Cold Climate Grape IPM

Diseases & Insects

Lorraine P. Berkett

University of Vermont

August 6, 2008

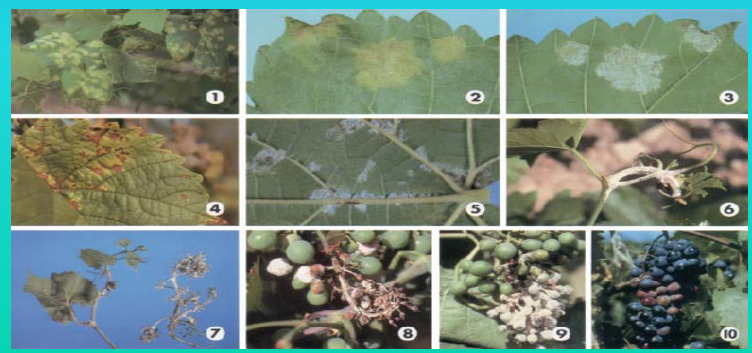
Major Diseases – The BIG 4

Phomopsis cane and leaf spot

Black Rot

Powdery Mildew

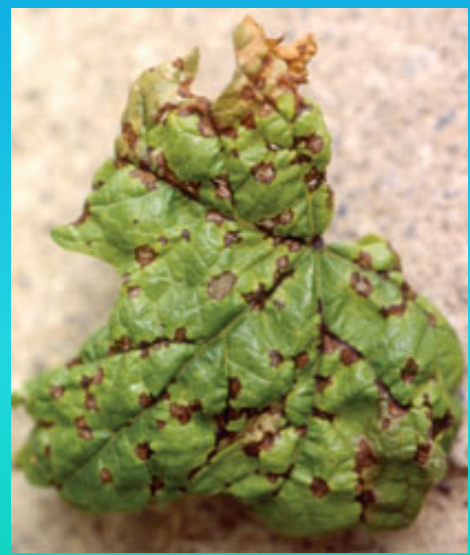
Downy Mildew



NYS IPM Fact Sheet

Another Important Disease –

Anthracnose

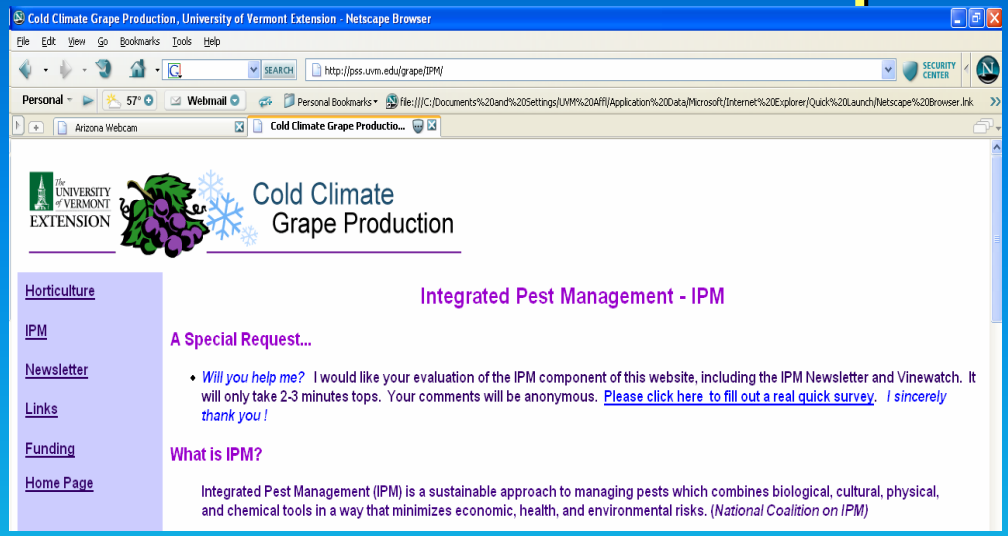


Midwest Grape Prod. Guide +LPB

This Presentation

- Go through the growing season and point out the key times to manage these diseases
- Point out some materials used to manage them, and
- Issue of resistance management.

Cold Climate Grape IPM - Resources



IPM Information ...

- IPM Primer - basic introduction to concepts, strategies, and components of an IPM program
- Cold Climate Grape IPM News and Vinewatch -- seasonal observations and IPM information in Vermont
- New York and Pennsylvania Pest Management Guidelines for Grapes -- excellent resource for background information on diseases, insects and weeds and options for management.
- NYS IPM Fact Sheets for Grape Diseases and Insects
- Mid-Atlantic Vineyards Grape IPM -- insect pest fact sheets along with information on biological control
- Grape IPM in the Northeast - by T. Weigle and J. Kovach, Cornell University
- Pest Management in the Vineyard - Michigan State University
- Diagnosing Problems and Scouting Vineyards - Michigan State University - includes information on diagnosing disease, insect, physiological conditions and nutritional disorders
- Midwest Grape Production Guide, Bulletin 919-05 -- a comprehensive resource which includes IPM information as well as information on site selection, cultivar selection, vineyard establishment, pruning and training, wildlife management, soil management, fertilization, etc.

2007 IPM Newsletters and Vinewatch

- July 16, 2007 - Newsletter
- June 22, 2007 - Newsletter
- May 24, 2007 - Newsletter
- April 5, 2007 - Newsletter

2006 IPM Newsletters and Vinewatch

- Sept. 12, 2006 - Vinewatch
- August 22, 2006 - Newsletter
- August 8, 2006 - Newsletter
- July 27, 2006 - Newsletter and Vinewatch
- July 10, 2006 - Newsletter
- June 16, 2006 - Vinewatch
- June 2, 2006 - Newsletter
- May 23, 2006 - Newsletter
- May 19, 2006 - Newsletter
- May 4, 2006 - Newsletter

2005 IPM Newsletters and Vinewatch

- July 11, 2005 - Vinewatch
- June 17, 2005 - Vinewatch
- May 31, 2005 - Newsletter

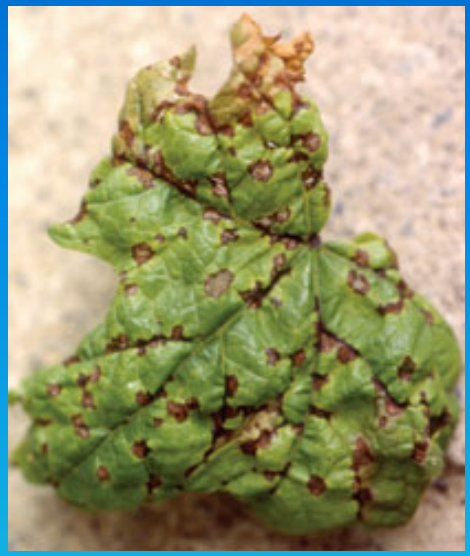
2004 Newsletter

Organic IPM Information ...

- Organic Integrated Management of Grape Diseases -- by Mike A. Ellis and Mizuho Nito, Ohio State University
- Organic Grape Production -- an ATTRA publication written by Rex Dufour
- Organic Viticulture in New York -- a 1995 report
- Organic and BioDynamic Grape Production -- a power point presentation by Kathleen Delate, Iowa State University

http://pss.uvm.edu/grape/

Anthracnose



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Anthracnose

- The fungus overwinters in the vineyards as sclerotia (fungal survival structures) on infected shoots.
- All succulent parts of the plant can be attacked, but lesions on shoots and berries are most common and distinctive.
- Conidia are spread by splashing rain to new growing tissues and are not carried by wind alone.
- Young leaves are more susceptible to infection than older leaves
- Clusters are susceptible to infection before flowering and until veraison.

Anthracnose

- Sanitation is very important – dormant pruning
- Late dormant fungicide – Liquid Lime Sulfur
- Early season fungicides- 1” growth
- Eliminate wild grapes near the vineyard
- Canopy management

Fungicide Specifics

Consult:

2008 NY-PA Pest Management Guidelines for Grapes

- http://ipmguidelines.org/grapes/

Please Note:

Where trade names or commercial products are used for identification, no discrimination is intended and no endorsement is implied.

