Vegetable Insecticide Update

Celeste Welty
Extension Entomologist
January 2017
Topics

• **Insecticides**
  – New products
  – New uses
  – Cancelled products

• **Pests of concern**

• **Results of recent trials**

• **Information resources**
New product, 2017: Trident

• Biological insecticide
• **B.t.t.** = *Bacillus thuringiensis tenebrionis*
• Colorado potato beetle, larvae only
  – Most effective on 1st instar larvae
  – Apply when eggs hatching
  – Must be ingested by beetles
  – Good coverage needed
• a.i. same as ‘M-One’ & ‘Novodor’
• Made by Certis
New product, 2016: **BeetleGONE!**

- Biological insecticide
- B.t.g. = *Bacillus thuringiensis galleriae*
- Targets adults (!) & larvae:
  - Japanese beetle
  - Asiatic garden beetle
  - Pepper weevil
- Must be ingested
- Cease feeding within hours
- Good coverage needed
- Made by Phyllom BioProducts
Coming soon? Spear

• Biological insecticide
• Registered: Spear T
  – For greenhouse use only
  – For thrips control
• Not yet registered:
  – Spear O
  – Spear C
  – Spear P
• Thrips, caterpillars, beetles, weevils
• By Vestaron Corp.
Closer & Transform

• Re-established October 2016
  – registered May 2013
  – suspended Sept. 2015
  – cancelled November 2015

• A.I.: sulfoxaflor (‘Isoclast’)

• IRAC group 4C:
  – ‘cousins’ of neonicotinoids (4A)
  – different subgroup than Admire
# sulfoxaflor

<table>
<thead>
<tr>
<th>Product</th>
<th>Crop</th>
<th>Pest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closer</td>
<td>brassica leafy veg, cucurbits, fruiting veg, leafy veg, leaves of root/tuber crops</td>
<td>plant bugs, aphids, leafhoppers, whiteflies</td>
</tr>
<tr>
<td>Transform</td>
<td>potato root/tuber (radish, beet, carrot) beans (succulent)</td>
<td>plant bugs, aphids, leafhoppers, whiteflies</td>
</tr>
</tbody>
</table>
New uses

• **Agri-Mek SC**
  – Green onions, for thrips control
    • 7-day PHI
    • On supplemental label

• **Portal XLO**
  – Potato, beans, cucumbers
    • On main label
    • No longer on supplemental label
Products re-named

• Portal XLO
  – Replaced Portal 0.4EC
  – Same rates

• Sivanto Prime
  – New September 2016
  – Replaced Sivanto 200SL
    • New January 2015
  – Some new uses added
  – Same rates
Sivanto Prime

- A.I.: flupyradifurone
- IRAC group 4D (butenolides)
  - ‘cousin’ to neonicotinoids (4A)
- Systemic action
- Liquid: 1.67 lbs a.i./gal
- By Bayer
Sivanto: target pests

- leafhoppers
- aphids
- whiteflies
- squash bug
- Colorado potato beetle
# Sivanto Prime

<table>
<thead>
<tr>
<th>Crop</th>
<th>PHI (days)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>foliar</td>
<td>soil</td>
</tr>
<tr>
<td>Brassica head &amp; leafy</td>
<td>1</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Cucurbits</td>
<td>1</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Fruiting veg.</td>
<td>1</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Leafy veg.</td>
<td>1</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Legumes</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Root veg.</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tuber/corm veg</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Cancellation: flubendiamide

• **Belt SC**, made by Bayer
• former **Synapse WG**, made by Bayer
• cancelled August 2016
• distributors can sell inventory
• growers can use product per label
  – sweet corn
  – Brassica veg
  – cucurbits
  – fruiting veg
  – leafy veg
  – legumes
Cancellation: Calypso 4F

- thiacloprid
- voluntary cancellation announced by Bayer, Dec. 2013
- state registrations being phased out
- still registered in Ohio for 2017
- growers can use product per label
  – peppers
# Phase-out of endosulfan (Thionex)

