripens.
- ❖ Controlled through normal fungicide program for black rot.



W. O. Cline; Muscadine Grape Diseases and Their Control



APS Press; Diseases of Small Fruits



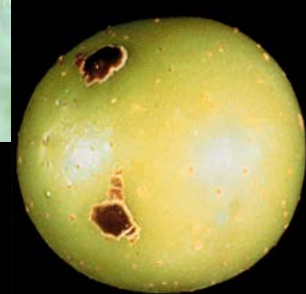
Black Rot

(Guignardia bidwellii f. muscadinii)

- ❖ Major problem in bunch grapes.
- ❖ If muscadines are sprayed with standard fungicides (i.e. Maneb and Captan), this is generally not a major problem.
- ❖ Control with early-season applications.



W. O. Cline; Muscadine Grape Diseases and Their Control

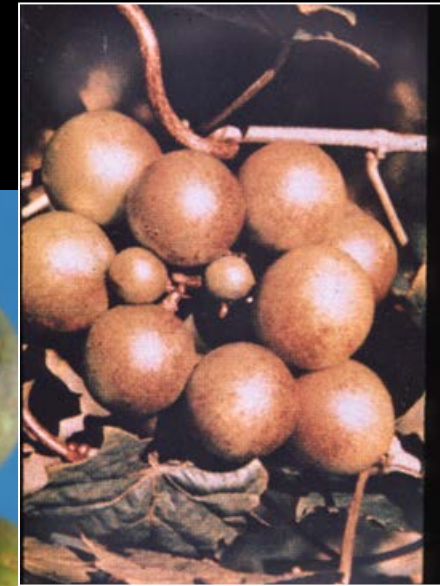


APS Press; Diseases of Small Fruits

Powdery Mildew

(*Uncinula necator*)

- ❖ Attacks leaves, cluster stem, and fruit shortly after bloom.
- ❖ Infected fruit become “russetted” and may crack.
- ❖ Can also result in fruit drop and/or reduced size.



W. O. Cline; Muscadine Grape Diseases and Their Control

Table 3 - Muscadine Grape Disease Spray Program

Application Time	Fungicide*	Amount/Acre	Remarks
First, just before bloom	Mancozeb	2 - 3 lb	
	or Captan 50WP	3 lb	
Second, just after bloom and fruit set	Nova 40W	1.2 - 2 oz	Do not omit application. Important for reducing bitter rot and other fruit infections.
	or Abound	11 - 15 oz	
Continue at 14-day intervals	Nova 40W or Abound	Above Rates	Use shorter application intervals during rainy periods. Extend application interval if conditions do not favor disease development.
Preharvest sprays beginning 6 to 8 weeks before harvest	Captan 50WP	3 lb	Necessary for berry rot control. Shorten application interval to 7 to 10 days if rainy conditions exist during berry maturation. Pay attention to days until harvest.
	or Nova 40W or Abound	Above Rates	