Always read the label before using any pesticide. **The label is the legal document for the product use. Disregard any information in this presentation if it is in conflict with the label.**

Relative Disease Ratings for Wine Grape Varieties Grown in Vermont*

Lorraine P. Berkett
University of Vermont

December 20, 2007
Updated July 2008

A Work in Progress…

Ratings: + slightly susceptible; ++ moderately susceptible; +++ highly susceptible

	Black Rot	Powdery Mildew	Downy Mildew	Botrytis	Angular Leaf Scorch	Phomopsis	Anthracnose
Baco Noir	+++	++	+	+++	++	+	?
Blanca	++	+	++	+	?	?	?
Cayuga White	+	+	++	+	++	+	?
Frontenac	+++	+++	+	++	++	+	+
Frontenac Gris	++	+++	+	++	?	+	+
LaCrescent	++	+++	+++	+	++	+	+++
LaCrosse	+++	++	+++	+++	?	++	+
Leon Millot	+	+++	+++	+	+	+	+
Louise Swenson	+	+	+	+	++	?	++
M. Foch	++	++	+	+	+	+	++
Marquette	+	+	+	+	?	?	?
Prairie Star	++	+	+++	+++	++	?	++
Riesling	+++	+++	+++	+++	+	++	?
Sabrevois	+	+	+	+	?	?	?
St. Croix	+++	++	++	++	++	?	+
St. Pepin	+	+++	++	++	+	?	?
Seyval	++	+++	++	+++	++	++	?
Swenson Red	+	++	+++	++	++	?	?
Swenson White	+	++	++	+	+++	+	++
Traminette	++	+	+++	+	+	?	+
Vidal	++	+++	+++	+	+	+	+++
Vignoles	+	+++	+++	+++	++	++	+++

*Resources: Midwest Grape Production Guide, Bulletin 918, OSU, 2005; New York and Pennsylvania Pest Management Guidelines for Grapes: 2006; "Characteristics of Cold Hardy Grape Cultivars", Dr. Paul Domoto, Iowa State University, 2007; and observations from Vermont vineyards. Note: Where there were differing ratings, the more susceptible rating was used.

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Phomopsis Cane & Leaf Spot

NYS IPM Fact Sheet, MW Guide, + LPB

Phomopsis

- Cool weather fungus
- Most likely to be a problem when fungus is allowed to build up on dead canes or on pruning stubs in vines
- Black pycnida overwinter in infected canes and rachises. During wet weather in spring, spores ooze from fruiting bodies.
- Lesions appear on shoots and leaves within 3-4 weeks after infection. They provide additional spores.
- Rachises are suscept. from the time young clusters first emerge until early summer although infections that occur during the early part of this period are the most damaging.

Phomopsis

- Fruit appear to be the most suscept. from bloom through pea-size (although some research suggests they may remain suscept. throughout the summer)
- Fruit infection occurs sporadically since it requires extended periods of rain and wetness during this time.
- Fruit infections remain latent until late summer or preharvest.
- The critical period to provide fungicide protection for fruit and rachis infection is probably from when the clusters are first exposed until two to four weeks after bloom.

Black Rot vs Phomopsis

Difference between BR and Phomopsis on the fruit is that Phomposis lesions typically do not appear until late summer or early fall, just before harvest whereas BR berry infections appear mid-July and all diseased berries should be evident before veraison.

Phomopsis

- Remove diseased canes and pruning stubs during pruning to reduce inoculum
- Need for fungicide applications dependent on level of inoculum w/i vineyard and frequency and duration of wetness periods.

Inoculum Sources !

Infected Dead Canes and Brush Piles

Phomopsis

- Most effective: captan, mancozeb,
- Strobilurins – “fair”
- Copper and sulfur = weak

2008 NY-PA Guidelines

Table 3.2.2. Effectiveness of fungicides for management of grape diseases[1].

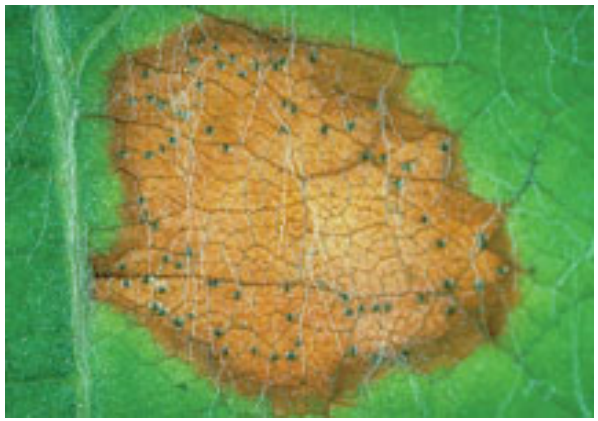
Fungicide	Phomopsis cane and leaf spot	Black rot	Downy mildew	Powdery mildew	Botrytis bunch rot
azoxystrobin (Abound)	++	++++	++++	++++[a]	+
boscalid (Endura)	0	0	0	++++	++/++++[b]
boscalid + pyraclostrobin (Pristine)	++	++++	++++	++++[a]	++/++++[b]
captan (Captan, Captec)	++++	+	+++	0	+
cyprodinil (Vangard)	0	0	0	+?	++++
dihydrogen potassium phosphate (Nutrol)	0	0	0	++	0
fenarimol (Rubigan, Vintage)[f]	0	++	0	+++[f]	0
fenhexamid (Elevate)	0	0	0	+	++++
ferbam	+++	+++	++	0	0
fixed copper (several formulations) and lime[c]	+	+	+++	++	0
iprodione (Rovral)[g]	0	0	0	0	+++[g]
kresoxim-methyl (Sovran)	++	++++	++	++++[a]	++
mancozeb (Dithane, Manzate, Penncozeb)	++++	+++	+++	+	0
mefanoxam (Ridomil)[d]	d	d	++++	d	0
myclobutanil (Nova, Rally)[f]	0	++++	0	+++[f]	0
phosphorous acid (various formulations)	0	0	+++	0	0
potassium bicarbonate (Kaligreen, Armicarb 100)	0	0	0	++	0
pyrimethanil (Scala)	0	0	0	+?	++++
quinoxyfen (Quintec)	0	0	0	++++	0
spray oil (JMS Stylet, PureSpray)	0	0	0	+++	0
sulfur (several formulations)e	+	0	0	+++[e]	0
tebuconazole (ΔElite, ΔOrius)[f]	0	++++	0	+++[f]	0
thiophanate-methyl (Topsin-M)	++	+	0	h	h
trifloxystrobin (Flint)	++	++++	+	++++[a]	++/++++[b]
triflumizole (*Procure)[f]	0	++?	0	+++[f]	0

[1]These ratings are relative rankings, based on standard application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to varietal susceptibility and disease pressure.

Key: ++++ excellent +++ good ++ moderate + slight 0 not effective

a. NOTE: Powdery mildew

Black Rot



Midwest Grape Prod. Guide + LPB

Black Rot

- One of most serious diseases of grapes in eastern US
- Overwinters primarily in mummified fruit on ground or left on vine. Removal of mummies is a critical component of BR management
- All green tissues of the vine are susceptible to infection
- Leaves - susc. for about 1 week after they unfold
- Fruit - highly susceptible for first 2-3 weeks after bloom; become resistant 4-8 wks after bloom depending on variety and year
- The incubation period for the disease can be very long

Black Rot

•The most critical time to control black rot fruit infections with fungicide is from immediately prior to bloom through three to four weeks after bloom.

• Berries become resistant, becoming highly resistant 5-8 wks after bloom, depending on the variety and year.

Black Rot

- Remove all MUMMIES– sanitation is critical
- Canopy Management
- Fungicide applications – Immediate Pre-Bloom and First Post-Bloom; Second Post-Bloom
- If more than a trace level of BR is observed - sprays should continue through end of July if conditions are suitable for infection (wet)

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captan (Captan, Captec)	++++	+	+++	0	+
cyprodinil (Vangard)	0	0	0	+?	++++
dihydrogen potassium phosphate (Nutrol)	0	0	0	++	0
fenarimol (Rubigan, Vintage)[f]	0	++	0	+++[f]	0
fenhexamid (Elevate)	0	0	0	+	++++
ferbam	+++	+++	++	0	0
fixed copper (several formulations) and lime[c]	+	+	+++	++	0
iprodione (Rovral)[g]	0	0	0	0	+++[g]
kresoxim-methyl (Sovran)	++	++++	++	++++[a]	++
mancozeb (Dithane, Manzate, Penncozeb)	++++	+++	+++	+	0
mefanoxam (Ridomil)[d]	d	d	++++	d	0
myclobutanil (Nova, Rally)[f]	0	++++	0	+++[f]	0
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potassium bicarbonate (Kaligreen, Armicarb 100)	0	0	0	++	0
pyrimethanil (Scala)	0	0	0	+?	++++
quinoxyfen (Quintec)	0	0	0	++++	0
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sulfur (several formulations)e	+	0	0	+++[e]	0
tebuconazole (ΔElite, ΔOrius)[f]	0	++++	0	+++[f]	0
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LaCrescent	++	+++	+++	+	++	+	+++
LaCrosse	+++	++	+++	+++	?	++	+
Leon Millot	+	+++	+++	+	+	+	+
Louise Swenson	+	+	+	+	++	?	++
M. Foch	++	++	+	+	+	+	++
Marquette	+	+	+	+	?	?	?
Prairie Star	++	+	+++	+++	++	?	++
Riesling	+++	+++	+++	+++	+	++	?
Sabrevois	+	+	+	+	?	?	?
St. Croix	+++	++	++	++	++	?	+
St. Pepin	+	+++	++	++	+	?	?
Seyval	++	+++	++	+++	++	++	?
Swenson Red	+	++	+++	++	++	?	?
Swenson White	+	++	++	+	+++	+	++
Traminette	++	+	+++	+	+	?	+
Vidal	++	+++	+++	+	+	+	+++
Vignoles	+	+++	+++	+++	++	++	+++