<table>
<thead>
<tr>
<th>Date for final use</th>
<th>Crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/31/2012</td>
<td>cukes, melons, summer squash, eggplant, cabbage+, kale+, lettuce, peach, plum, cherry, strawberry (annual)</td>
</tr>
<tr>
<td>7/31/2013</td>
<td>pear</td>
</tr>
<tr>
<td>7/31/2015</td>
<td>pumpkin, winter squash, tomato, pepper, potato, sweet corn, apple, blueberry</td>
</tr>
<tr>
<td>7/31/2016</td>
<td>strawberry (perennial)</td>
</tr>
</tbody>
</table>
Deletions from midwest spray guides

• **Courier (buprofezin)**
  - registered in Ohio but not in most other midwest States
Pollinator Protection:
new bee advisory box on label

• Now on labels of neo-nics (Belay, Actara, Admire, Venom) & Exirel
## Pests of current interest

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>brown marmorated stink bug</td>
</tr>
<tr>
<td></td>
<td>western bean cutworm</td>
</tr>
<tr>
<td>Potential</td>
<td>Swede midge</td>
</tr>
<tr>
<td>Old</td>
<td>spider mites</td>
</tr>
</tbody>
</table>
Brown marmorated stink bug

- Attacks fruits & seed pods
- Invading Ohio since 2007
Brown marmorated stink bug: injury

- Corn
- Pepper
- Beans
- Tomato
Monitoring BMSB with traps

- Improved lure by USDA-ARS
- Double lure for synergy
  - ARS#20 (10 mg)
  - MDT (66 mg)
- Available from several companies
  - AgBio
  - Alpha Scents
  - Rescue
  - Trécé
  - Scentry
  - Bedoukian
Pyramids: black vs yellow
PVC pipe topped by Dead Inn: black vs yellow
PVC pipe topped by Dead Inn: black vs yellow plain vs netted
BMSB adults in traps in corn, August 2013

- PVC pipe, yellow, screened: 90
- PVC pipe, black, no screen: 50
- Pyramid, black: 45
- PVC pipe, black, screened: 40
- Pyramid, yellow: 30
- PVC pipe, yellow, no screen: 20
- Stovepipe with Unitrap: 10

Total number caught in 4 weeks
BMSB nymphs in traps in corn, August 2013

- PVC pipe, yellow, screened: 837
- PVC pipe, black, no screen: 678
- PVC pipe, black, screened: 659
- Pyramid, black: 470
- Pyramid, yellow: 426
- PVC pipe, yellow, no screen: 389
- Stovepipe with Unitrap: 4

Total number caught in 4 weeks
Efficacy ratings for BMSB control in veg crops (Maryland)

**Best in field trials:**
- Venom/Scorpion
- **Leverage** (Provado + Baythroid)

**Also good:**
- Brigade
- Belay
- Orthene
- **Hero** (Mustang + Brigade)
- **Athena** (Brigade+ Agri-Mek)
- **Endigo** (Warrior + Actara)

**Fair/Good:**
- Baythroid
- Vydate
- Lannate
- Warrior
- Assail
# Insecticides for stink bug

<table>
<thead>
<tr>
<th>Product</th>
<th>Sweet corn</th>
<th>Peppers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PHI</td>
<td>Limit</td>
</tr>
<tr>
<td>Venom</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Leverage</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Brigade</td>
<td>1 day</td>
<td>2-6 ap.</td>
</tr>
<tr>
<td>Belay</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Orthene</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hero</td>
<td>3 days</td>
<td>1-2 ap.</td>
</tr>
</tbody>
</table>

**Note:** PHI (Days to Apply) / Limit (Application)
Western bean cutworm

- Long-time pest of corn & dry beans in Colorado & Nebraska
- Moving eastward (Iowa) starting 2000
- Now common in Illinois & Wisconsin
- Pest of sweet corn ears
### How to identify it?

<table>
<thead>
<tr>
<th></th>
<th>Western bean cutworm</th>
<th>Corn earworm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of worms per ear</strong></td>
<td>Many</td>
<td>One</td>
</tr>
</tbody>
</table>
# How to identify it?

