Management of Key Vineyard Pests

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MSU Extension, Berrien County

Sources: E154, Fruit Mgmt Guide 2016
Management of Key Vineyard Pests

• Insect pest life cycles, damage, recommended management

• Disease life cycles, damage, recommended management
Verbage

- Residual
- Contact material
- Ingestion material
- Systemic material
- Scouting
- Cultural control

- Primary Inoculum
- Secondary Inoculum
Insect Pests

- Spring bud feeders:
  - Flea beetles
  - Climbing cutworm
Insect Pests

• Spring bud feeders:
  • Flea beetles
  • Climbing cutworm

• Leaf feeders:
  • Leafhoppers
  • Japanese Beetle
Insect Pests

- Spring bud feeders:
  - Flea beetles
  - Climbing cutworms
- Leaf feeders:
  - Leahoppers
  - Japanese Beetle
- Grape Berry Moth
Insect Pests

- Spring bud feeders:
  - Flea beetles
  - Climbing cutworm
- Leaf feeders:
  - Leafhopper
  - Japanese Beetle
- Grape Berry Moth
- Mealybug
- Phylloxera
Classes of Insecticides

• “Reduced-risk”
  • longer residual
  • ingestion poisons
  • specific

• “Broad-Spectrum”
  • =“Conventional”
  • shorter residual
  • contact poisons
  • kill everything
Classes of Insecticides

- “Reduced-risk”
  - Delegate, SpinTor, Entrust
  - Intrepid
  - Altacor, Belt
  - Dipel (B.T.)
  - Agri-Mek
  - Oberon, Movento

- Broad-spectrum
  - Lorsban, Imidan
  - Danitol, Mustang Max, etc.
  - Lannate, Sevin

- In Between
  - Neonicotinoids
What is “reduced risk?”

• “Risk” refers to…
  • Applicator, consumer, and neighbor health risks
  • Non-target critters
    • Bees
    • Predatory insects
    • Predatory mites
    • Parasitoids

• Official “Reduced Risk” EPA designation for some materials.
  • Often, these are ingestion poisons rather than contact poisons.
    • More thorough coverage needed,
    • More precise timing needed
Bud Feeders

- Feeds from bud swell to 2-5 inch shoots
- Scouting: brown/black, hollowed out buds.
- Can result in serious damage!

(S. Van Timmermen, MSU)
Bud Feeders

• Flea beetle on clay soils
• Cutworm on sandy soils
• Cultural control:
  – Leave extra buds
    • (+ frost protection)
  – Clean understory
  – >4% buds: poison

(D. Pfieffer, V. Tech)
Cultural control: Sanitation

No place for flea beetle to emerge from!
Insecticides for Bud Feeders

- **Flea Beetle**
  - Pyrethroids
    - Gladiator
    - Brigade
    - Brigadier
    - Danitol
    - Hero
    - Baythroid
    - Mustang Max
  - Sevin

- **Climbing Cutworm**
  - Excellent control
    - Pyrethroids: Gladiator, Brigade, Danitol, Hero, Baythroid, Mustang Max
    - Lorsban
  - Good control
    - Oberon*
    - Delegate*
    - Altacor*
The Leafhoppers

- do not overwinter in Michigan
- Adults come in on storm fronts from the Gulf in May or June
- Summer leaf feeding
Leafhopper damage

• During an infestation:
  • clouds of them jump up from the grass when disturbed.