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Powdery Mildew

LPB and APS pictures

Powdery Mildew

- Fungus can infect all green tissue.
- PM may reduce wine quality even though yield is not affected.
- Winters in cleistothecia on bark of vines. Ascospores released from bud break until shortly after bloom when have .1” rain and temp. above 50F.
- Conidia are wind-dispersed -- do not require rain -- but high humidity favors disease development
- Generational time (number of repeating cycles) driven by temp. → at optimal temp in mid-60’s to mid-80’s, a new generation occurs every 5--7 days.

Powdery Mildew

- Fungus is on surface
- Vinifera and suscept. hybrids continued management of PM beyond fruit set until veraison to avoid early defoliation, poor ripening and reduced winter hardiness.
- Berries highly susept. from immediate prebloom until about 2 wks after fruit set. Severe fruit damage and berry splitting later in season are almost always result of infections during this peak period of suscept.
- Vinifera and some hybrids remain suscept. until bunch closure or slightly after.

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LaCrosse	+++	++	+++	+++	?	++	+
Leon Millot	+	+++	+++	+	+	+	+
Louise Swenson	+	+	+	+	++	?	++
M. Foch	++	++	+	+	+	+	++
Marquette	+	+	+	+	?	?	?
Prairie Star	++	+	+++	+++	++	?	++
Riesling	+++	+++	+++	+++	+	++	?
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Seyval	++	+++	++	+++	++	++	?
Swenson Red	+	++	+++	++	++	?	?
Swenson White	+	++	++	+	+++	+	++
Traminette	++	+	+++	+	+	?	+
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Powdery Mildew

- The most critical time to control fruit infection with fungicides is from immediately prior to bloom through two to four weeks after bloom.

- Even though the berries become resistant with age, cluster stems (rachis) and leaves remain susceptible throughout the season

- It is important to remember that powdery mildew can be a serious problem during growing seasons when it is too dry for most other diseases, such as black rot or downy mildew, to develop.

Powdery Mildew

- Canopy Management – Sun exposure, Relative Humidity (leaf pulling, shoot positioning)
- Fungicide applications – Immediate Pre-Bloom,First Post-Bloom, Second Post-Bloom [may need to start earlier]
- Resistance Management Plan

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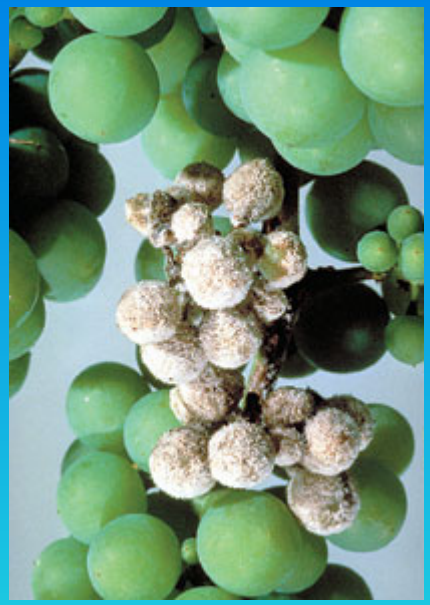

Midwest Grape Prod. Guide + LPB

Downy Mildew

- Can infect all green, actively growing parts that have mature, functional stomates.
- Winters as dormant spores within infected leaves on vineyard floor.
- Primary spores splashed in rain and > 52F (Primary inoc. from w/i vineyard)
- Secondary spores -- only produced at night when relative humidity is high (>95%);can be blown great distances - blown into vineyard; infect in morning when plant is wet.

Downy Mildew

- **Generational time = 4 days in ideal conditions (temps mid- to upper- 70F) → explosive disease development**
- **Leaves lose suscept. at the time they are fully expanded.**
- **Fruit remain susc. as long as stomata on the surface are functional; fruit lose sucept. to infection by midsummer**
- **Eventually, severely infected portions of the vine wither and die.**

Downy Mildew

- **Premature defoliation is a serious problem, because it predisposes the vine to winter injury. It may take a vineyard several years to fully recover after severe winter injury.**
- **Frequent rainfall and high humidity are the most important environmental factors promoting downy mildew epidemics.**
- **In general, vinifera (*Vitis vinifera*) cultivars are much more susceptible than American types; the French hybrids are somewhat intermediate in susceptibility**

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Swenson White	+	++	++	+	+++	+	++
Traminette	++	+	+++	+	+	?	+
Vidal	++	+++	+++	+	+	+	+++
Vignoles	+	+++	+++	+++	++	++	+++

*Resources: Midwest Grape Production Guide, Bulletin 918, OSU, 2005; New York and Pennsylvania Pest Management Guidelines for Grapes: 2006; "Characteristics of Cold Hardy Grape Cultivars", Dr. Paul Domoto, Iowa State University, 2007; and observations from Vermont vineyards. Note: Where there were differing ratings, the more susceptible rating was used.

Acknowledgement of Support: The Cold Climate Grape Program has been funded, in part, by an EPA Pesticide Environmental Stewardship Grant.

Downy Mildew

- Any practice that improves air circulation and speeds drying w/i canopy will help
- Spring cultivation to bury fallen leaves
- Focus of management:

  (1) preventing early disease establishment and cluster infections during the prebloom and early postbloom periods

  (2) limiting secondary spread on the foliage during the summer

2008 NY-PA Guidelines

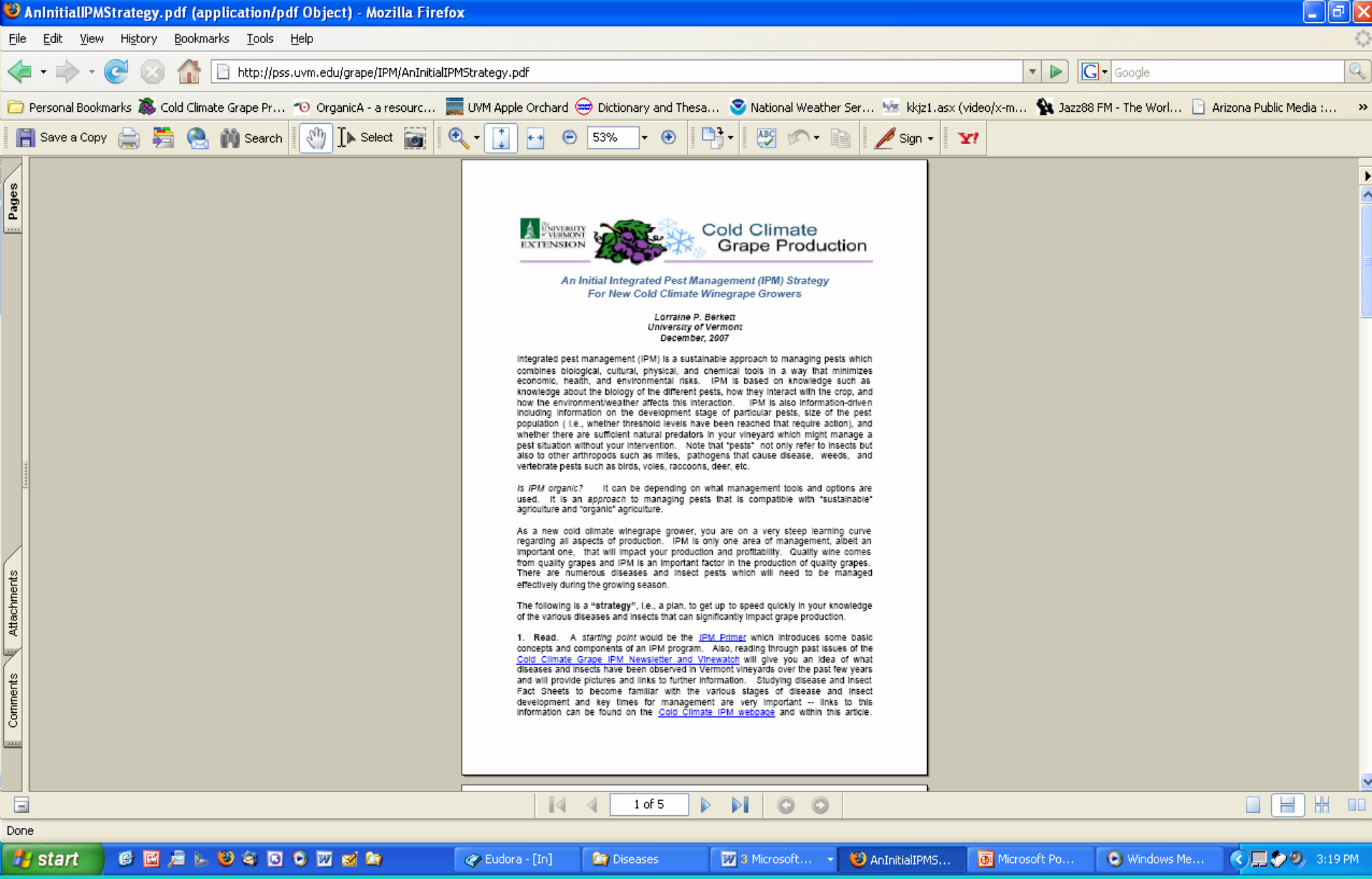
Table 3.2.2. Effectiveness of fungicides for management of grape diseases[1].

