Insect Pest Management in Mint

2011 Midwest Mint Growers Annual Meeting
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Chula Vista Resort, Wisconsin Dells, WI

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Factors Influencing Insect Pest Management

‘Environmental Concerns’

– With increasing affluence reaching the developing world, there will be increasing concerns about pesticide usage and perceived environmental effects.

– This will accelerate the shift to “softer” products and technologies.
Factors Influencing Insect Pest Management
‘Food Safety’

– Major food retailers are setting acceptable residue levels below those set by government regulatory agencies.

“No detectable residues” will be a competitive advantage for food retailers.

– Older insecticides that do not meet these requirements are not being re-registered, resulting in increased use of novel insecticides (reduced-risk & bio-pesticides).
Mint Insect IPM – Presentation Format

• Key arthropod pests of mint – new technologies

• Scotch spearmint persistence – virus detections

• New and Re-emerging pest species
Varied Mint Insect Pests

Key Pests
- Mint Bud Mite
- Mint Flea Beetle

Sporadic Pests
- Cutworms - armyworms
- Loopers
- Two-spotted spider mites

Intermittent Pests
- Mint root borer
- Mint stem borer
- Mint aphid
- Spittlebugs
- Fleahoppers
- Wireworms

Mint flea beetle (*Longitarsus waterhousei*)
Non-chemical Control – **Rotation**; Do not retain infested stand past 4 years

Threshold - 25 adults/100 sweeps on stubble or presence of larval damage is evident
Mint Flea Beetle: Chemical Control

- **Chemical:** target summer adults in August after harvest on stubble.

- **Materials:**
  - Malathion 57EC
    - 0.7 to 1.0 lb. a.i./A, 7 day phi
  - Lannate LV
    - 0.065 to 0.9 lb. a.i./A, 14 day phi
  - Actara 35 WDG
    - 1.5 to 3.0 oz/A, 7 day phi

- **Online Phenology Model:** degree-days (DD), using a base temperature of 41°F, accumulated from Jan. 1 (Morris, 1990)

  - 1st instar larvae 405 DD
  - 2nd instar larvae 575 DD
  - 3rd instar larvae 775 DD
  - Prepupae 1045 DD
  - Pupae 1370 DD
  - Adults 1555 DD

http://pnwpest.org/cgi-bin/ddmodel
Mint Flea Beetle: Chemical Control

Wisconsin Pest Bulletin Volume 53 No. 15
August 1, 2008

DEGREE DAYS MARCH 1 - JULY 31

LOCATION | 50°F | 2007 | NORM | 48°F | 40°F
----------|------|------|------|------|------
Dubuque, IA | 1692 | 1598 | — | 1771 | 2760
Lone Rock | 1552 | 1382 | — | 1431 | 2556
Beloit | 1708 | 1656 | — | 1740 | 2666
Madison | 1541 | 1793 | 1729 | 1640 | 2544
Sullivan | 1628 | 1714 | 1539 | 1668 | 2658
Juneau | 1554 | 1712 | — | 1634 | 2553
Waukesha | 1523 | 1671 | — | 1608 | 2524
Hancock | 1492 | 1697 | — | 1594 | 2485
Racine | 1451 | 1657 | — | 1638 | 2445
Milwaukee | 1426 | 1656 | 1564 | 1513 | 2414
Appleton | 1457 | 1669 | 1593 | 1558 | 2419
Green Bay | 1365 | 1548 | 1535 | 1449 | 2323
Big Flats | 1421 | 1691 | — | 1499 | 2358
Hancock | 1441 | 1677 | 1710 | 1623 | 2382
Port Edwards | 1378 | 1672 | 1529 | 1460 | 2303
Lo Crosse | 1556 | 1970 | 1874 | 1616 | 2551
Eau Claire | 1411 | 1904 | 1688 | 1483 | 2360
Cumberland | 1226 | 1650 | 1602 | 1292 | 2120
Bayfield | 971 | 1301 | 1230 | 1030 | 1791
Wausau | 1254 | 1556 | 1546 | 1334 | 2144
Medford | 1192 | 1509 | 1597 | 1272 | 2073
Chippewa | 1259 | 1491 | — | 1357 | 2183
Granton | 1126 | 1411 | 1259 | 1186 | 1970

Method: Modified850: Sine48; Modified840 as of March 1, 2008.