• Leaf damage: stippling on leaf surface, to yellow or rust colored.
Insecticides for Leafhoppers

• Excellent Control
  • Belay, Scorpion*, Venom, Leverage, Agriflex
  • Baythroid

• Good Control
  • Lannate, Sevin
  • Brigade, Danitol, Mustang Max
  • Gladiator

• Soil-applied, 6-12” shoot:
  • Admire Pro*
  • Platinum
  • Venom

• Note: generally a nuisance pest when present, sprays seldom needed.
Japanese Beetle

- Grubs underground in sod, pasture, turf environments
- Adults emerge Jun/Jul, migrate into vineyards
- Traps: NOT RECOMMENDED

Jeff Hahn, U-MN
Insecticides for Japanese Beetle

• Good Control:
  • Altacor*
  • Avaunt*
  • Neonicotinoids: Provado*, Actara*, Assail*, Belay
  • Pyrethroids: Brigade, Danitol, Baythroid, Mustang Max, Hero
  • Imidan
  • Sevin

• Excellent Control:
  • Scorpion* (Neonic)

• JB tend to clump in small areas, usually spot-spraying is what’s needed.
A note on leaf-feeders...

• Looks ugly?
  • May be harming yield, quality, growth, or hardiness
  • But not always!

• Leafhoppers: Mild damage -> no impact on fruit quality...

• JB 15% leaf loss or more
Grape Berry Moth
Grape Berry Moth

1st generation
Grape Berry Moth

1st generation

2nd generation
Grape Berry Moth

pupae in leaf litter – in vineyard and neighboring woodlands

1st generation
2nd generation
3rd generation
4th generation?
Grape Berry Moth

- **Scouting**
  - flat, white eggs on clusters
  - characteristic wounds and webbing in clusters
  - infested red grapes will get color early in the season

- **Infestation worse on borders**

(Rufus Isaacs, MSU)
Grape Berry Moth

- Sprays: timing and location of sprays are everything.
Grape Berry Moth: Many poisons that work well...

Excellent Control:
- Intrepid*
- Altacor* and Belt*
- Imidan
- Sevin
- Danitol, Hero, Gladiator

Good Control:
- BT toxin*
- Entrust*
- Avaunt*
- Neonics: Belay, Scorpion*, Venom
- Oberon*
- Spinosyns: Delegate,* SpinTor*
- Lannate
- Pyrethroids: Mustang Max, Leverage, Baythroid, Brigade
Grape Berry Moth: Spray Timing

Why is timing so important?
Grape Berry Moth: Spray Timing

- Broad spectrum contact poisons:
  - Sevin
  - Imidan
  - Danitol
  - SHORT residual, spray on larvae directly

- Reduced risk ingestion poisons:
  - Altacor
  - Belt
  - Intrepid
  - Dipel
  - Entrust
  - LONG residual, spray on leaf surface BEFORE larvae hatch
What is a “Growing Degree Day?”
Grape Berry Moth: Spray Timing

- That’s why we suggest Growing Degree Day model.
How can I track berry moth degree days?

Tools for: Field crops | Fruit | Trees | Turfgrass | Vegetables | Landscape & Nursery | More weather

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East Lansing (MSUHort), Michigan

Latest observations at East Lansing (MSUHort)
12/04/2014 03:00 PM (Station online). Measurements by 5-minute average or total unless otherwise indicated.

- 30.6°F Air temperature
- 0.0 in. Rainfall (12/04/2014)
- 43.5% Relative Humidity
- 11.0°F Dewpoint
- E Wind Direction (hourly average)
- 3.6 mi/hr Windspeed
- 0% Percent of last full hour wet - leaf wetness (tripod-mount)

Weather observations and summaries
- Overnight temperatures/ hours below freezing
- Rainfall comparisons for Region
- Temperature, rainfall and degree-day summary
- Rainfall comparisons last 5 years at this station
- Soil conditions
- More weather for this station

Degree-day tools
- Current degree day maps
- Degree Day accumulations for Region
- Degree Day accumulations for Region (alfalfa and corn development)
- Average degree day summary
- Degree day comparisons: Compare 2 sensors
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- Average degree day summary
- Degree day comparisons: Compare 2 sensors
- Degree day comparisons: last 5 years at this station

Weather Station at East Lansing (MSUHort)
Thanks to our station sponsors:
We estimated 810 GDD around July 2\textsuperscript{nd}. 910 GDD July 6\textsuperscript{th} or 7\textsuperscript{th}