Fungicide	Phomopsis cane and leaf spot	Black rot	Downy mildew	Powdery mildew	Botrytis bunch rot
azoxystrobin (Abound)	++	++++	++++	++++[a]	+
boscalid (Endura)	0	0	0	++++	++/++++[b]
boscalid + pyraclostrobin (Pristine)	++	++++	++++	++++[a]	++/++++[b]
captan (Captan, Captec)	++++	+	+++	0	+
cyprodinil (Vangard)	0	0	0	+?	++++
dihydrogen potassium phosphate (Nutrol)	0	0	0	++	0
fenarimol (Rubigan, Vintage)[f]	0	++	0	+++[f]	0
fenhexamid (Elevate)	0	0	0	+	++++
ferbam	+++	+++	++	0	0
fixed copper (several formulations) and lime[c]	+	+	+++	++	0
iprodione (Rovral)[g]	0	0	0	0	+++[g]
kresoxim-methyl (Sovran)	++	++++	++	++++[a]	++
mancozeb (Dithane, Manzate, Penncozeb)	++++	+++	+++	+	0
mefanoxam (Ridomil)[d]	d	d	++++	d	0
myclobutanil (Nova, Rally)[f]	0	++++	0	+++[f]	0
phosphorous acid (various formulations)	0	0	+++	0	0
potassium bicarbonate (Kaligreen, Armicarb 100)	0	0	0	++	0
pyrimethanil (Scala)	0	0	0	+?	++++
quinoxyfen (Quintec)	0	0	0	++++	0
spray oil (JMS Stylet, PureSpray)	0	0	0	+++	0
sulfur (several formulations)e	+	0	0	+++[e]	0
tebuconazole (ΔElite, ΔOrius)[f]	0	++++	0	+++[f]	0
thiophanate-methyl (Topsin-M)	++	+	0	h	h
trifloxystrobin (Flint)	++	++++	+	++++[a]	++/++++[b]
triflumizole (*Procure)[f]	0	++?	0	+++[f]	0

[1]These ratings are relative rankings, based on standard application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to varietal susceptibility and disease pressure.

Key: ++++ excellent +++ good ++ moderate + slight 0 not effective

a. NOTE: Powdery mildew



http://pss.uvm.edu/grape/IPM/AnInitialIPMStrategy.pdf

Note that the program assumes resistance has not developed to the sterol-inhibitor class of fungicides and the strobilurin fungicides.

An Example of a "Skeletal" Disease Program for Cold Hardy Cultivars which can be Modified to Your Conditions

Stage of Growth - *A Fungicide Option(s) [for specific diseases listed]*

5" – 8" shoot - **Mancozeb** [for Phomopsis, Black Rot (BR), and Downy Mildew (DM)]

Immediate Pre-Bloom to Early Bloom - **Nova** [Powdery Mildew (PM), BR] + **Mancozeb** [BR, DM, Phomopsis]

1st Post-Bloom (10-14 days from last spray) - **Nova** [PM, BR] + **Mancozeb** [BR, DM, Phomopsis]

2nd Post-Bloom (10-14 days from last spray) - **Sovran** or **Abound*** or **Pristine*** [BR, DM, PM] [These are 'big guns'; use if have very favorable weather for disease.] OR **Sulfur*** [PM] + **Mancozeb** [BR, DM] [if outside 66 days to harvest and if under the maximum amount allowed per season per acre] OR **Sulfur*** [PM] + **Captan** [DM] [note captan has a restricted-entry interval of 72 – 96 hours] [*denotes potential phytotoxicity issues - check labels]

Additional Summer Sprays - possible options include **Sulfur*** for PM; **Captan** OR a phosphonate product for DM

Red denotes **critical period** for disease management.

For rates of materials and further details see the
New York and Pennsylvania Pest Management Guidelines

Note: If your vineyard had a Phomopsis or Black Rot problem last year, the first spray should go on earlier, at 3"- 5" shoot growth.

ALWAYS READ PESTICIDE LABELS VERY CAREFULLY
— THE LABEL IS THE LAW ON HOW THE MATERIAL CAN BE USED—

Effective Disease Management

- Knowledge about the Diseases -- when are critical times to manage based on their disease cycles
- Knowledge about the relative susceptibility of the varieties to specific diseases
- Knowledge about what cultural factors can impact disease development
- Knowledge about what materials are effective
- Knowledge about fungicide resistance management

GRAPES

Cornell Cooperative Exte

Grapevine Powdery

Uncinula necator (Schw.) Burr.

Wayne F. Wilcox
Professor, Department of Plant Pathology
NYSAES, Geneva, NY

Introduction

Powdery mildew (PM) is perhaps the m
disease of grapevines worldwide. This dise
em North America, but gained notoriety wh
into European vineyards in 1845, causing
spread rapidly throughout the continent. U
destroy infected clusters outright or reduce
dispose them to bunch rot infections. Foli
photosynthesis, thereby reducing Brix lev
winter hardiness. Generally, cultivars of *Vi*
brids are much more susceptible to PM
native American grape species.

Fig. 1. Whitish powdery coating on leaf.

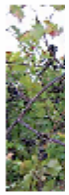


Fig. 2. Pre
powdery m

Fig. 5. Brown patches on dormant canes.

Fig. 6. Whi
infections.

Grape IPM
Disease Identification Sheet No. 5

downy mildew

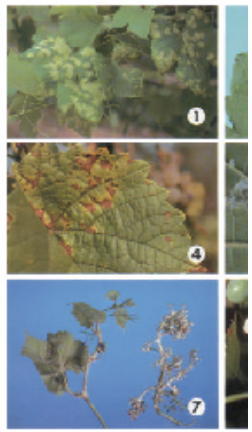
Plasmopara viticola (Berk. & Curt.) Berl.

INTRODUCTION

Downy mildew, a fungal disease na
America, attacks most species of wild a
grape. The disease was inadvertently in
European vineyards in the late 1870's w
tated the European grape, *Vitis vinifera*,
erally more susceptible to the diseas
American grapes. Today, the disease ca
grapevines in most regions of the worl
during the growing season. The fungus
yield losses by rotting inflorescences,
shoots, and indirect losses by premature
vines which increases their susceptibi
injury and delays ripening of the fruit.

SYMPTOMS AND SIGNS

Plasmopara viticola can infect all g
growing parts of the vine that have matu
stomata (tiny pores or openings) which a
exchange on plant tissues. Leaves devel
green lesions on their upper surfaces 7
infection (Fig. 1). As lesions expand, the



1984 turn brown, necrotic or mottled (Fig. 2). White, "downy" sporulation of the fungus forms on the lower

Disease Identification

GRAPES

CORNELL COOPERATIVE EXTENSION

Phomopsis Cane and Leaf Spot of Grape

Phomopsis viticola (Sacc.) Sacc.

J. W. Pscheidt and R. C. Pearson
Department of Plant Pathology
NYS Agricultural Experiment Station
Cornell University

Phomopsis cane and leaf spot, once known as "dead arm," is a common disease in most regions of the world where viticulture is practiced. Severely infected leaves are misshapen, yellow, and fall from the vine prematurely. Infected rachises are brittle so that portions of the cluster may fall off before harvest. Infected fruit are discolored and can drop to the ground before maturity. When incidence of the disease is high, crop losses of 10 to 40 percent can occur.