FORAGES

Potato Leafhopper: Counts in alfalfa remain nearly the same as last week. Nymphs still comprise approximately 50% of the population and numbers rarely exceed 2.5 per sweep, except in occasional fields on sandy soils where counts of 3-5 per sweep were detected. A few alfalfa fields in Columbia and Marquette counties are exhibiting minor yellowing symptoms, but this condition is not apparent in most areas. Yellowing caused by this insect can be confused with nutrient deficiencies, both of which are magnified by dry weather. Timely harvest should effectively reduce leafhopper populations in those fields with counts at or above the economic threshold of 2.0 per sweep.

PEA APHID: Populations in alfalfa have declined noticeably in the past 2 weeks, possibly due to an increase in parasitism by braconid wasps, predation by ladybeetles and damsel bugs, or other factors. Sampling in the south central and central districts found an average of 1.8 aphids per sweep, and a range of 1-4 per sweep.

http://pestbulletin.wi.gov/pdf/08-01-08.pdf
Mint Insect Control: Variegated Cutworm & Loopers

- Early season leaf damage / stand loss
- Mid to later season leaf damage / localized
Cutworm & Looper Control

Established Thresholds: 2-3 larvae ft\(^2\)

Early Season:
- Lorsban 4E broadcast (1-2 lb ai/ac) (Pilot 4E)

Mid to Late Season:
- Orthene 90S (1.0-1.3 lb ai/ac)
- Lannate LV (0.7-0.9 lb ai/ac)
- Intrepid 2F (0.2-0.25 lb ai/ac)
- Avaunt 30 WDG (0.07 lb ai/ac) (2007)

Variegated cutworm: early larvae
Reduced-Risk Foliar Registrations (2008-09)

- **Radiant®SC (spinetoram)**
  - Macroyclic lactone (spinosad: MoA group 5)
  - Use rate 4 - 12 oz / ac (Lepidoptera)
  - 10-14 days persistence (improved photostability)
  - Very low impact on beneficials

- **Coragen™ (chlorantraniliprole)**
  - Anthranilic diamide (MoA group 28)
  - Use rate 3 - 6 oz (Lepidoptera) + MSO 5% v/v
  - 14+ days persistence
  - Very low impact on beneficials and low toxicity
  - Ovicidal activity
  - IR-4, All Data Received
DuPont Cyazypyr™ US Registration

- **DPX-HGW86 (cyantraniliprole)**
  - Anthranilic diamide (MoA group 28)
  - Use rate 6.7 – 13.5 fl oz (Lepidoptera ++) +MSO 5% v/v
  - 14+ days persistence
  - Very low impact on beneficials and low toxicity
  - Ovicidal activity
  - EPA – Submission June 2011
  - Anticipated Approval December 2012

- Fruiting vegetables, Cucurbits, Tuberous and Corm vegetables,
  Leafy vegetables, Brassicas, Bulb vegetables, etc…

- Large pest spectrum
Mint Bud Mite
*Floridotarsonemus* spp.

- A Key Pest in Midwest Mint Since 1995

- Widely distributed
- Found on muck and mineral soil
- Most destructive on peppermint
- Squirrelly mint symptoms
- Low oil yield (60-80% reductions)

• *Damage increases with stand age*
Crop Rotation

- Mite infestation increases as age of the stand increases.

- Low mite levels will likely becoming damaging in 2 to 3 years.

- Rotation after 3 years of mint greatly reduces threat (depending on field history).