- Spray Belt, Altacor, Delegate, or Intrepid as close to July 2\textsuperscript{nd} (810 GDD) as possible!
- Spray Sevin, Imidan, Danitol (or other Pyrethroids) at July 6 or 7 (910 GDD).
Grape Berry Moth: Points to Remember

1. Scout vineyards to determine the level and distribution of GBM. Focus in regions with higher pressure (near woodlots)

2. If cluster protection needed, time sprays to **prevent larval entry**.

3. Sprayers must get excellent *cluster* coverage.
   - pruning to keep canopy open
   - increase water volume through season
   - spray every row

4. Select insecticides based on:
   - activity spectrum
   - residual control
   - resistance management

5. Beware of late-season pest pressure starting at veraison.
A note on spray equipment...

- Good coverage matters for:
  - reduced-risk insecticide applications
  - consistent disease control – reduce # of sprays needed
- Early season: not much foliage, kick it up a notch and skip rows.
- As canopy fills in:
  - Slow down
  - Spray every row
Grape Mealybug and Leafroll virus

- In vinifera winegrapes
- Numerous infestations detected 2014 in Michigan
- Vector the grape leafroll virus
- Virus causing vine decline in some vineyards
- Grape leafroll virus
  - White varieties: leaf curl
  - Red varieties: leaf curl plus early senescence
Grape Mealybug and Leafroll virus

• Prevent spread of virus:
  • Chemical option for mealybug
  • Movento

• Source new vines from virus-tested suppliers
Grape Mealybug and Leafroll Virus

- Prevent spread of *mealybug*:
  - moves on machinery, harvested grapes, people
  - SW Michigan wineries, growers doing custom harvest, etc: *practice sanitation*
• Confused yet?

• Available at your local MSU Extension office

• Also online:
  • shop.msu.edu
  • Extension Bookstore tab off on the right
Disease Management

- Powdery Mildew
- Downy Mildew
- Black Rot
- Phomopsis
- Anthracnose
- Botrytis
Types of Fungicides

• Protectants
  • On surface of plant - kill fungal spores as they germinate, therefore:
    • Preventative only
  • Kill by poisoning several sites in fungus, therefore:
    • Less likely for resistance to develop

• Systemics
  • Absorbed into plant and kill fungus as it penetrates the plant.
  • Generally a single-mode poison:
    • resistance more likely
Modes of Action

FRAC code:
Fungicide Resistance Action Committee

- Rotate FRAC codes throughout the season!
- Especially with systemic fungicides
Cultural Control!

- Air
- Sunlight
- On leaves
- On clusters
- With pruning!

- Resistant varieties! (when marketing permits)
- See Fruit Management Guide for big list
Powdery Mildew

- On leaves:
  - Looks like a white powder on the top of the leaf.
Powdery Mildew

- On fruit:
  - Powdery only at first
  - Eventual
discoloring, berry cracking
Powdery Mildew

- Overwinters on bark
- **Primary** spores from *bud break to bloom*, 0.1” rain and >50°F
- After initial infection
Powdery Mildew

- Lives on surface of plant parts, injects haustoria into plant.
Powdery Mildew

- **Most susceptible varieties:**
  - Most *vinifera* fall into this category.
  - **Hybrids:** Chardonel, Vidal Blanc, Vignoles

- **Least susceptible varieties:**
  - Cayuga White, Chambourcin, Corot Noir, Noiret, Traminette, Marquette

Everything else: Moderately susceptible.
Powdery Mildew

• Most important time to cover fruit:
  – Pre-bloom, until
  – 2–4 wks later
    • depending on var.