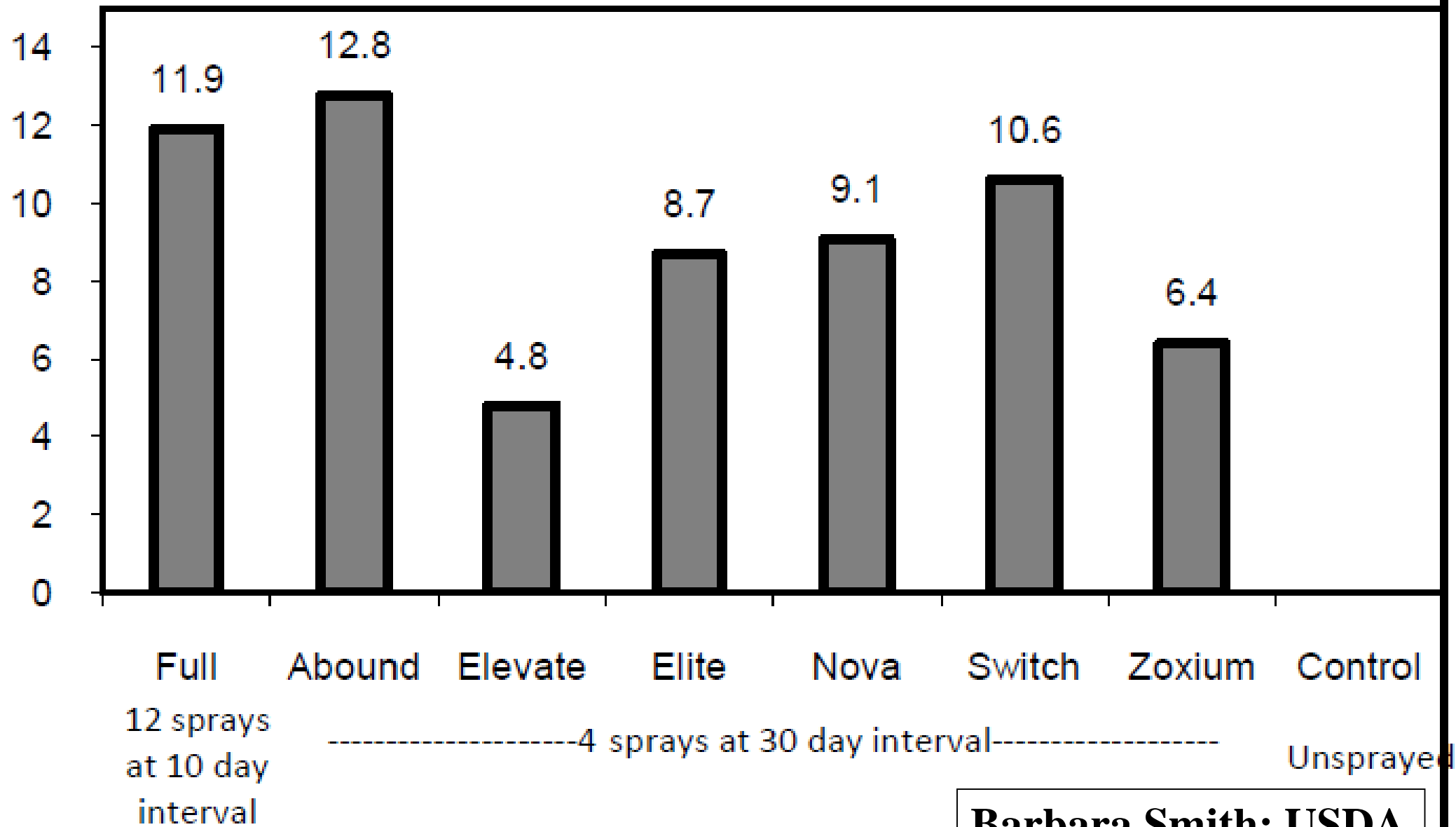
Minimum days from last application until harvest:
Nova – (14); Captan – (0); Mancozeb – (66); Abound – (14)

Fungicides – the short version

- Alternate Nova with Captan, apply every 2 wks from Mid-May through August
- Where ripe rot is a problem, replace Captan with Abound, Pristine or Flint
- Use enough water for adequate coverage
- ALWAYS READ AND FOLLOW THE LABEL!!