- “New” roots can be dug from “clean” first year fields, no need to buy new roots every planting.
Current Chemical Controls

- Currently both Comite/Omite and Fujimite/Portal are registered for control of Mint Bud Mite in Wisconsin
  - Comite (propargite) is less effective and requires careful spray timing along with high spray volumes
  - Poor persistence (2-3 weeks)
  - B2 carcinogen (human health)

- Kelthane contains trace amounts of DDT and as a result cannot be used in Wisconsin (WI DATCP).

- Few alternatives to Comite/Omite & Fujimite/Portal
Reduced-Risk Experimental Acaricides

- **IR-4 sponsored projects – December 2010**
  - spiromesifin (Oberon®): mites, whiteflies, psyllids
    * activity against all stages (eggs)
    * lipid biosynthesis inhibitor, MoA Class 23
    * 8-10 days residual activity
    * low toxicity profile
    * soft on beneficials

- **Chemtura (3c Registration & 24c SLN WI)**
  - bifenazate (Acramite®): two-spotted spider mites
    * very fast acting
    * carboxylic acid ester, MoA Class 25
    * 10-15 days residual activity
    * safe on beneficials and predatory mites
Reduced-Risk Experimental Acaricides

- **Chemtura (3c Registration & 24c SLN WI)**
  - abamectin (Agri-Mek® 0.15EC, Agri-Mek® SC, Abba®, Temprano®): two-spotted spider mites
    - very fast acting
    - chloride channel activator, MoA Class 6
    - 7-10 days residual activity

- **Nichino America (3c Registration 2010)**
  - fenpyroximate (Portal®): mint bud mite
    - METI, MoA Class 21A
    - 1-2 pts / acre
    - 10-14 days residual activity
# 2008 Reduced-Risk Experimental Acaricides: At Threshold

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active Ingredient</th>
<th>App No.</th>
<th>App Rate</th>
<th>14 Jun</th>
<th>21 Jun</th>
<th>28 Jun</th>
<th>6 Jul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>26.5 a</td>
<td>13.2 a</td>
<td>19.2 ab</td>
<td>16.9 a</td>
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<tr>
<td>Comite EC</td>
<td>propargite</td>
<td>2</td>
<td>48 fl oz / A</td>
<td>13.6 b</td>
<td>8.8 b</td>
<td>10.4 b</td>
<td>14.1 ab</td>
</tr>
<tr>
<td>Fujimite 5EC</td>
<td>fenpyroximate</td>
<td>1</td>
<td>40 fl oz / A</td>
<td>4.8 bc</td>
<td>2.1 c</td>
<td>0.8 c</td>
<td>3.0 bc</td>
</tr>
<tr>
<td>Oberon 2SC*</td>
<td>spiromesifen</td>
<td>2</td>
<td>8.0 fl oz / A</td>
<td>5.1 bc</td>
<td>0.8 c</td>
<td>1.3 c</td>
<td>1.8 bc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>12.0 fl oz / A</td>
<td>5.6 bc</td>
<td>1.4 c</td>
<td>1.9 c</td>
<td>0.8 c</td>
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<tr>
<td></td>
<td></td>
<td>2</td>
<td>16.0 fl oz / A</td>
<td>3.9 c</td>
<td>2.1 c</td>
<td>1.8 c</td>
<td>0.2 c</td>
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<tr>
<td>Acramite 4SC*</td>
<td>bifenazate</td>
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<td>16.0 fl oz / A</td>
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<td>4.9 bc</td>
<td>7.1 bc</td>
<td>15.2 ab</td>
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<tr>
<td></td>
<td></td>
<td>1</td>
<td>24.0 fl oz / A</td>
<td>7.3 bc</td>
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<tr>
<td>Temprano</td>
<td>abamectin</td>
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<td>8.0 fl oz / A</td>
<td>2.3 c</td>
<td>3.4 bc</td>
<td>5.3 bc</td>
<td>5.6bc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>12.0 fl oz / A</td>
<td>2.8 c</td>
<td>1.5 c</td>
<td>1.4 c</td>
<td>1.9 c</td>
</tr>
<tr>
<td>Dimilin 2L*</td>
<td>diflubenzuron</td>
<td>1</td>
<td>40 fl oz / A</td>
<td>14.6 b</td>
<td>12.0 b</td>
<td>18.9 ab</td>
<td>17.9 ab</td>
</tr>
</tbody>
</table>