GRAPES

Cornell Cooperative Extension

IPM Integrated Pest Management

Black rot

Guignardia bidwellii (Ellis) Viala and Pavaz.

Wayne F. Wilcox
Professor, Department of Plant Pathology, Cornell University,
NYSAES, Geneva, NY

Introduction

Black rot is an important fungal disease of grapes that originated in eastern North America, but which now occurs in portions of Europe, South America, and Asia as well. It can cause complete crop loss in warm, humid climates, but is virtually unknown in regions with arid summers. There is a wide variation in susceptibility to this disease among native American and hybrid cultivars, whereas all common cultivars of *Vitis vinifera* appear to be highly susceptible.

Symptoms and Signs

All young green tissues of the vine are susceptible to infection. Relatively small, brown circular lesions develop on infected leaves (Fig. 1), and within a few days tiny black spherical fruiting bodies (pycnidia) protrude from them (Fig. 2). Elongated black lesions on the petiole (Fig.3) may eventually girdle these organs (Fig. 4), causing the affected leaves to wilt (Fig. 5). Shoot infection results in large black elliptical lesions (Figs. 5 and 6). These lesions may contribute to breakage of shoots by wind, or in severe cases, may girdle and kill young shoots altogether.

Infection of the fruit is by far the most serious phase of the disease and may result in substantial economic loss. Infected berries first appear light or chocolate brown (Fig. 7), but quickly turn darker brown, with masses of black pycnidia developing on the surface (Fig. 8). Finally, infected berries shrivel and turn into hard black raisin-like bodies that are called mummies (Fig. 9).

Fig. 1. Small, circular lesions on leaves.

Fig. 2. Tiny, black pycnidia in leaf lesion.

Fig. 3. Elongated lesions on petiole.

Fig. 4. Girdled petiole causes leaves to sag and wilt.

Fig. 5. Shoot and petiole lesions from spores in mummies attached to wire.

Fig. 6. Elliptical lesion on shoot.

Relative Disease Ratings for Wine Grape Varieties Grown in Vermont*

Lorraine P. Berkett
University of Vermont

December 20, 2007
Updated July 2008

A Work in Progress...

Ratings: + slightly susceptible; ++ moderately susceptible; +++ highly susceptible

	Black Rot	Powdery Mildew	Downy Mildew	Botrytis	Angular Leaf Scorch	Phomopsis	Anthracnose
Baco Noir	+++	++	+	+++	++	+	?
Blanca	++	+	++	+	?	?	?
Cayuga White	+	+	++	+	++	+	?
Frontenac	+++	+++	+	++	++	+	+
Frontenac Gris	++	+++	+	++	?	+	+
LaCrescent	++	+++	+++	+	++	+	+++
LaCrosse	+++	++	+++	+++	?	++	+
Leon Millot	+	+++	+++	+	+	+	+
Louise Swenson	+	+	+	+	++	?	++
M. Foch	++	++	+	+	+	+	++
Marquette	+	+	+	+	?	?	?
Prairie Star	++	+	+++	+++	++	?	++
Riesling	+++	+++	+++	+++	+	++	?
Sabrevois	+	+	+	+	?	?	?
St. Croix	+++	++	++	++	++	?	+
St. Pepin	+	+++	++	++	+	?	?
Seyval	++	+++	++	+++	++	++	?
Swenson Red	+	++	+++	++	++	?	?
Swenson White	+	++	++	+	+++	+	++
Traminette	++	+	+++	+	+	?	+
Vidal	++	+++	+++	+	+	+	+++
Vignoles	+	+++	+++	+++	++	++	+++

*Resources: Midwest Grape Production Guide, Bulletin 818, OSU, 2005; New York and Pennsylvania Pest Management Guidelines for Grapes: 2006; "Characteristics of Cold Hardy Grape Cultivars", Dr. Paul Domoto, Iowa State University, 2007; and observations from Vermont vineyards. Note: Where there were differing ratings, the more susceptible rating was used.

Acknowledgement of Support: The Cold Climate Grape Program has been funded, in part, by an EPA Pesticide Environmental Stewardship Grant.

Pesticide Alternatives

– Cultural Practices -

-Cultivar resistance

-Sanitation (mummies, overwintered infected leaves)

-Pruning, Shoot Positioning, Leaf Removal

2008 NY-PA Guidelines

Table 3.2.2. Effectiveness of fungicides for management of grape diseases[1].

Fungicide	Phomopsis cane and leaf spot	Black rot	Downy mildew	Powdery mildew	Botrytis bunch rot
azoxystrobin (Abound)	++	++++	++++	++++[a]	+
boscalid (Endura)	0	0	0	++++	++/++++[b]
boscalid + pyraclostrobin (Pristine)	++	++++	++++	++++[a]	++/++++[b]
captan (Captan, Captec)	++++	+	+++	0	+
cyprodinil (Vangard)	0	0	0	+?	++++
dihydrogen potassium phosphate (Nutrol)	0	0	0	++	0
fenarimol (Rubigan, Vintage)[f]	0	++	0	+++[f]	0
fenhexamid (Elevate)	0	0	0	+	++++
ferbam	+++	+++	++	0	0
fixed copper (several formulations) and lime[c]	+	+	+++	++	0
iprodione (Rovral)[g]	0	0	0	0	+++[g]
kresoxim-methyl (Sovran)	++	++++	++	++++[a]	++
mancozeb (Dithane, Manzate, Penncozeb)	++++	+++	+++	+	0
mefanoxam (Ridomil)[d]	d	d	++++	d	0
myclobutanil (Nova, Rally)[f]	0	++++	0	+++[f]	0
phosphorous acid (various formulations)	0	0	+++	0	0
potassium bicarbonate (Kaligreen, Armicarb 100)	0	0	0	++	0
pyrimethanil (Scala)	0	0	0	+?	++++
quinoxyfen (Quintec)	0	0	0	++++	0
spray oil (JMS Stylet, PureSpray)	0	0	0	+++	0
sulfur (several formulations)e	+	0	0	+++[e]	0
tebuconazole (ΔElite, ΔOrius)[f]	0	++++	0	+++[f]	0
thiophanate-methyl (Topsin-M)	++	+	0	h	h
trifloxystrobin (Flint)	++	++++	+	++++[a]	++/++++[b]
triflumizole (*Procure)[f]	0	++?	0	+++[f]	0

[1]These ratings are relative rankings, based on standard application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to varietal susceptibility and disease pressure.

Key: ++++ excellent +++ good ++ moderate + slight 0 not effective

a. NOTE: Powdery mildew

Pesticide Considerations

- Efficacy
- Spectrum of Activity
- Applicator Risk
- Resistance Management
- Non-Target Impacts
- Sensitivity of Plant to Material
- Label Restrictions
- Cost