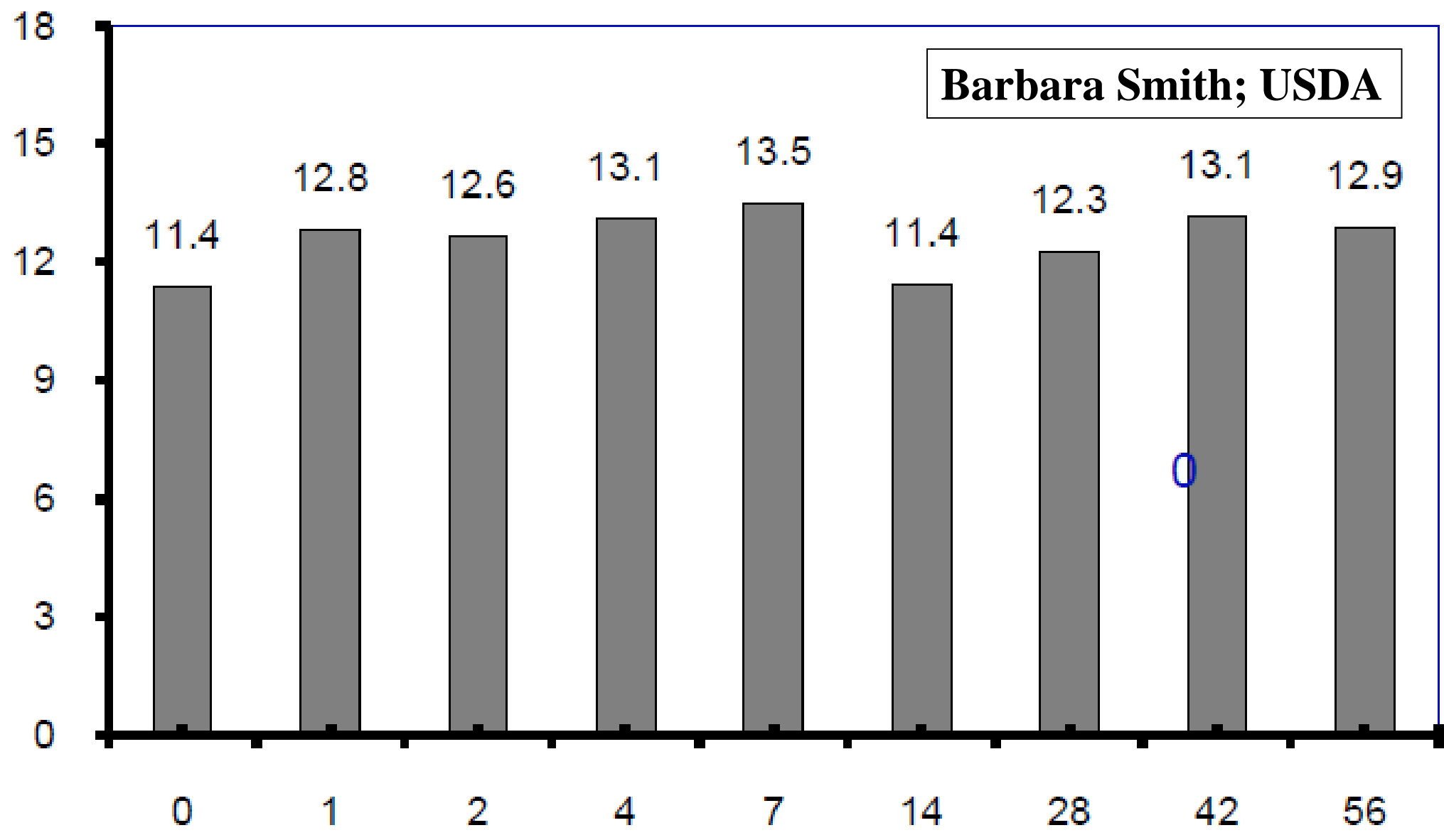
Bill Cline; NCSU

Number of berries with no disease symptoms



Barbara Smith; USDA

Barbara Smith; USDA



Number of days between last fungicide application and harvest

Recommended Spray Schedule for Control of Berry Diseases

Begin fungicide applications at bud break – usually early to mid-May.

Continue applications at 10 – 14 day intervals alternating among three classes of fungicides such as Nova, Abound, and Elite.

It is important to alternate between fungicides with different modes of action to prevent the pathogens from becoming resistant to the fungicides.

Apply fungicides at a 10 day interval during rainy periods and at a 14 day interval during dry periods.

Fungicide applications may be discontinued two months before harvest.

If muscadines are being grown for juice it is not necessary to apply any fungicides to most cultivars because the berry rots are not severe enough to effect their yield or quality.

Barbara Smith; USDA

Efficacy of selected fungicides against diseases of muscadine grape¹

Fungicide	PHI (Pre-Harvest Interval)	Mode-of-Action (MOA) Grouping ²	FRAC code ³	Bitter rot	Powdery mildew	Ripe rot	Macro-phoma rot	Black rot	Sooty blotch	Dead arm	Angular leaf spot
Myclobutanil (Rally)	14 days	G	3	++ ²	++++	NA	+	++++	+++	???	++++
Thiophanate-methyl (Topsin- M)	7 days	B	1	++	+++	+	+	+++	+++	++	+++
Wettable Sulfur (Microthiol and other trade names)	1 day (re-entry)	Multi-site	M 2	NA	++++	NA	NA	NA	???	NA	NA
Pyraclostrobin + boscalid (Pristine)	14 days	C	7+11	+++	++++	++++	+++++	++++	+++++	++	++++
Kresoxim-methyl (Sovran)	14 days	C	11	+++	+++	+++	++	+++	+++	++	+++
Azoxystrobin (Abound)	14 days	C	11	+++	++++	++++	++++	++++	++++	++	++++
Trifloxystrobin (Flint)	14 days	C	11	+++	++++	++++	+++++	++++	+++++	++	+++
Ziram (Ziram)	21 days	Multi-site	M 3	++	++	+++	++	+++	+++	++	+++
Captan (Captan, Captec)	0 days (72 hrs re-entry)	Multi-site	M 4	++	++	++++	+++	+++	+++	++	+++
EBDCs (includes Maneb, Manex, Penncozeb, Manzate, Dithane M-45)	66 days	Multi-site	M 3	+++	++	NA	++	+++	++	++	+++

¹ NA = no significant activity, ??? = unknown activity; + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity, +++++ = excellent activity.