<table>
<thead>
<tr>
<th></th>
<th>Western bean cutworm</th>
<th>Corn earworm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of worms per ear</strong></td>
<td>Many</td>
<td>One</td>
</tr>
<tr>
<td><strong>Prothorax (segment behind head)</strong></td>
<td>Broad dark stripes</td>
<td>No stripes</td>
</tr>
<tr>
<td><strong>Micro-spines on body</strong></td>
<td>None</td>
<td>Many</td>
</tr>
<tr>
<td><strong>Net-like marks on head</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**WBCW**

**CEW**
How to monitor it?

• Pheromone lure in trap
  – Milk jug or unitrap
  – One generation per year
  – Adults active in July
  – Trap mid-June to mid-August
Monitor by scouting

- Late July & early August
- In plantings with tassels emerging
- Upper 4 leaves of 100 plants/planting
- Look for eggs
- Look for young larvae
How to decide on control?

- **Thresholds (sweet corn):**
  - 4% of plants infested (processing)
  - Tentative: 1% of plants (fresh-market)
What are control options?

- **Insecticide:**
  - If threshold exceeded
  - When eggs are hatching
  - When ~90% of tassels have emerged
  - A pyrethroid or Sevin
What are control options?

• **Insecticide:**
  - If threshold exceeded
  - When eggs are hatching
  - When ~90% of tassels have emerged
  - A pyrethroid or Sevin

• **Transgenic BT hybrid varieties:**
  - not effective
Swede midge

- Attacks cabbage, canola
- Ontario & Quebec, 2000
- Quarantines on plants moving Canada to USA
- USA first in 2004 (NY)
Swede midge: spread

- NY, 2004
- MA, 2005
- CT, 2006
- VT, 2007
- OH, 2009
- NJ
Survey Status of Swede midge - Contarinia nasturtii
2009

Legend:
- Established by Consensus
- Not Found
- Being Eradicated
- No Survey
- Established by Survey
- Found
- Eradicated
- Survey In Progress
Swede midge: change in status

- Removed from quarantine 2009
  - Unlikely to be eradicated
  - Regulatory action impractical
  - Status in USA: present but managed
Recent problems with an old pest:

Two-spotted spider mite
Two-spotted spider mite

- Often overlooked
- Often mistaken for disease
- Build up in hot dry weather
Two-spotted spider mite: identification

- Tiny (1/60 inch)
- White with 2 black spots
- 8 legs
Two-spotted spider mite: hosts & symptoms

• Tomato
  – Yellow blotches

• Bean
  – White stippling
Two-spotted spider mite: hosts & symptoms

- Watermelon
  - Yellow blotches
  - Brown lesions
Two-spotted spider mite: hosts & symptoms

- Sweet corn
  - Flag leaf
Two-spotted spider mite: diagnosis

- Fine webbing on leaf underside
- Scout by tapping leaf over paper, look for moving specks
- Early diagnosis for good control
Spider mite management

- Tolerable at low density
- Conserve natural predators
- Overhead irrigation can help
- Soft control:
  - Insecticidal soap
  - Horticultural Oil
- Chemical control:
  - Agri-Mek or others
Insecticides for spider mites

- **Organophosphates**
  - Dimethoate
  - MSR (Metasystox-R) RUP

- **Miticides (newer)**
  - Agri-Mek RUP
  - Acramite
  - Oberon
  - Zeal
  - Portal

- **Miticides (older)**
  - Dicofol, Kelthane
  - Vydate RUP
Insecticide efficacy trials

- bell peppers
- sweet corn
- cabbage
Worms in Peppers
Caterpillar pests of peppers

• **Key**: European corn borer
  – Bore into fruit
  – Quality loss
  – Yield loss

• **Occasional pests**:
  – Corn earworm
  – Fall armyworm
  – Beet armyworm
Challenge: good control

• 100% control of ECB is rare

• Due to canopy:
  – Dense
  – Hard to cover thoroughly

• Due to borer location:
  – Entry on stem often oriented down
  – Protected inside fruit