• Cover leaves afterwards:
  – For sugar, esp.
Powdery Mildew

Most effective materials:

- **Endura (7)**
- **JMS Stylet Oil**
- **Bayleton**
- **Elite**
- **Mettle**
- **Procure/Viticure**
- **Rally**

- **Flint**
- **Sovran**
- **Pristine (11 & 7)**
- **Inspire Super (3 & 9)**
- **Luna Experience (3 & 7)**
- **Quadris Top (3 & 11)**
- **Quintec (13)**
- **Topsin M (1)**
- **Torino**
- **Vivando**
- **Revus**
Downy Mildew

- On leaves:
  - Orange/brown oil spots on top side
  - White, "downy" areas on underside of leaf
Downy Mildew

- On fruit:
  - White downy sporulation on berry
- Primary inoculum:
  - Infected leaves on vineyard floor
Downy Mildew

- Overwinters on leaves / soil surface
- Primary infections:
  - 2-3 weeks before bloom
  - Rain splash required for infection: saturated soil surface
- Secondary infections: warm wet nights
How to get downed by downy mildew:

• Scout from truck or tractor or don’t scout at all
• Let the disease get established
• Use ineffective materials or at too low a rate
• Grow a humongous canopy
• Poor fungicide coverage
Downy Mildew

• **Most effective materials:**
  - Protectants
    - Captan (protectant only, M4)
    - Manzate, Koverall, etc.
  - Copper products (M1)

  **Systemics**
  - Abound
  - Sovran
  - Tanos (11 & 27)
  - Pristine (11 & 7)
  - Quadris Top (11 & 3)

• **Phosphonates**
  - Agri-Fos
  - Aliette
  - Phostrol
  - Prophyt

• **Ridomil products**

• **Special systemics for downy:**
  - Zampro (40 & 45)
  - Revus (40)
  - Revus Top (40 & 3)
  - *Presidio*
Black Rot

- On leaves:
  - Light brown, roughly circular spots
  - Ring of fruiting bodies as they mature: *secondary*
Black Rot

• On fruit:
  - Starts as small whitish spot
  - Brown spot expands outwards.
  - Berries shrivel to mummies: primary inoculum

• Also forms shoot lesions
Black Rot

- Overwinters in mummy berries on vineyard floor
- Primary spores emerge from 6” shoot until just after bloom
- Berries susceptible from beginning of bloom until 3-5 weeks later
Black Rot

• **Protectants:**
  - Manzate, Koverall, etc.

• **Systemics:**
  - Abound
  - Flint
  - Pristine
  - Sovran
  - Inspire Super (3 & 9)
  - Luna Experience (3 & 7)
  - Quadris Top (3 & 11)
  - Revus Top (3 & 40)

• **Mild activity:**
  - Copper
  - Phosphonates
  - Revus
  - Ridomil

• NOT Sulfur
Phomopsis

- On leaves:
  - Puckered, brown spots usually with yellow surrounding

- On shoots:
  - Lesions:
Phomopsis

- On fruit:
  - Usually rachis is infected
  - Berries go brown and shrivel
Phomopsis

- **Protectants:**
  - Captan
  - Manzate, Koverall, etc.

- **Systemics:**
  - Abound
  - Flint
  - Sovran

Phosphonates:
- Agri-Fos
- Phostrol
- Prophyt
- Gavel

Luna Experience
Pristine
Sour Rot

- Smells and tastes of vinegar
- Usually fruit flies present
- Caused by group of yeasts and fungi vectored by the flies – no single causative agent
- No visible
Sour Rot

- Risk factors:
  - tight-clustered varieties
  - wet clusters after veraison
  - rainfall
  - thick canopy
  - wounds: birds, insects, powdery mildew
Sour Rot

- Chemical options:
  - Not a fungus! Fungicides won’t help
  - Biologicals as protectants: for example, Serenade

- Broad spectrum insecticides when fruit flies appear
Botrytis Fruit Rot

- On fruit only
- Primary inoculum is ubiquitous
- Infection occurs late
- Ants instead of fruit flies.
- Does not smell of vinegar
- Fuzzy
Botrytis Fruit Rot

- Risk factors:
  - tight-clustered varieties
  - wet clusters after veraison
  - thick canopy
  - wounds: birds, insects, powdery mildew
  - excessive Nitrogen
Botrytis Fruit Rot