² Alternation of fungicides with different modes of action helps prevent the development of pest resistance to a particular class of fungicide. There is no benefit to alternating or tank-mixing fungicides with the same mode of action. Fungicides listed as "multi-site" are the least likely to be overcome by a resistant strain of a pathogen.

³ In addition to MOA grouping, the FRAC code also indicates fungicides that can be alternated to discourage pest resistance; alternate or tank-mix only those products having different FRAC codes.

Critical Periods for Achieving Control of Muscadine Diseases

Bitter Rot	During shoot extension, through bloom, and preharvest.
Black Rot	During shoot extension, through bloom, and from fruit set until fruit is larger than ½ inch diameter.
Ripe Rot	From cap fall until harvest.
Macrophoma Rot	Last 6 weeks prior to harvest, especially 14 to 7 days before harvest, and immediately after a harvest but within the PHI before the next harvest.
Angular Leaf Spot	From fruit set through fruit ripening, and possibly after harvest.
Powdery Mildew	From fruit set through first hint of color change.

Chen et al. in Muscadine Grapes; 2001.

Muscadine Fungicide Program Realities

- ❖ **Muscadine is a grape, and it therefore benefits from registrations for bunch grapes.**
- ❖ **Generally, registrations for shared disease problems are limited to black rot and powdery mildew.**
- ❖ **Through control programs for black rot and powdery mildew, we obtain suppression/control of angular leaf spot, ripe rot, bitter rot, and Macrophoma rot.**

Pierce's Disease

- ❖ Caused by *Xylella fastidiosa*.
- ❖ Not a major problem in muscadines.
- ❖ Infected vines have minimal symptoms or issues.
- ❖ Pride cultivar is highly susceptible, and can be killed.



Leaf scorch on susceptible Carlos variety.

Nematodes

- ❖ **Generally not considered to be a problem on muscadines.**
- ❖ **Very limited research.**

Viruses???

Crown Gall

- ❖ **Generally not considered to be as much of a problem as observed in wine grapes.**
- ❖ **Associated with wire rubs and cold damage.**



Winter Injury

- ❖ **Stress from overproduction may not allow vines to “harden off” quickly enough or to the degree we need for protection against winter injury.**
- ❖ **Duration of freezing temperatures may also have an impact on winter injury.**







Grape Bot Canker

(Botryodiplodia theobromae)



“pruning wound disease commonly seen in vines 10 or more years old” ... “the major cause of arm and cordon death statewide.” UC Pest Management Guidelines

Grape Bot Canker

(Botryodiplodia theobromae)

WHEN TO TREAT

As soon as possible after pruning.

