Factors Influencing Insect Pest Management

‘Food Safety and Environmental Concerns’

– 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

• New and Re-emerging pest species
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](http://pnwpest.org/cgi-bin/ddmodel)
Mint Insect Control:
Variegated Cutworm & Loopers

- Early season leaf damage / stand loss

- Mid to later season leaf damage / localized

Variegated cutworm larvae

Alfalfa looper larvae

Cabbage looper larvae
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)

Variegated cutworm: early larvae
Reduced-Risk Foliar Registrations – Worm Pests

- **Radiant®SC (spinetoram) - registered**
  - **Blackhawk (spinosad) – researchable (2012)**
    - Macrocyclic lactone (spinosad: MoA group 5)
      - Use rate 4 - 12 oz / ac (Lepidoptera)
    - 10-14 days persistence (improved photostability)
    - Very low impact on beneficials
  - **Not currently registered for use**

- **Coragen™ (chlorantraniliprole)**
  - Anthranilic diamide (MoA group 28)
    - Use rate 3.5 - 5 oz (Lepidoptera) +MSO 5% v/v
  - 14+ days persistence
  - Very low impact on beneficials and low toxicity
  - Ovicidal activity
Benevia 10OD (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

  Anticipated Approval late 2012, early 2013

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

- Loopers, cutworms, mint root borer
Two-spotted spider mites, *Tetranychus urticae*

**Occurrence**
- Usually occur in hot dry conditions
- More severe in dusty, road side locations
- Multiple generations on undersurface of leaf

**Damage**
- Adults feed in large numbers on leaf surface causing “silvering”
- Lower surface often covered with webbing
- Late season pest
- Can be ‘flared’ by pyrethroids
Spider mite, Management

**Cultural**
- Maintain good plant growth, irrigation
- Avoid dusty roads

**Biological**
- Several effective predators
- Avoid broad-spectrum insecticides

**Chemical**
- Unless necessary, do not use
- ‘Hormoligosis’: boosts egg production
- Agri-Mek, Acramite, Portal, and Oomite
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 has been voluntarily cancelled in the US.

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

- **Bayer Crop Science (3c registration): mint bud mite, two-spotted spider mite**
  - spiromesifin (Oberon® 4SC & 2SC): 4-8 fl oz/acre
    * 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): two-spotted spider mite (2002)**
  - bifenazate (Acramite®): 12-24 fl oz/acre
    * very fast acting
    * carboxylic acid ester, MoA Class 25
    * 10-15 days residual activity
    * safe on beneficials and predatory mites
Reduced-Risk Experimental Acaricides

- **Syngenta (3c Registration)**: two-spotted spider mites
  - abamectin (Agri-Mek® 0.15EC, Abba® 0.15EC, Reaper 0.15EC®): 8-12 fl oz/ac
  - abamectin (Agri-Mek 0.7SC): 1.75 – 2.5 fl oz/ac
    * very fast acting
    * chloride channel activator, MoA Class 6
    * 7-10 days residual activity