• Processors demand <3% damage
Insecticide timing for borer control in pepper

• First spray:
  – within 1 week of surge in trap catch
  – when >1 moth/night in trap
  – usually late July

• Spray schedule:
  – spray every 7 days (range 5 - 14 days)
  – during time moths active, 4 - 6 weeks

• Stop spraying:
  – once trap catch falls (usually early Sept.)
  – or until harvest if other pests active
# Insecticides for borer on peppers

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>PHI</th>
<th>Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coragen</td>
<td>1</td>
<td>E</td>
</tr>
<tr>
<td>Orthene</td>
<td>7</td>
<td>E</td>
</tr>
<tr>
<td>Mustang Maxx</td>
<td>1</td>
<td>G</td>
</tr>
<tr>
<td>Pounce/Ambush</td>
<td>3</td>
<td>G</td>
</tr>
<tr>
<td>Warrior</td>
<td>5</td>
<td>G</td>
</tr>
<tr>
<td>Baythroid</td>
<td>7</td>
<td>G</td>
</tr>
<tr>
<td>Brigade</td>
<td>7</td>
<td>G</td>
</tr>
<tr>
<td>Radiant</td>
<td>1</td>
<td>G</td>
</tr>
<tr>
<td>Intrepid</td>
<td>1</td>
<td>G</td>
</tr>
<tr>
<td>Confirm</td>
<td>7</td>
<td>G</td>
</tr>
<tr>
<td>Asana</td>
<td>7</td>
<td>F</td>
</tr>
<tr>
<td>Sevin</td>
<td>3</td>
<td>F</td>
</tr>
<tr>
<td>Lannate</td>
<td>3</td>
<td>F</td>
</tr>
<tr>
<td>B.t.</td>
<td>0</td>
<td>F</td>
</tr>
</tbody>
</table>
European Corn Borer on Peppers

- **Years with average temperature:**
  - Only 2 generations likely
  - Need 4 to 6 sprays total

- **Years with very hot temperature:**
  - 3 generations likely
  - Need 8 to 10 sprays total
Bell pepper insecticide trials

• **Target:**
  – European corn borer *
  – Fall armyworm
  – Corn earworm

• **Uncertainty**
  – ECB population size

• **Spray interval**
  – 10-day in 2013
  – 7-day in 2014 & 2016
Bell pepper insecticide trials 2013, 2014, 2016

- Registered insecticides
  - Orthene
  - Coragen
  - Avaunt
  - Radiant
  - Mustang Maxx
  - Hero
  - Gladiator

- Experimental insecticides
  - Harvanta (cyclaniliprole)
  - Intrepid Edge (Intrepid + Radiant)
  - RDS-63 (dicloromezotizaz)
Worm pressure varies year to year

<table>
<thead>
<tr>
<th></th>
<th>% of pepper fruit damaged by caterpillars in untreated plots</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year &gt;&gt;</strong></td>
<td>2013</td>
</tr>
<tr>
<td>Harvest #1</td>
<td>0%</td>
</tr>
<tr>
<td>Harvest #2</td>
<td>34%</td>
</tr>
<tr>
<td>Harvest #3</td>
<td>41%</td>
</tr>
<tr>
<td>Harvest #4</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Cumulative</strong></td>
<td>25%</td>
</tr>
</tbody>
</table>
Marketable yield of red bell peppers in 4 harvests (cumulative) after 5 insecticide applications at 10-day spray interval, Fremont, Ohio, 2013

- Coragen: 19 kg (A)
- Orthene: 18.4 kg (AB)
- Cyclaniliprole, high: 17.2 kg (AB)
- Glad/Hero/Mustang: 16.6 kg (AB)
- Cyclaniliprole, low: 15.7 kg (BC)
- Avaunt: 12.9 kg (CD)
- Radiant: 12.7 kg (D)
- Untreated: 11.9 kg (D)

P = 0.0002
Red bell pepper insecticide trial, **2014**
Marketable yield in 4 cumulative harvests
After 7 sprays at **7-day** intervals