COMMENTS ON CONTROL

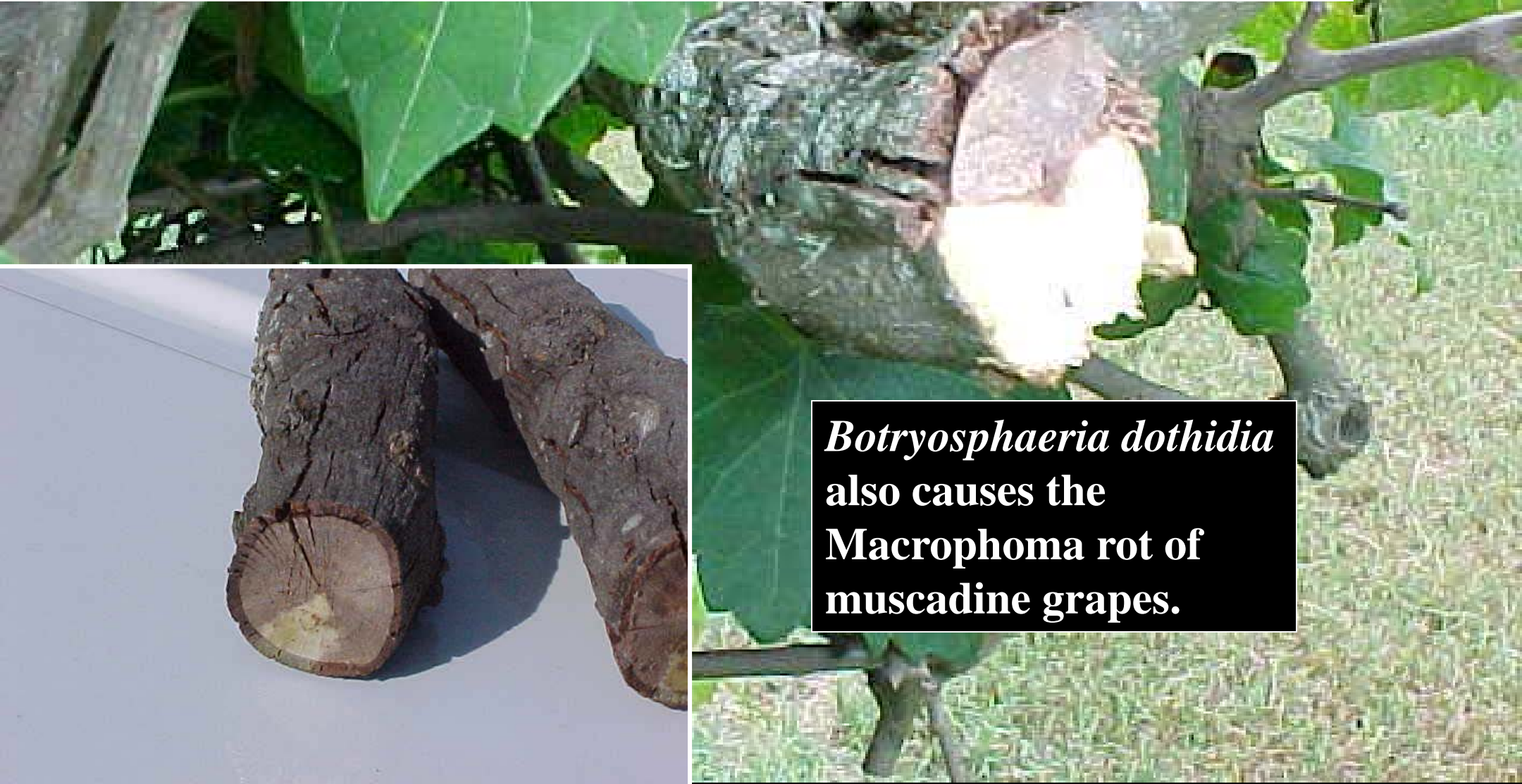
Pruning wounds provide an infection site. Thoroughly paint or hand spray pruning wounds with fungicide as soon as possible after pruning. Once infected, complete removal of canker is necessary. On older vines, doubling of spurs to replace lost spur positions and extensive cordon retraining is necessary to maintain production. Cultural practices, such as proper water and fertilizer management and good pruning techniques, designed to maintain vine vigor are necessary and will enable the vines to outgrow infections by this organism.



Pruning Wounds



Pruning wound diseases are also observed in muscadine. The most prevalent dieback disease in GA is caused by *Botryosphaeria dothidia*. Generally thought to be associated with pruning cuts, wire rubs, or broken spurs.



***Botryosphaeria dothidia*
also causes the
Macrophoma rot of
muscadine grapes.**





Stress (drought, overproduction, and/or winter injury) can allow latent infections to become major infections of muscadine. Varieties differ in susceptibility.



Collapse of muscadines in the midseason as grapes start to mature.



Current Control Measures

- ❖ **Following general pruning (Jan-Mar), spray pruning cuts with a compound such as Topsin M or Rally at the end of each day.**
- ❖ **If “dead arm” or “dieback” is observed, cut out the infected arm. Make the cut at least 8 inches below the canker. Sterilize the blades between cuts in a 10% bleach solution. Spray the cut with a fungicide.**
- ❖ **Maintain proper fertility and otherwise healthy vines.**

Postharvest Disease Control

- ❖ Largely a “black hole” with limited information.
- ❖ Low temperatures (between 0° and 3.5 °C) with saturated relative humidity are generally recommended, but saturated conditions increase rots.
- ❖ As a general rule, muscadine fruit should be moved to market in refrigerated trucks (4°C) and sold within seven days of harvest.

Postharvest Disease Control

- ❖ *Alternaria*, *Aspergillus*, *Botrytis*, *Fusarium*, *Penicillium*, and *Greeneria* (very prevalent in storage) spp. have been reported.
- ❖ Torn stem scars are a major source of infection.
- ❖ Some producers have looked at use of Elevate (active only against *Botrytis*) as a preharvest treatment. Results???

Postharvest Disease Control

- ❖ Sulfur dioxide generators can be utilized, and they have been – with some success. However, damage to fruit is also possible.
- ❖ Ethylene oxide use has also been reported.
- ❖ Controlled atmosphere studies have been conducted.
- ❖ In general, the lack of research and costs have precluded use of these methods in muscadine grape storage.