IPM News, May 19, 2006

New

Cold Climate Grape Industry

Learn from Experiences

in other

Grape Regions

"High Risk" - Fungicide Resistance

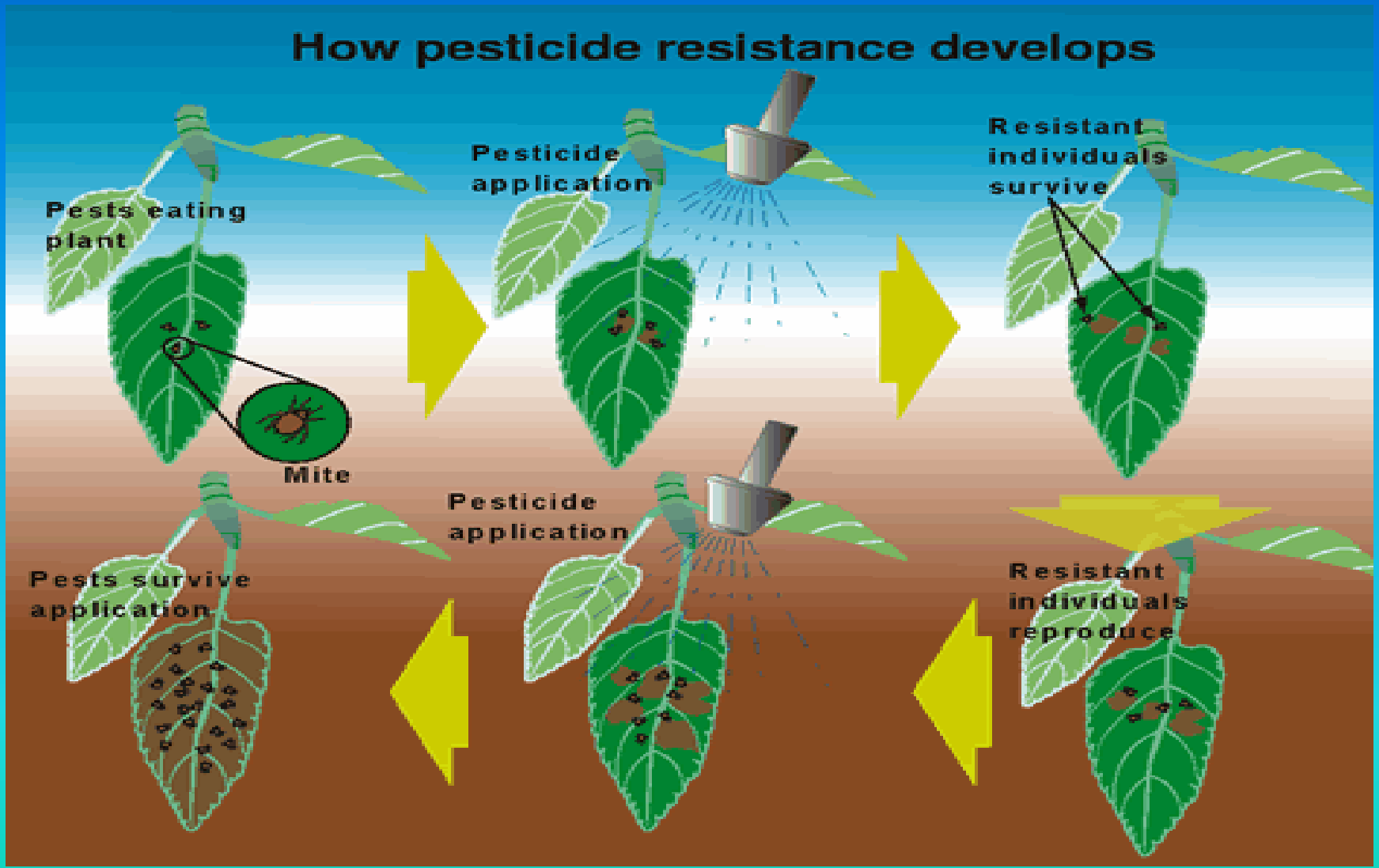
- **Sterol Inhibitors** - includes Rally, Elite, Procure, Rubigan, Vintage
- **Strobilurins** - includes Sovran, Flint, Abound

  [Note: Pristine is a combination product which contains both a strobilurin fungicide and a carboxin fungicide]
- **Anilinopyriidine** - includes Scala, Vangard
- **Phenylamide** - Ridomil products
- **Dicarboximide** - Rovral

Fungicide Resistance

Reduced sensitivity of a fungal population to a pesticide = resistance.

Reduced sensitivity is thought to be a result of **genetic mutations** which occur at low frequencies (1 in 1,000,000 or less) in a pathogen population or of **naturally occurring sub-populations** of resistant individuals



•Source: http://grapes.msu.edu/pesticideResist.htm

Resistance Management Strategies

Sterol-Inhibiting Fungicides

- Limit the total number of SI applications to a maximum of 3 sprays per year
- Maintain full recommended rates on the vine (i.e., full rates in the tank PLUS good spray coverage.
- Do not use the SI fungicides if more than a very modest amount of powdery mildew is present
- Do not exceed 14-day spray intervals, even when labels allow it

Resistance Management Strategies

Strobilurin Fungicides

- Make no more than a total of 2 strobilurin applications per year
- Use appropriate label rates and spray intervals
- Assure thorough spray coverage

Fungicide “Class” or “Family”

- You need to know what fungicides belong to the same “class” so that you can limit the total use of that class (e.g., 1 application of Rally + 1 application of Elite = 2 SI sprays)

- You need to know what fungicides are unrelated or, in other words, are in a different class, when you choose a fungicide for rotation.

- Note: There are some fungicide products that are actually a combination of two fungicides. If a sterol-inhibiting fungicide or strobilurin is in the mix, they should be counted in the total number allowed per year per fungicide class.

Two Disease "Concepts"

- **The Disease Triangle**
  plant – pathogen – env.

- **If you see symptoms, you have missed the boat !**

Grape Insects

- **Grape Phylloxera (leaf form)**
- **Grape Berry Moth**
- **Grape Leafhopper**

- **Rose Chafer**
- **Japanese Beetles**
- **Etc.**

Phylloxera – Leaf Form

Management

- Immediate Pre-Bloom and First Post-Bloom

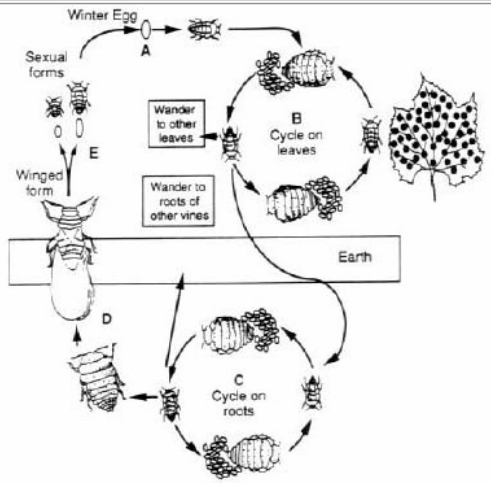


Figure 1. Life cycle of grape phylloxera, *Daktulosphaira vitifoliae* (Fitch), (after Williams, 1938). (A) Winter egg, (B) foliar form (Gallicola), (C) root form (radicola), (D) winged adult, (E) sexual stage.

OSU Fact Sheet

Grape Berry Moth

Webbing of the grape berry moth larvae.

Substantial damage caused by the grape berry moth.

Grape Insect IPM
Insect Identification Sheet No. 4

1984

grape leafhopper

Erythroneura comes (Say)

INTRODUCTION

Three leafhopper species can be found feeding on grapes in the Northeast: *Erythroneura comes* (Say), commonly known as the grape leafhopper (GLH), *E. tricincta* Fitch, the threebanded leafhopper, and *Empoasca fabae* (Harris), the potato leafhopper. Of the two *Erythroneura* species, *E. comes* is the dominant species in most areas of the Northeast. In contrast to the GLH and *E. tricincta*, the potato leafhopper does not overwinter in this area. It is an annual migrant from the south and usually appears around mid-June in this region. In some years *E. fabae* can be more destructive than the GLH.

The GLH has 1 1/2 to 2 generations per year. It overwinters as an adult in non-cultivated areas adjacent to vineyards, preferring dry, elevated, sheltered sites with accumulations of plant debris. Wide fluctuations in abundance between localities and from year to year are common.

THE ADULTS

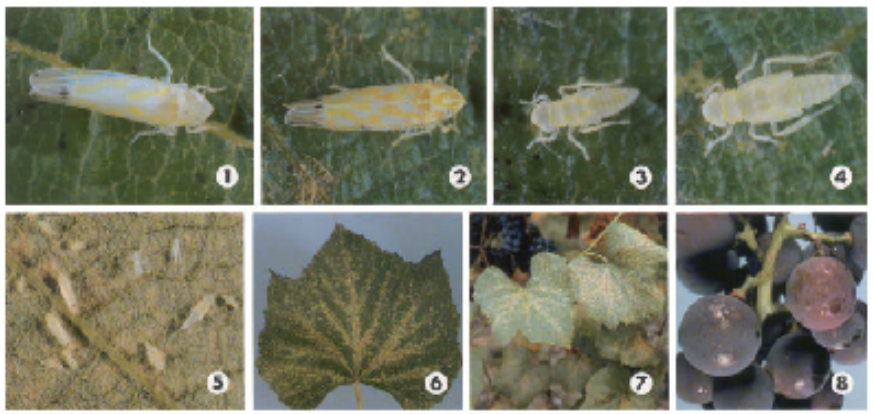
As spring temperatures in May reach the mid-60s, the overwintering adults emerge from hibernation and begin feeding on various plants such as strawberry, the various berry bushes, catnip, Virginia creeper, burdock, beech, and sugar maple. The leafhoppers mate but don't reproduce on these plants. They remain there until new growth develops in the vineyard. In western NY, migration to the grape vines begins in late May and continues through mid-July.

Generally, the 3 mm long adults emerge from hibernation with a reddish-orange coloring which changes to yellow when they begin feeding. The summer form of the GLH adult is pale yellow with three black spots and some zig-zag lines of deeper yellow on the forewings (Fig. 1). As the season continues the markings darken and just prior to hibernation the insect becomes salmon-colored overall with red eyes (Fig. 2).