- Cyclan 16: 29 kg/plot
- Coragen: 28.1 kg/plot
- Avaunt: 27.1 kg/plot
- Cyclan 11: 26.5 kg/plot
- Radiant: 26.3 kg/plot
- Cyclan22: 25.9 kg/plot
- Orthene: 24.8 kg/plot
- Untreated: 22.6 kg/plot

\[ P = 0.08 \]
‘Standard’ program for bell peppers, 2016

<table>
<thead>
<tr>
<th>spray</th>
<th>product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coragen SC 5 fl oz/A</td>
</tr>
<tr>
<td>2</td>
<td>Orthene 97SP, 1 lb/A</td>
</tr>
<tr>
<td>3</td>
<td>Coragen SC 5 fl oz/A</td>
</tr>
<tr>
<td>4</td>
<td>Orthene 97SP, 1 lb/A</td>
</tr>
<tr>
<td>5</td>
<td>Coragen SC 5 fl oz/A</td>
</tr>
<tr>
<td>6</td>
<td>Mustang Maxx, 4 fl oz/A</td>
</tr>
<tr>
<td>7</td>
<td>Mustang Maxx, 4 fl oz/A</td>
</tr>
<tr>
<td>8</td>
<td>Mustang Maxx, 4 fl oz/A</td>
</tr>
</tbody>
</table>
Red bell pepper insecticide trial, 2016
Marketable yield in 4 cumulative harvests
After 8 sprays at 7-day intervals

Coragen/Orthene/Mustang
untreated
Harvanta
IntrepidEdge
Radiant

weight (kg) per plot

$P = 0.08$

$P = 0.45$
Red bell pepper insecticide trial, 2016
% of total fruit damaged by caterpillars
After 8 sprays at 7-day intervals

P = 0.20
Corn earworm control, sweet corn field trials 2007-2015

Jim Jasinski & Celeste Welty

- Concern about pyrethroid resistance
- Start spray program at 1st silk
- 6 sprays at 3- to 4-day intervals
Target pests

• Primary:
  – Corn earworm

• Other caterpillars:
  – European corn borer
  – Fall armyworm

• Other pests
  – Silk-clipping beetles
  – Corn leaf aphid (in husks)
Treatments

• Older a.i.s:
  – Pyrethroids: Brigade (= Capture), Warrior, Hero, Asana, MustangMax
  – Carbamates: Lannate, Larvin

• Newer a.i.s:
  – Radiant
  – Coragen
  – Belt
  – Blackhawk
  – virus: Gemstar

• Pre-mix:
  – Voliam Xpress

• Hybrids
  – BT corn ‘Attribute BC 0805’
  – ‘Providence’ isoline
<table>
<thead>
<tr>
<th>Year</th>
<th># larvae per ear in untreated plots</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corn earworm</td>
</tr>
<tr>
<td>2007</td>
<td>2.7</td>
</tr>
<tr>
<td>2008</td>
<td>0.1</td>
</tr>
<tr>
<td>2009</td>
<td>1.3</td>
</tr>
<tr>
<td>2010</td>
<td>0.8</td>
</tr>
<tr>
<td>2011</td>
<td>0.1</td>
</tr>
<tr>
<td>2012</td>
<td>0.2</td>
</tr>
<tr>
<td>2013</td>
<td>0.1</td>
</tr>
<tr>
<td>2014</td>
<td>1.8</td>
</tr>
<tr>
<td>2015</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Corn earworm seasonal activity
- red dashed line = “high” moth density, 13 moths/day in trap

Pheromone traps, South Charleston, Ohio

Corn earworm, 2010

2010
Corn earworm seasonal activity

- red dashed line = “high” moth density, 13 moths/day in trap
- red shading = silking = spray period

2010
Corn earworm seasonal activity

- red dashed line = “high” moth density, 13 moths/day in trap
- red shading = silking = spray period

