New Insecticides and Their Fit for Michigan Grape Growers

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Overview

- **Introduction**
  - Forces of change
  - Trends in new insecticide development

- **Major new classes of insecticides**
  - Modes of action
  - Performance against key insect pests
  - Potential fit in grape IPM programs

- **Future directions**
Forces of change

- Public concern about pesticide exposure and pesticides in the environment.

- Food Quality Protection Act
  - Tolerance reassessments by US-EPA
  - Penncap-M, Guthion, Lannate...

- New insecticide options
  - Selective insecticides, biopesticides, pyrethroids, pre-mixes

- Insecticide resistance?
Insecticide resistance

Nagarkatti et al. (2001). Carbaryl resistance in populations of grape berry moth (Lepidoptera: Tortricidae) in New York and Pennsylvania. Journal of Economic Entomology vol. 95

Commercial populations had 7 to 71-fold higher LC$_{50}$ than the susceptible population from wild grape.
Trends in new insecticides

• Reduced time from discovery to marketing

• Generally more pest specific, but some have breadth

• Some ‘gaps’ being filled by older products registered for grape

• Broad activity achieved through pre-mixes

• Prices declining for some new insecticides
Major grape insect pest groups
Leafhopper pests

Grape leafhopper

Mobile adults, less mobile nymphs
Feed on leaf tissue
On undersides of leaves
   GLH inside canopy
   PLH on new growth
High damage can reduce fruit quality and vine growth
Temperature drives # gen’s.

Potato leafhopper

Three banded leafhopper

Grape phylloxera
(not a leafhopper!)

DON’T SPREAD PHYLLOXERA
Neonicotinoid insecticides for grape protection

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Company</th>
<th>Description</th>
<th>Solubility g/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>imidaclorid. Bayer.</td>
<td>Bayer</td>
<td>Provado: foliar insecticide - leafhoppers, beetles, mealybug.</td>
<td>0.51</td>
</tr>
<tr>
<td>Admire Pro 4.6F.</td>
<td>Bayer</td>
<td>Admire Pro 4.6F: soil insecticide - scale, mealybug, and phylloxera.</td>
<td></td>
</tr>
<tr>
<td>acetamiprid. UPI.</td>
<td>UPI</td>
<td>Assail: foliar insecticide - leafhopper, rosechafer, Japanese beetle, phylloxera.</td>
<td>4.25</td>
</tr>
<tr>
<td>thiamethoxam. Syngenta.</td>
<td>Syngenta</td>
<td>Actara: foliar formulation - leafhoppers, beetles.</td>
<td>4.1</td>
</tr>
<tr>
<td>Platinum.</td>
<td>Syngenta</td>
<td>Platinum: Soil formulation active on leafhoppers, beetles.</td>
<td></td>
</tr>
<tr>
<td>clothianidin. Valent.</td>
<td>Valent</td>
<td>Belay: leafhoppers, beetles, berry moth, mealybugs. Foliar and soil application.</td>
<td>0.33</td>
</tr>
<tr>
<td>dinotefuran. Valent, Gowan.</td>
<td>Valent, Gowan</td>
<td>Venom/Scorpion foliar for leafhoppers, GBM, and multicolored Asian ladybeetles</td>
<td>39.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Venom/Scorpion soil for mealybug, leafhoppers, thrips</td>
<td></td>
</tr>
</tbody>
</table>
Systemic movement within vines

Sample of Translaminar Movement

Scorpion moves throughout leaf

Foliar application

Soil application

Absorption by root cells

xylem vessel
Effect of chemigated neonicotinoids on PLH

Chemigation of young hybrid vines with insecticides

June 6 application

8-10 inch shoots
    Admire, Platinum, Belay

Measured PLH per leaf for one month after application

2006 trial
Full Systemic Activity

Application site

Phloem
Acropetal and basipetal transport

Xylem
Acropetal transport

Artificial infestation of aphids controlled 3d after application

Example

Movento
Two-way systemic

spirotetramat
New chemical class: tetramic acids
Movento provides excellent phylloxera control

- Treatments to a phylloxera-infested Rougeon vineyard in 2009

- Comparison of
  Assail 30SG at 2.5 oz/ac (July 5)
  Movento 240SC* at 6 oz/ac 1x (July 5)
  Movento 240SC* at 6 oz/ac 2x (+Aug 6)
  *plus non-ionic surfactant

- All treatments worked well in Year 1

- Maintained control in Year 2.