The GLH is found in the vineyard into the fall. Migration to overwintering sites begins the latter part of October and continues into December.

THE EGGS

The eggs of the GLH are laid singly just beneath the epidermis on the underside of the grape leaf producing a slight blister. They are tiny (0.8 mm in diam.), colorless, and slightly bean-shaped. Egg laying usually begins during mid- to late June.



NUMBER 138, 1991 ISSN 0362-0069

New York's Food and Life Sciences Bulletin

New York State Agricultural Experiment Station, Geneva, A Division of New York State College of Agriculture and Life Sciences, a Statutory College of the State University, at Cornell University, Ithaca

Risk Assessment of Grape Berry Moth and Guidelines for Management of the Eastern Grape Leafhopper

T. E. Martinson, C. J. Hoffman, T. J. Dennehy, J. S. Kamas, and T. Weigle

Department of Entomology, New York State Agricultural Experiment Station
Cornell University, Geneva, NY 14456 and
Cornell Cooperative Extension, Vineyard Laboratory, Fredonia, New York 14063

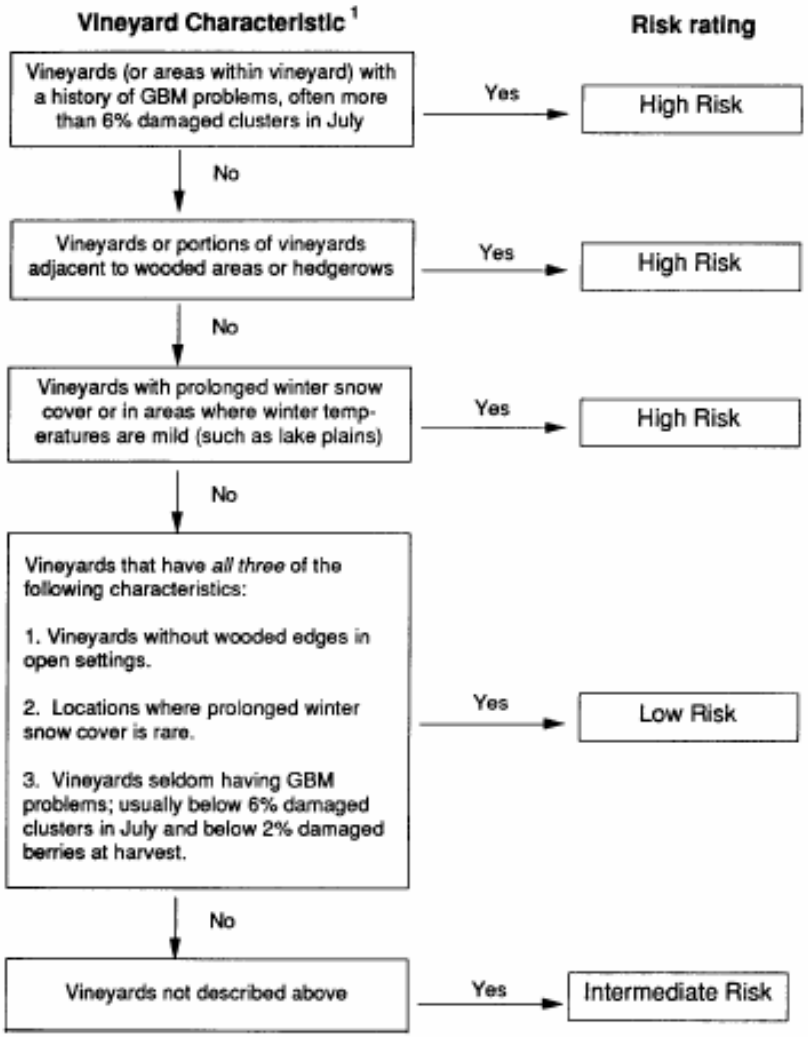
INTRODUCTION AND BACKGROUND

Several factors have prompted the reevaluation of control recommendations for key pests of grapes in recent years. First, the costs of insecticides and their application have risen substantially. Growers who improve the efficiency of their use of pesticides can realize significant savings in production costs. Second, grape processors have responded to consumer desires to minimize pesticide residues in food by promoting judicious use of pesticides. Finally, increased governmental restrictions regarding what pesticides can be used in vineyards and how they may be used may increase the overall difficulty that growers encounter when using pesticides. The result of these factors is that while producers and processors continue to require control of economically-damaging pests, this now must be achieved with the least amount of pesticide possible. The Grape Berry Moth Risk Assessment Program was developed to address these concerns. In this publication we describe how Risk Assessment can be used to maintain acceptable control of grape berry moth and the Eastern grape leafhopper while minimizing use of insecticides.

Grape berry moth (GBM), *Endopiza viteana*, is the most important pest of grapes in New York State. The larval stage of this small moth bores into grapes and feeds within developing berries. A long-standing recommendation for controlling grape berry moth was to apply three insecticide sprays, properly timed, to kill eggs and newly-hatched larvae before they bore into the fruit. Recent research on GBM ecology and control revealed that an estimated 50 percent of the insecticides used to control GBM could be eliminated by using the newly-developed GBM Risk Assessment Program. GBM Risk Assessment was first presented to growers in 1987 in the New York Food and Life Sciences Bulletin No. 120. Since 1987, this method of GBM control has undergone extensive testing in commercial vineyards throughout New York. Results of these vineyard trials are presented herein and demonstrate that, indeed, the Risk Assessment Program can provide the necessary control of GBM while substantially reducing insecticide use. Reducing insecticide use in vineyards has caused some growers to be concerned about the possibility that other pest problems might increase. They are concerned most about increases in damage caused by the Eastern grape leafhopper (*Erythroneura comes*). Research addressing this question, conducted in 1989 and 1990, showed that grape leafhoppers can easily be monitored and controlled. In this bulletin we summarize three years of implementation of the GBM Risk Assessment Program and present complementary guidelines for management of the Eastern grape leafhopper. Use of these methods will constitute another step taken by grape growers to move away from past practices of routine application of preventative insecticide treatments.

WHAT IS THE GRAPE BERRY MOTH RISK ASSESSMENT PROGRAM?

Risk Assessment for grape berry moth control is a method of classifying vineyard blocks based on factors that influence



[1] These risk categories apply to processing grapes, where the industry standard for acceptable GBM Damage is 2% damaged berries. Table grapes and premium wine grapes should always be classified as high-risk.

Figure 4. Classifying vineyards for risk of grape berry moth infestation.

Grape Berry Moth—Select four areas in the vineyard to be sampled: two in the center of the vineyard (1 and 2) and two on the edge of the vineyard (3 and 4). Visually inspect, at random, 10 clusters on each of five vines (a total of 50) in each of the four areas. Record the number of GBM-damaged clusters in each area. Compute separate totals for areas 1 and 2 (center) and 3 and 4 (edge) to determine the percent damaged clusters. For the July sampling date (low-risk and intermediate risk sites), treatment should be applied if the percentage of the clusters with damage exceeds six percent. For the August sampling date (high-risk vineyards), treatment should be applied if the percentage of damaged clusters exceeds 15 percent. See the IPM fact sheet #1 on Grape Berry Moth for photographs of damage.

Eastern Grape Leafhopper—First observe whether or not leaves have stippling damage. If stippling is present, the block should be sampled to estimate the number of leafhopper nymphs per leaf present. Counts should be made at the same 4 locations used for GBM counts. At each area, examine the undersides of the third through seventh leaves of one shoot (leaf one is the first leaf at the base of the shoot) on each of five vines. Divide the total number of leafhopper nymphs by 100 to compute the number of leafhoppers per leaf. If more than five nymphs per leaf in the third week in July or 10 nymphs per leaf in the fourth week in August are found, an insecticide treatment should be applied. See the IPM fact sheet #4 for photographs of leafhopper nymphs and damage.