Pheromone traps, South Charleston, Ohio

South Charleston, Ohio, 2011
## Corn earworm in field trials

<table>
<thead>
<tr>
<th>Year</th>
<th>Corn earworm pressure</th>
<th># moths/day at peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Very high, prolonged</td>
<td>388</td>
</tr>
<tr>
<td>2008</td>
<td>Low</td>
<td>5</td>
</tr>
<tr>
<td>2009</td>
<td>High but quick</td>
<td>63</td>
</tr>
<tr>
<td>2010</td>
<td>Very high</td>
<td>270</td>
</tr>
<tr>
<td>2011</td>
<td>High but late</td>
<td>66</td>
</tr>
<tr>
<td>2012</td>
<td>Moderate</td>
<td>37</td>
</tr>
<tr>
<td>2013</td>
<td>Low</td>
<td>5</td>
</tr>
<tr>
<td>2014</td>
<td>Moderate but late</td>
<td>15</td>
</tr>
<tr>
<td>2015</td>
<td>Moderate</td>
<td>53</td>
</tr>
</tbody>
</table>
# Year-to-year differences in damage

<table>
<thead>
<tr>
<th>Year</th>
<th>CEW pressure</th>
<th>% of ears with no kernel damage</th>
<th>Untreated</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Very high</td>
<td></td>
<td>3%</td>
</tr>
<tr>
<td>2008</td>
<td>Low</td>
<td></td>
<td>59%</td>
</tr>
<tr>
<td>2009</td>
<td>High</td>
<td></td>
<td>9%</td>
</tr>
<tr>
<td>2010</td>
<td>Very high</td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>2011</td>
<td>High, late</td>
<td></td>
<td>82%</td>
</tr>
<tr>
<td>2012</td>
<td>Moderate</td>
<td></td>
<td>61%</td>
</tr>
<tr>
<td>2013</td>
<td>Low</td>
<td></td>
<td>51%</td>
</tr>
<tr>
<td>2014</td>
<td>Mod., late</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>2015</td>
<td>Moderate</td>
<td></td>
<td>2%</td>
</tr>
<tr>
<td>Year</td>
<td>CEW pressure</td>
<td>% of ears with no kernel damage</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
<td>--------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Untreated</td>
<td>Warrior (max rate)</td>
</tr>
<tr>
<td>2007</td>
<td>Very high</td>
<td>3%</td>
<td>49%</td>
</tr>
<tr>
<td>2008</td>
<td>Low</td>
<td>59%</td>
<td>96%</td>
</tr>
<tr>
<td>2009</td>
<td>High</td>
<td>9%</td>
<td>94%</td>
</tr>
<tr>
<td>2010</td>
<td>Very high</td>
<td>1%</td>
<td>60%</td>
</tr>
<tr>
<td>2011</td>
<td>High, late</td>
<td>82%</td>
<td>99%</td>
</tr>
<tr>
<td>2012</td>
<td>Moderate</td>
<td>61%</td>
<td>96%</td>
</tr>
<tr>
<td>2013</td>
<td>Low</td>
<td>51%</td>
<td>99%</td>
</tr>
<tr>
<td>2014</td>
<td>Mod., late</td>
<td>0%</td>
<td>18%</td>
</tr>
<tr>
<td>2015</td>
<td>Moderate</td>
<td>2%</td>
<td>8%</td>
</tr>
</tbody>
</table>
Sweet Corn 2010

- VoliamXpress, 7 oz/A: 94%
- Hero: 88%
- Coragen before Asana, Lannate: 86%
- Coragen mid & late: 70%
- Coragen after Asana, Lannate: 68%
- Warrior II: 60%
- Attribute with no sprays: 21%
- Untreated: 1%

P < 0.0001

% of ears with no kernel damage
Comparison of spray schedule intensity, 2010

• One product: Warrior, at max rate

• Treatments (during silking):
  – Spray every 2 days (11 times)
  – Spray every 3 days (7 times)
  – Spray every 4 days (6 times)
  – Spray every 5 days (5 times)
  – Usual: start 3-day, then 4-day (6 times)
Sweet corn, 2010, spray interval trial: % with no kernels damaged

- 2-day: 84%
- 3-day: 80%
- 4-day: 65%
- 3- to 4-day: 60%
- 5-day: 54%
- Untreated: 1%