Most susceptible varieties:

- vinifera: Chardonnay, Chelois, Gewurtztraminer, Pinot Meunier, Pinot Noir, Riesling, Sauvignon blanc
- French hybrids: Seyval, Vignoles super hardy: La Seyval

Gewurtz

Seyval
Botrytis Fruit Rot

- **Most resistant varieties:**
  - juice grapes: Concord and Niagara both resistant.
  - French hybrids: Foch, Vidal Blanc
  - Cornell hybrids: Cayuga white, Arandell, Aromella, Corot Noir, Noiret
  - Minnesota hybrids: Marquette
  - *vinifera:* Cabernet Franc, Cabernet Sauvignon, Blaufrankische
Botrytis Fruit Rot

• Most effective materials:
  Group 7
  - Endura
  - Luna Experience
  Group 9
  - Inspire Super
  - Scala
  - Switch
  - Vanguard
  Elevate

• Infections possible from bloom onwards

• Most important to cover after a rain post-veraison
Botrytis AND Sour Rot

• Cultural management:
  - air flow and sunlight penetration
  • prune harder
  • on VSP, timely shoot-tucking and hedging
  • leaf removal in fruiting zone

= site selection / variety
Disease Management in the Dormant Period: Where is the inoculum?

- Powdery Mildew (leaves and soil)
- Downy Mildew (leaves and soil)
- Black Rot (mummies)
- Phomopsis (cane base lesions)
Anthracnose

(all infected parts)

Sour rots: everywhere

Botrytis: everywhere
Disease Management in Dormant Period

• Dormant sprays
  – Lime sulfur (M2)
  – Sulfur (M2)
  – Copper (M1)

• After leaf fall
• and/or before bud break
• See p.50 of Fruit Management Guide 2016
• “Fruit fungicides that have a shared mode of action”
Table 3. Fruit fungicides that have a shared mode of action (biocontrol agents and antibiotics not included).

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Fungicide Group</th>
<th>Multisite Protectant Fungicides</th>
<th>Systemic Fungicides</th>
<th>Mixtures</th>
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<td>Ziram</td>
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</tbody>
</table>

*AP=Anthranilamides; B=Benomyl; C=Chloronitro; CAA=Carboxylic acid amides; CX=Carboxamides; D=Dicarboxamides; DC=Dithiocarbamates; ES=Ethioyl ethiothiocarbamates; G=Guanidines; HA=Hydroxyanilides; I=Phaniketones; MBC=Methyl benzimidazole carbamates; P=Phenylamides; PH=Phosphonates; PP=Phenylpyridines; PT=Phthalimides; Q=Quinoline; S=Sulfonylurea; SI=Sterol inhibitors; U=unclassified.
## Grapevine growth stages

<table>
<thead>
<tr>
<th>Vegetative growth</th>
<th>Dormant</th>
<th>Early bud swell</th>
<th>Late bud swell</th>
<th>Bud burst</th>
<th>1- to 3-inch shoots</th>
<th>4- to 8-inch shoots</th>
<th>10- to 16-inch shoots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bud closed. No visible indication of growth.</td>
<td>The bud is visibly swollen, brown and fuzzy. No green or pink tissue is visible yet.</td>
<td>The bud has elongated and green or pink leaf tissue is visible though bud is still closed.</td>
<td>The leaves have separated at the tip, usually exposing the growing point.</td>
<td>The shoot is 1-3 inches (2.5-7.5 cm) long with 1-3 small leaves at right angles to the stem.</td>
<td>Shoots are 4-8 inches (10-20 cm) long with 3-6 leaves. Flower clusters are exposed.</td>
<td>Shoots are 10-16 inches (25-40 cm long). Flower clusters are clearly visible.</td>
<td></td>
</tr>
</tbody>
</table>
## Grapevine growth stages