- **Nichino America (3c Registration 2010)**: mint bud mite & two-spotted spider mite
  - fenpyroximate (Portal®): 1-2 pts/ac
    * METI, MoA Class 21A
    * 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>Appl 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>
</tr>
<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></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>
</tr>
<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>
</tr>
<tr>
<td>Acramite 4SC*</td>
<td>bifenazate</td>
<td>1</td>
<td>16.0 fl oz / A</td>
<td>8.6 bc</td>
<td>4.9 bc</td>
<td>7.1 bc</td>
<td>15.2 ab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>24.0 fl oz / A</td>
<td>7.3 bc</td>
<td>7.7 bc</td>
<td>5.3 bc</td>
<td>9.8 b</td>
</tr>
<tr>
<td>Temprano</td>
<td>abamectin</td>
<td>2</td>
<td>8.0 fl oz / A</td>
<td>2.3 c</td>
<td>3.4 bc</td>
<td>5.3 bc</td>
<td>5.6 bc</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>Appl Rate</th>
<th>25 Jun</th>
<th>2 Jul</th>
<th>9 Jul</th>
<th>16 Jul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>9.8 a</td>
<td>19.3 a</td>
<td>38.7 a</td>
<td>27.6 a</td>
</tr>
<tr>
<td>Comite EC</td>
<td>propargite</td>
<td>2</td>
<td>48 fl oz / A</td>
<td>3.6 b</td>
<td>8.7 b</td>
<td>7.3 b</td>
<td>15.8 ab</td>
</tr>
<tr>
<td>Fujimite 5EC</td>
<td>fenpyroximate</td>
<td>1</td>
<td>40 fl oz / A</td>
<td>2.8 b</td>
<td>3.7 c</td>
<td>5.9 b</td>
<td>4.2 c</td>
</tr>
<tr>
<td>Oberon 2SC</td>
<td>spiromesifen</td>
<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>8.1 bc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>16.0 fl oz / A</td>
<td>2.6 b</td>
<td>5.2 bc</td>
<td>5.9 b</td>
<td>6.8 bc</td>
</tr>
<tr>
<td>Acramite 4SC</td>
<td>bifenazate</td>
<td>1</td>
<td>16.0 fl oz / A</td>
<td>4.2 b</td>
<td>5.0 bc</td>
<td>7.4 b</td>
<td>17.9 ab</td>
</tr>
<tr>
<td>Temprano</td>
<td>abamectin</td>
<td>2</td>
<td>8.0 fl oz / A</td>
<td>3.7 b</td>
<td>6.3 bc</td>
<td>5.8 b</td>
<td>10.4 bc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>16.0 fl oz / A</td>
<td>2.9</td>
<td>7.6</td>
<td>8.3</td>
<td>9.3 bc</td>
</tr>
</tbody>
</table>
2008-09 Experimental Summary: At Threshold

- Acaricide applications at threshold reduced bud mite numbers 14-21 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 has been voluntarily cancelled, but RR-options are available!!
Example of Acaricide Application Sequence
Mint Bud Mite Control

Threshold = 10 mites / bud

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

Mint Crop

Emergence


Bud Mite

Oberon (PHI=21d)

Portal (PHI=7d)

Harvest
Example of Acaricide Application Sequence Mint Bud Mite and Two-Spotted Spider Mite

Threshold = 10 mites / bud


Emergence

Mint Crop

Bud Mite

Oberon (PHI=21d)

Portal (PHI=7d)

Spider Mite

Harvest
Mint Insect IPM – Presentation Format

- Key arthropod pests of mint – new technologies
- New and Re-emerging pest species

Pest Management and Scouting

2012 WI Mint Sustainability Questionnaire
**Garden fleahopper**  
**Peppermint 2010-11**

- *Halticus bractatus* (Hemiptera: Miridae)
  - Foliar-feeding, polyphagous pest  
    (bean, beet, cabbage, celery, cucumber, eggplant, lettuce, pepper, potato, pumpkin, squash, tomato, and numerous weeds)

- 2-3 generations / year (WI and IN)

- overwinters as eggs (forage crops) and can develop large populations in forages
Garden fleahopper
Peppermint 2010-11

- Damage is whitish and yellow speckling plus frass (black spots)

- Possible explanations for occurrence:
  - rarely considered a problem in commercial vegetable production
  - suppression with insecticides is easily accomplished
  - reductions in broad-spectrum insecticide use in mint and adjoining forage legumes may be partially responsible
Emerging risk of wireworms in 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

Adult click beetle

Wireworm larvae
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

![Diagram showing wireworm lifecycles with stages from eggs to emergence of beetles.](image-url)
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)

![Graph showing percentage of crop treated over years](chart.png)

**Wisconsin Agricultural Statistics, 2007**

- x-axis: Year
- y-axis: Percent of crop treated
Corn Wireworm, *Melanotus communis*

- Can be abundant in soil following corn (or wheat) for 2 years.

1st corn year

2nd 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
Acknowledgements

Wisconsin Mint Board, Inc.

• Jack’s Pride Farms
• Gumz Muck Farms
• Dennis Zeloski

• Anders Huseth
• Scott Chapman

QUESTIONS