- 1% stylet oil works as surfactant on grapes
Movento for grape tumid gallmaker

- This fly is a sporadic pest of grapevines.
- Cluster damage can reduce yield in susceptible cultivars.
- Movento @ 6-8 oz/acre is a new control option.
- Early application at first sign, use a penetrating oil (stylet oil)
Beetle pests

Mobile insects

- Often most abundant at borders
- Active outside of vines
- Most are easily reached by sprays
- Feed on leaf and fruit surface
- One generation a year

- Rosechafer
- Japanese beetle
- Multicolored Asian ladybeetle
- Grape flea beetle
- Grape cane gallmaker
- Grape cane girdler
- Grape rootworm
7 vine plots @ TNRC

Five foliar insecticides
   Danitol
   Imidan
   Clutch (Belay)
   Actara
   Warrior

Applications:
   July 5 for all treatments

Assessments:
   1, 7, 14 days after treatment
Residual activity of insecticides on Japanese beetle

2003 JB Grape Efficacy, TNRC (P= .05, LSD)
Japanese beetle control, 2010

Applications on July 7 to 7-vine plots of Niagara grape

Beetles per 2 min count

Leaf feeding
Moth pests

Larvae cause damage to buds, fruit, leaves, and roots

Molt through instars from egg to pupa

Monitor for some moths to predict egglaying and larvae

Invasive species?
Pre-bloom Lorsban for GBM control? This is NOT effective

Four commercial SW Michigan vineyards

No Lorsban (control) vs. Lorsban 4E @ 32 oz/acre in late May

**MOTHS IN TRAPS**

- **Border**
  - Comparison
  - Lorsban

- **Interior**
  - Comparison
  - Lorsban
Delegate: spinetoram

• New active ingredient

• A spinosyn class insecticide, replacing SpinTor

• A mixture of 2 spinosyns which are chemically modified to increase potency, residual and translaminar movement

• Active by ingestion and contact
Intrepid: methoxyfenozide

Mimic of insect molting hormone, 20-hydroxyecdysone

- 8-12 oz per acre, with spreader-sticker
- 14 + days of control
- Minimum of 40 gallons per acre
  - coverage, coverage, coverage
  - control through ingestion
- Best fit for later applications
  - bunch closing

*Trademark of Dow AgroSciences LLC*
Degree-day timings improved GBM control, 2009

Degree-day timings improved GBM control, 2009

<table>
<thead>
<tr>
<th>GBM from 50 infested berries</th>
<th>Cost per acre</th>
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<tbody>
<tr>
<td>47</td>
<td>$0</td>
</tr>
<tr>
<td>22</td>
<td>$53.36</td>
</tr>
<tr>
<td>15</td>
<td>$45.25</td>
</tr>
<tr>
<td>12</td>
<td>$30.32</td>
</tr>
<tr>
<td>7</td>
<td>$39.90</td>
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</table>
A new target site for insect control

Central/Peripheral Nerve

Organophosphates
Carbamates

Neonicotinoids
Naturalytes

Mitochondrial insecticides

Motor Nerve

AChE Acetylcholine receptors

GABA receptors

Chlorine channels

Pyrethroids
Indoxacarb

Cyclodienes
Fipronil

Mitochondria

Muscle Fiber

Ryanodine Receptors

Rynaxypyr™
Rynaxypyr mode of action

- Muscle paralysis
- Rapid feeding cessation
- Death within ~ 72 hours
• Surface residual active foliar insecticide
• Active on insects through contact and ingestion
• Rapid cessation of feeding
• Active Ingredient – Flubendiamide
• Chemical Class - Phthalic Acid Diamide
• Mode of Action
  – Disruption of cellular calcium balance, (Ryanodine Receptor)
• Active against moth pests
Grape Berry Moth control

Unt = # Clusters Infested / 100
Sevin/Intrepid/Imidan
Sevin/Brigade/Mustang
Belt 4 oz
Ryn / thia 3.6 oz flexi equiv
Altacor 2 oz + Induce
Alverde 16oz + LI700

% Control

One spray per GBM
Generation = 3 Sprays
On-farm evaluation of IPM Program incorporating GBM model, new insecticides, and border sprays 2009-2011

- Four (2009) and five (2010, 2011) farms, 2 x 3-5 acre vineyards
- Growers Standard program vs. IPM program

<table>
<thead>
<tr>
<th>TIMING</th>
<th>STANDARD Applied to whole vineyard</th>
<th>IPM* Mid- and Late sprays to border only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post bloom</td>
<td>Brigade 2EC 3.2 oz</td>
<td>Brigadier 5.1 oz</td>
</tr>
<tr>
<td>Mid-season</td>
<td>Sevin XLR 64 oz 910 GDD</td>
<td>Intrepid 8 oz 810 GDD</td>
</tr>
<tr>
<td>Late-season</td>
<td>Imdidan 2 lb 1720 GDD</td>
<td>Altacor 3 oz 1620 GDD</td>
</tr>
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*Two growers used Assail 30WG for leafhopper/Japanese beetle control in July 2009
Accurate timing + effective sprays = improved GBM control

**BORDER**

- **Avg. cost/acre**
  - Standard: $51.24
  - IPM: $32.68

**INTERIOR**

- **Avg. cost/acre**
  - Standard: $51.24
  - IPM: $32.68
So what? Does GBM reduce yield?