*Not currently registered for use in Wisconsin
## 2009 Reduced-Risk Experimental Acaricides: At Threshold

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active Ingredient</th>
<th>App No.</th>
<th>App Rate</th>
<th>25 Jun</th>
<th>2 Jul</th>
<th>9 Jul</th>
<th>16 Jul</th>
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<tbody>
<tr>
<td>Untreated</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>19.3 a</td>
<td>38.7 a</td>
<td>27.6 a</td>
</tr>
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<td>7.3 b</td>
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<td>3.7 c</td>
<td>5.9 b</td>
<td></td>
</tr>
<tr>
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<td>2</td>
<td>8.0 fl oz / A</td>
<td>2.4 b</td>
<td>9.2 b</td>
<td>7.8 b</td>
<td>13.1 b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>12.0 fl oz / A</td>
<td>2.3 b</td>
<td>8.3 b</td>
<td>6.0 b</td>
<td></td>
</tr>
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<td>3.7 b</td>
<td>6.3 bc</td>
<td>5.8 b</td>
<td></td>
</tr>
</tbody>
</table>

*Mean number of mint bud mites/bud*

*Not currently registered for use in Wisconsin*
2008-09 Experimental Summary: At Threshold

- Acaricide applications at threshold reduced bud mite numbers 28 days after application.

- Most effective applications included Fujimite / Portal (2.0 pts/A), Temprano (12 oz/A), and Oberon (12 & 16 oz/A).

- Lower rates of Acramite (12 oz/A) and Oberon (8.0 oz/A) did not maintain acceptable population levels longer than 14 days in either trial year.

- Kelthane is still an effective alternative for Indiana mint growers, but RR-options are available!!

- 2010 Experimental plot flooded…..
Example of Acaricide Application Sequence
Mind Bud Mite Control

Threshold = 10 mites / bud

Need to protect crop from Mint Bud Mite for 4-6 weeks

Emergence

Bud Mite

Harvest

Oberon

Portal

Mint Crop

Mint Insect IPM – Presentation Format

• **Key arthropod pests of mint** – new technologies

• **Scotch spearmint persistence** – virus detections

• **New and Re-emerging pest species**
Possible explanations for Scotch spearmint persistence

- **varietal (rootstock) selection**

- **non-specific, stolon decline (complex of...)**
  - *Rhizoctonia* spp.
  - *Schlerotinia* spp.
  - *Fusarium* spp.
  - *Alternaria* spp.
Viral Etiology for Scotch Persistence, ‘Running Out’

1. Strawberry latent ringspot virus (SLRV)
2. Mint Virus X (MVX): novel Potexvirus
3. Mint Veinbanding Virus (MVBaV): novel Closterovirus
5. Mint Virus A (MVA): a novel Vitivirus

Other notables.....
CMV, AMV, TMV

Tzanetakis et al. 2010 Plant Disease 94:4-12
Mint Persistence
dsRNA Extraction

- Confirmation of dsRNA: DNase digestion, RNase digestion under low salt (any RNA) or high salt (only ssRNA) concentrations.
- Lane 2 CMV infected snap bean, lanes 2-5 mint leaf samples
- Cloned and sequenced fragments support infections with both CMV and AMV

<table>
<thead>
<tr>
<th>Date</th>
<th>No Tested</th>
<th>CMV (%)</th>
<th>AMV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2009</td>
<td>59</td>
<td>3 (5.1%)</td>
<td>1 (1.7%)</td>
</tr>
<tr>
<td>Spr 2010</td>
<td>127</td>
<td>--</td>
<td>1 (0.8%)</td>
</tr>
</tbody>
</table>
Mint Insect IPM – Presentation Format

• Key arthropod pests of mint – new technologies

• Scotch spearmint persistence – virus detections

• New and Re-emerging pest species – persistence??
An increasing risk of wireworms in Wisconsin mint??