<table>
<thead>
<tr>
<th>Reproductive growth</th>
<th>Immediate prebloom</th>
<th>First bloom</th>
<th>Full bloom</th>
<th>Buckshot berries</th>
<th>Berry touch/bunch closure</th>
<th>Veraison</th>
<th>Ripe for harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caps are still attached. No flowers are visible.</td>
<td>First flowers open, caps are falling off.</td>
<td>Most of the flowers are open.</td>
<td>Berries are the size of buckshot pellets.</td>
<td>Berries touch and cluster is starting to close.</td>
<td>Berries soften and change color as they begin to ripen.</td>
<td>Berries are soft and ripe with high sugar content.</td>
<td></td>
</tr>
</tbody>
</table>
## Bud Break

<table>
<thead>
<tr>
<th>Phenology</th>
<th>Pests</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bud Break</td>
<td>Climbing Cutworm</td>
<td>Pyrethroids: Danitol, etc Lorsban</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grape Flea Beetle</td>
<td>Sevin Pyrethroids: Danitol, Baythroid, etc Delegate*, Oberon*, Altacor*</td>
</tr>
</tbody>
</table>

* (Longstroth)
Shoot Growth

• Main Early Problem is Disease
• Scout for black rot, powdery mildew, and phomopsis symptoms
  • symptoms = secondary inoculum
• Spray to protect shoot growth
  • Group 11 or Group 3 work well against all 3
  • (e.g. Flint, Sovran, Bayleton, Rally)
  • More commonly used: Group M3 (Manzate, Koverall)
• More rain = sprays more critical

(Longstroth)
Bloom Time!

• Most important time for disease control.
• All diseases are active and controls are needed.
• Insecticides also used if insects are feeding on bloom and young berries.
• Bloom and post bloom sprays!!
## Infection Risk (Michigan)

<table>
<thead>
<tr>
<th></th>
<th>1-3” shoot</th>
<th>5-8” shoot</th>
<th>10-16” shoot</th>
<th>pre-bloom</th>
<th>buck-shot berry</th>
<th>bunch closure</th>
<th>veraison</th>
<th>pre-harvest</th>
<th>post harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phomopsis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Black Rot</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Powdery Mildew</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Downy Mildew</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Bloom
- leaf
- rachis
- berry

The table and diagram illustrate the infection periods for various fungi during different stages of the grapevine's growth.
Grape diseases through the season

DORMANT SPRAYS

Phomopsis → Anthracnose → Black rot → Powdery mildew → Downy mildew → Botrytis

Bud swell → Shoot growth → Bloom → Fruit set → Berry-touch → Veraison → Harvest
### Post Bloom

<table>
<thead>
<tr>
<th>1st Cover - (Post-bloom) 2 weeks after prebloom spray</th>
<th>Grape Berry Moth: GDD 810 &amp; 1620</th>
<th>Intrepid, Altacor, Belt, Imidan, Sevin, Danitol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grape Leafhopper (if needed)</td>
<td></td>
<td>Neonics, Pyrethroids</td>
</tr>
</tbody>
</table>
Late season

- Ripening fruit become resistant to **Black Rot** and **Powdery Mildew**

- **Downy mildew** comes. Especially in wet, dewy condition

- Scout and protect!
### After veraison, before harvest

<table>
<thead>
<tr>
<th>After veraison</th>
<th>MALB, wasps, fruit flies (if needed)</th>
<th>Pyrethroid, Sevin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sour Rot</strong></td>
<td>(some varieties)</td>
<td>Serenade</td>
</tr>
<tr>
<td><strong>Botrytis</strong></td>
<td>(some varieties)</td>
<td>Switch, Vanguard, Scala (9), Endura (7)</td>
</tr>
</tbody>
</table>

(Longstroth)
MSU In-season Resources for grape pest management,

- Weekly to bi-weekly scouting reports by MSU research and extension:
  - grapes.msu.edu
  - grape email digest
MSU In-season Resources for grape pest management, 2015

• In-season grape grower meetings.

• In-season scouting meetings in Coloma.