Sampling at harvest from 15 vineyards

Weighed berries that were healthy, and infested with GBM.

Use clusters per vine and berries per cluster values to estimate yield.

Negative correlation between infestation and yield:
   60% infestation = 1 ton lost
# Grape insecticides and their activity profiles

<table>
<thead>
<tr>
<th>INSECT GROWTH REGULATORS</th>
<th>ORGANOPHOSPHATE</th>
</tr>
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<tbody>
<tr>
<td>Intrepid, Confirm</td>
<td>Imidan</td>
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<table>
<thead>
<tr>
<th>SPINOSYNS</th>
<th>CARBAMATE</th>
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<tbody>
<tr>
<td>Delegate, SpinTor</td>
<td>Sevin</td>
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<table>
<thead>
<tr>
<th>DIAMIDES (RYANODINE)</th>
<th>PYRETHROIDS</th>
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<tbody>
<tr>
<td>Altacor, Belt</td>
<td>Baythroid</td>
</tr>
<tr>
<td></td>
<td>Brigade</td>
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<tr>
<td></td>
<td>Mustang Max</td>
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<tr>
<td></td>
<td>Danitol</td>
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<tr>
<th>OXADIAZINE</th>
<th>MIXTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avaunt</td>
<td>Voliam Flexi</td>
</tr>
<tr>
<td></td>
<td>(CTPR &amp; thiamethoxam)</td>
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<tr>
<th>NEONICOTINOIDs</th>
<th></th>
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<tr>
<td>Provado, Assail, Belay, Venom, Scorpion</td>
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<thead>
<tr>
<th>TETRAMIC ACID</th>
<th></th>
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<tbody>
<tr>
<td>Movento</td>
<td></td>
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<tr>
<td>Phylloxera, gallmaker</td>
<td></td>
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<table>
<thead>
<tr>
<th>M.E.T.I. (not yet registered)</th>
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<tbody>
<tr>
<td>Tolfen</td>
<td></td>
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<table>
<thead>
<tr>
<th>BIOLOGICALS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B.t.’s: Dipel, Javelin, etc.</td>
<td></td>
</tr>
<tr>
<td>Neem: Ecozin, Neemix, etc.</td>
<td></td>
</tr>
<tr>
<td>Pyrethrums: Evergreen, Pyganic, etc.</td>
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# References

- Michigan State University
# Grape insect control program (focus on GBM)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Phenological Phase</th>
<th>Key Timings for GBM Control</th>
</tr>
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<tbody>
<tr>
<td>Bud swell</td>
<td>pre-bloom</td>
<td>Wild grape bloom</td>
</tr>
<tr>
<td></td>
<td>bloom</td>
<td>810</td>
</tr>
<tr>
<td></td>
<td>post bloom</td>
<td>1620</td>
</tr>
</tbody>
</table>

**GBM moths**

- No clear signal for timing sprays

**GBM eggs**

- GBM sprays for mid- and late-season pressure if needed, timed using the degree day model

**Main insect pests**

- Cutworm
- Flea beetle
- Rosechafer
- Leafhopper
- Jap. Beetle
- MALB

**Control windows**

- Based on scouting, target pests if present in sufficient abundance

<table>
<thead>
<tr>
<th>Product</th>
<th>Stage</th>
<th>Phases</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lorsban</td>
<td>Pyrethroids</td>
<td>Gen. 1</td>
<td>Neonic's</td>
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<tr>
<td></td>
<td></td>
<td>Gen. 2</td>
<td>Intrepid</td>
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<tr>
<td></td>
<td></td>
<td>Gen. 3</td>
<td>Altacor</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Intrepid</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Belt</td>
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What's new...
- Presentations from Short Course on Aromatic White Wine Production, June 2.
- Presentations from NW Winegrape Kickoff Meeting, April 1.
- Enviro-weather: MSU's upgraded weather resources for fruit growers

News you can use
Disease management
- Insect management: When fruit clusters become visible, protect them from Promacopea with a fungicide application.
- Insect management: With grape berries still green on May 20 n Bill, Michigan, Fan for EMILY will grape berries often in the next few weeks to be able to use the MSU grape berry moth model.
- TNMQ Phenomenon Trapping Station: For growers who use the trap data from the Trap Monitoring Research Complex in Ferrisville, here is the link: http://www.missouri.edu/adhusanmn/trapping.html

Growing degree days
- See full list of growing season data and grower meetings in June.
- Grower meetings in June: Check out the calendar of events or page 12 for the next grower meetings in your area.

Grape insect scouting survey: The Michigan and Indiana County Conservation Districts will be conducting a survey for potential insect pests of grapes in Michigan. See page 1 for details on how you can help.

Welch's
- National Grape CCOOP
- Mission VWUG
- IR-4 Project
- USDA