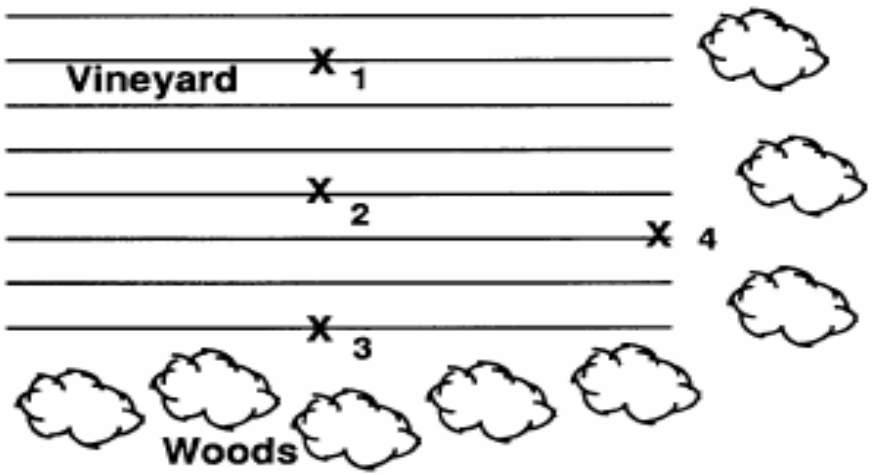


Figure 3. Sampling procedures for Grape Berry Moth and Eastern grape leafhopper.

LEAFHOPPER SCOUTING FORM

Site	Date
Variety	Scout

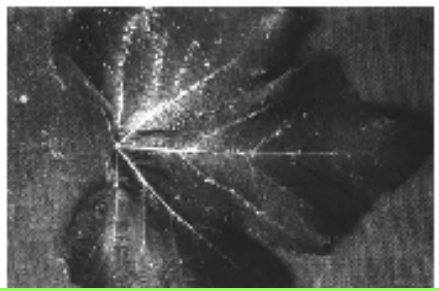
Inspect 5 leaves (leaves 3-7) on one shoot per vine. Record number of "damged" leaves on each shoot.

Site Number	Describe Site	Vine 1	Vine 2	Vine 3	Vine 4	Vine 5	Total
Site 1 (edge)							
Site 2 (edge)							
Site 3 (interior)							
Site 4 (interior)							

Average Damage	No. Damaged
Edge	
Interior	
Total	

DAMAGE THRESHOLD
3rd week July: average of 10% damaged leaves.

At each of the four grape berry moth sampling sites, randomly select one shoot from each of five vines. Examine five leaves per shoot, starting with the 3rd leaf from the base of the shoot. Compare each leaf sampled witht the photograph below. If the leaf has more injury than this photograph, classify the leaf as "damaged." Add up the total number of damaged leaves in each area to determine whether the damage threshold shown above has been exceeded.



http://www.nysipm.cornell.edu/publications/grapeman/hpprform.pdf

GRAPE BERRY MOTH SCOUTING FORM

Site	Date
Variety	Scout

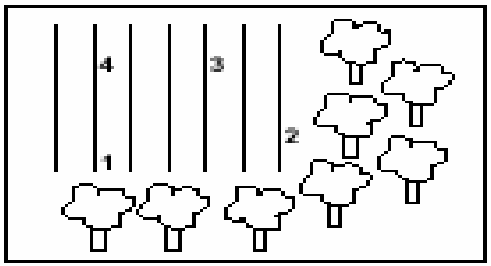
Inspect 10 Clusters per Vine for Damage

Site Number	Describe Site	Vine 1	Vine 2	Vine 3	Vine 4	Vine 5	Total
Site 1 (edge)							
Site 2 (edge)							
Site 3 (interior)							
Site 4 (interior)							

Average Damage	
Edge	
Interior	
Total	

DAMAGE THRESHOLD
3rd week July: 6% ave. damaged clusters
3rd week Aug: 15% ave. damaged clusters

Select 4 areas in each vineyard to be sampled: 2 on the vineyard edge, preferably a wooded edge (see 1 and 2 below), and 2 in the center (see 3 and 4 below). Visually inspect, at random, 10 clusters on each of 5 vines (a total of 50) in each of the 4 areas.



http://www.nysipm.cornell.edu/publications/grapeman/mothform.pdf

Table 3. Management Procedures for Grape Berry Moth and Eastern Grape Leafhopper.

GBM risk category	Recommended Sampling Times and Treatment Thresholds				Recommended Time to Spray[2]	
	Grape Berry Moth		Eastern Grape Leafhopper[1]		Grape Berry Moth	Eastern Grape Leafhopper
	Sampling	Threshold[1]	Sampling	Threshold		
High risk	•4th week of August	•15% damaged clusters	•4th week of August	•10 per leaf	•Ten days post bloom •Early August • BOS Late August	BOS Late August
Intermediate risk	•3rd week of July	•6% damaged clusters	•3rd week of July •4th week of August	•5 per leaf •10 per leaf	•10 days post-bloom •BOS Early August	•BOS Early August •BOS late August
Low risk	•3rd week of July	•6% damaged clusters	•10 days post-bloom •3rd week of July •4th week of August	•Stippling + adults •5 per leaf • 10 per leaf	•BOS Early August	•BOS 10 days post-bloom •BOS Early August •BOS Late August

1 An insecticide treatment is recommended if damage levels exceed the stated threshold. Consult Cornell Pest Management Recommendations for selection of appropriate insecticide.

2 BOS = Based On Sampling. BOS sprays are those made only when the results of sampling confirm that damage exceeds the stated threshold. Sampling often will demonstrate that a BOS treatment is not needed.

2008 NY-PA Guidelines

Table 4.2.1. Effectiveness of insecticides for management of grape insects and mites.

Material	Pests												
	BGB	*GBM*	*LH*	*GP*	*GCGL, JB*	*GCGR*	*GFB, CW*	*GE, RBLR*	*SB*	*SF*	*M*	*GR*	*RC*
*abamectin (*Agri-mek, *ABBA)	?	++	?	?	0?	0?	0?	?	0?	?	++	0?	0?
acetamiprid (Assail)	++	0	+++	++	++	?	?	?	?	?	0	?	+++
Bt (Dipel 2X)	0	++	0	0	0	0	0	0	0	0	0	0	0
bifenazate (Acramite)	0	0	0	0	0	0	0	0	0	0	+++	0	0
bifenthrin (*Capture)	?	+++	+++	?	+++	?	++?	++?	++?	?	?	?	++?
carbaryl (Sevin)	+++	+++	+++	0	+++	0	+++	+	+++	+++	0	+++	+++
*diazinon (*Diazinon)	?	0	++	0	0	0	0	0	0	0	0	0	0
dicofol (Kelthane)	0?	0	0	0	0	0	0	0	0	0	+++	0	0
*endosulfan (*Thionex)	?	?	++	+++	?	?	?	?	?	?	0	?	?
*fenbutatin-oxide (*Vendex)	0?	0	0	0	0	0	0	0	0	0	+++	0	0
*fenpropathrin (*Danitol)	+++	+++	+++	++	+++	?	++	++	++	?	?	?	++
indoxacarb (Avaunt)	?	++	+	?	++	?	?	?	?	?	0	?	?
insecticidal soap (M-Pede)	?	0	++	0	0	0	0	0	0	0	?	0	0
*imidacloprid (*Provado)	?	0	+++	++	0	0	0	0	0	0	0	0	0
*methomyl (*Lannate)	?	++	++	?	?	?	?	?	?	?	?	?	?
^methyoxyfenozide (^Intrepid)	0	+++	0	0	0	0	0	?	0	0	0	0	0
*phosmet (Imidan)	+++	+++	++	?	+++	+++	++	+++	++	+	0	?	++
Zeal Miticide1 (etoxazole)	0	0	0	0	0	0	0	0	0	0	+++	0	0

Key to pests:

GBM	grape berry moth
GP	grape phylloxera
GCGL	grape cane gallmaker
CW	cutworms
GFB	grape flea beetle
SF	8 spotted forester
M	mites
RC	rose chafer
LH	leafhoppers
JB	Japanese beetle
GCGR	grape cane girdler
RBLR	redbanded leafroller
SB	steely beetle
GE	grapevine epimenis
GR	grape rootworm
BGB	banded grape bug

Key to ratings:

+++	highly effective
++	moderately effective
+	slightly effective effective or not labe
0	not
?	effectiveness not known

High Quality Wine

starts with

High Quality Grapes

Thank you


The
UNIVERSITY
of VERMONT


Risk Management
RMA
For The 21st Century
Risk
Management
Agency
United States
Department of
Agriculture

Announcement
NEW EPA-Funded Project

Focus:

- **Ecologically-Based IPM**
- **Reducing Pesticide Risks in Cold Climate Winegrape Production**

Resources for Presentation

- http://ohioline.osu.edu/b919/index.html
- http://www.nysipm.cornell.edu/factsheets/grapes/
- http://www.nysaes.cornell.edu/pubs/fls/OCRPDF/138a.pdf
- http://grapes.msu.edu/pesticideResist.htm
- http://ipmguidelines.org/grapes/
- http://pss.uvm.edu/grape/IPM/AnInitialIPMStrategy.pdf
- http://pss.uvm.edu/grape/IPM/