- Soil-dwelling larvae (grubs) of click beetles
- Worldwide in distribution
- Many different species, all with unique lifecycles
- Can be a pest on a wide range of vegetable and fruit crops:
  - cereals, vegetables, potatoes, and mint
Wireworm Damage

Field corn

Sweetpotato

Transplant Cucumbers

Beans

Peanuts
Generalized Wireworm Lifecycles

- Varied, taking 3 – 4 years to develop from egg to adult.
- Nearly all spent in larval stages: egg & pupa = 1 month
- Overwinter at 10 – 24”, movement > 55°F
- Females emerge to mate, then burrow and re-emerge to oviposit
# Changing Cultural Management of Field Corn

**Commodities**  
**Corn (CBT)**  
Mar 2011 (cents per bu.)  

<table>
<thead>
<tr>
<th>Commodities</th>
<th>Price</th>
<th>Change</th>
<th>High</th>
<th>Low</th>
<th>Settle</th>
<th>Last Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn (CBT)</td>
<td>645.25</td>
<td>+1.8%</td>
<td>678.60</td>
<td>618.60</td>
<td>648.60</td>
<td>01/16/11 3:30 pm</td>
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</tbody>
</table>

**Year**  
**Planted All Purposes**  
**Harvested**  
**Yield**  
**Production**  
**Price per Unit**  
**Value of production**

<table>
<thead>
<tr>
<th>Year</th>
<th>Planted All Purposes</th>
<th>Harvested</th>
<th>Yield</th>
<th>Production</th>
<th>Price per Unit</th>
<th>Value of production</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>88,798</td>
<td>81,005</td>
<td>162.5</td>
<td>13,159,700</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>2009</td>
<td>86,482</td>
<td>78,590</td>
<td>164.7</td>
<td>13,110,062</td>
<td>3.70</td>
<td>48,588,665</td>
</tr>
<tr>
<td>2008</td>
<td>85,982</td>
<td>78,570</td>
<td>153.9</td>
<td>12,091,648</td>
<td>4.06</td>
<td>49,312,615</td>
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<tr>
<td>2007</td>
<td>93,600</td>
<td>86,542</td>
<td>151.1</td>
<td>13,037,875</td>
<td>4.20</td>
<td>54,666,959</td>
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<tr>
<td>2006</td>
<td>78,327</td>
<td>70,648</td>
<td>149.1</td>
<td>10,531,123</td>
<td>3.04</td>
<td>32,094,586</td>
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<tr>
<td>2005</td>
<td>81,779</td>
<td>75,117</td>
<td>148</td>
<td>11,114,082</td>
<td>2.00</td>
<td>22,198,472</td>
</tr>
</tbody>
</table>
Changing Cultural Management of Field Corn

- Activity against European corn borer, corn earworm, rootworms, cutworms, and armyworms: not wireworm.

- Adoption of transformants continues to increase:
  - 2004 (22%) to 2010 (62%)

- RR Technology has lead to grass competition: armyworm
  - Burn down dates have been extended.

- Land removed from conservation reserve program (CRP):
Pest Management in Field Corn

- **Corn transformants receive low rate nicotinoid seed trt:**
  - 0.25 mg / kernel Poncho® 250 (clothianadin)
  - 0.25 mg / kernel Cruiser® 250 (thiamethoxam)
  - typical seed treatment rates 1.25 mg / kernel
  - increased repellency and less acute toxicity?

- **Transition from broad spectrum, long residual insecticides:**
  - turbophos (Counter® 15G)
  - chlorpyrifos (Lorsban® 15G)
  - tefluthrin (Force® 3G)
  - cyfluthrin (Aztec® 2.1%)
  - fipronil (Regent® 4SC)

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![Graph showing Wisconsin Agricultural Statistics, 2007](image)
Corn Wireworm, *Melanotus communis*

- Can be abundant in soil following corn for 2 years.

1\(^{st}\) corn year

2\(^{nd}\) corn year

Early mint after corn
Difficult Pest Management

- Incomplete understanding of wireworm biology
- Limited availability of completely effective chemicals
- Lack of efficient and labor-friendly monitoring tools which would allow growers to predict likelihood of damage or to assist in decisions about the necessity of insecticide treatment
Brown Marmorated Stink Bug
Brown Marmorated Stink Bug

- Native to Asia (China, Japan, Korea).
- First detected in Allentown, PA, in 1998.
- Wide host range, including tree fruits, many vegetables, soybeans, corn, forest trees, ornamentals, and probably mint.
- Seeks buildings, commonly homes, in the fall as overwintering sites.
- Severe economic losses in mid-Atlantic states in 2010.
- Detected in MN in 2009, IL, MO and NE this past year for the first time.
Current BMSB Distribution in the United States.

Stages of Invasion by Alien Species
- Arrival
- Establishment
- Integration
- Spread
Projected Life Cycle of BMSB

1st Gen Adults
Appeared in June/July

Overwinter as adults
Emerge early April

1st Gen eggs
late April thru May

Nymphs
5 nymphal instars
May-June

198x500
Projected Life Cycle of BMSB

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Appeared in June/July

Overwinter as adults
Emerge early April

1st Gen eggs
late April thru May

Nymphs
5 nymphal instars
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198x500
Projected Life Cycle of BMSB

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Appeared in June/July

Overwinter as adults
Emerge early April

1st Gen eggs
late April thru May

Nymphs
5 nymphal instars
May-June
Factors Contributing to BMSB Abundance

• Wide host range
  – >300 plants are hosts
  – Allows for populations to buildup in many non-managed habitats (woods) or field crops with few insecticide sprays (i.e., soybean)

• Absence of effective natural enemies
  – % parasitism in US by native *Trissolcus spp.* <5%
  – % parasitism in China 50-80%

• Highly mobile and “nervous” insect
Insecticidal Control

- Contact activity more important than toxicity by ingestion

Exposed to insecticide-treated Petri dishes for 4.5 hrs

Stink bugs transferred to carrot and mortality recorded for 7 days
Alive
Moribund
Dead

Sevin

Asana

Lannate

T.C. Leskey, 2010
<table>
<thead>
<tr>
<th>Insecticide</th>
<th>PHI (days) - # Appl.</th>
<th>LI (Lethality Index)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endosulfan (Thionex) (voluntary cancellation)</td>
<td>21 d – 3</td>
<td>90.4</td>
</tr>
<tr>
<td>Lannate</td>
<td>15 d – 5</td>
<td>90.1</td>
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<tr>
<td>Lorsban (in review)</td>
<td>Prebloom only</td>
<td>89.0</td>
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<tr>
<td>Permethrin</td>
<td>Petal fall only</td>
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<td>Guthion</td>
<td>21 d – 2</td>
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<td>Danitol</td>
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<td>66.7</td>
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<tr>
<td>Carzol</td>
<td>Petal fall only</td>
<td>63.5</td>
</tr>
<tr>
<td>Actara</td>
<td>35 d – 2</td>
<td>56.3</td>
</tr>
<tr>
<td>Clutch/Belay</td>
<td>7 d – 2</td>
<td>55.6</td>
</tr>
<tr>
<td>Baythroid</td>
<td>7 d – 2</td>
<td>54.8</td>
</tr>
<tr>
<td>Warrior</td>
<td>21 d - 3</td>
<td>52.9</td>
</tr>
<tr>
<td>Asana</td>
<td>21 d - 3</td>
<td>43.3</td>
</tr>
</tbody>
</table>

T.C. Leskey, 2010