P < 0.0001
Conclusions from 9 years of field trial data

• Relief that pyrethroids still ok
  – when CEW low
  – but max rates needed

• Relief that new a.i.s now available
  – diamides
  – spinosyns

• Worry about whether efficacy of pyrethroids will suddenly drop
Thrips trials on cabbage 2012, 2013, 2015

- Evaluate Exirel (cyazypyr)
- Damage rating: scale 1 to 5
- Rate each of outer 10 head leaves
- Use sum of 10 ratings per head

Onion Thrips Severity Ratings in Cabbage

Thrips Damage Rating: 0.5  Thrips Damage Rating: 1.0  Thrips Damage Rating: 2.0

Thrips Damage Rating: 2.5  Thrips Damage Rating: 4.0  Thrips Damage Rating: 5.0

Scale of 0-5: 0 = no damage; 1 = minor; 2 = below average; 3 = average; 4 = above average; 5 = very bad
### Thrips treatments in 2012:
**Sequence of 3 products @ 2 sprays, spray every 2 weeks**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Spray 1 (&amp; 2)</th>
<th>Spray 3</th>
<th>Spray 4</th>
<th>Spray 5</th>
<th>Spray 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (standard)</td>
<td>Movento + Dipel</td>
<td>Radiant</td>
<td>Radiant</td>
<td>Assail</td>
<td>Assail</td>
</tr>
</tbody>
</table>
**Thrips treatments in 2012:**
Sequence of 3 products @ 2 sprays, spray every 2 weeks

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Spray 1 (&amp; 2)</th>
<th>Spray 3</th>
<th>Spray 4</th>
<th>Spray 5</th>
<th>Spray 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (standard)</td>
<td>Movento + Dipel</td>
<td>Radiant</td>
<td>Radiant</td>
<td>Assail</td>
<td>Assail</td>
</tr>
<tr>
<td>2</td>
<td>Movento + Dipel</td>
<td>Exirel</td>
<td>Exirel</td>
<td>Assail</td>
<td>Assail</td>
</tr>
<tr>
<td>3</td>
<td>Exirel</td>
<td>Radiant</td>
<td>Radiant</td>
<td>Assail</td>
<td>Assail</td>
</tr>
<tr>
<td>4</td>
<td>Exirel</td>
<td>Exirel</td>
<td>Exirel</td>
<td>Exirel</td>
<td>Exirel</td>
</tr>
<tr>
<td>5</td>
<td>Radiant</td>
<td>Radiant</td>
<td>Radiant</td>
<td>Radiant</td>
<td>Radiant</td>
</tr>
<tr>
<td>6</td>
<td>Hero</td>
<td>Hero</td>
<td>Hero</td>
<td>Hero</td>
<td>Hero</td>
</tr>
<tr>
<td>7</td>
<td>Assail</td>
<td>Assail</td>
<td>Assail</td>
<td>Assail</td>
<td>Assail</td>
</tr>
<tr>
<td>8 (untrt)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Thrips on cabbage, Fremont, 2012
Thrips on cabbage, Fremont, 2012

Onion thrips control on cabbage

- Exirel only (C)
- Radiant only (C)
- Movento/Exirel/Assail (BC)
- Movento/Radiant/Assail (BC)
- Assail only (B)
- Exirel/Radiant/Assail (B)
- Hero only (A, standard)
- Untreated (A)

Damage rating: 0 to 7
Thrips on cabbage, Fremont, 2012

Onion thrips control on cabbage

- Exirel only: C
- Radiant only: C
- Movento/Exirel/Assail: BC
- Movento/Radiant/Assail: BC
- Assail only: B
- Exirel/Radiant/Assail: B
- Hero only: A
- Untreated: A

'standard'
Thrips treatments in 2013:
Sequence of 4+ products @ 2 sprays, spray every 10 days

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Sprays 1 &amp; 2</th>
<th>Sprays 3 &amp; 4</th>
<th>Sprays 5 &amp; 6</th>
<th>Sprays 7 &amp; 8</th>
<th>Spray 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (standard)</td>
<td>Movento + Dipel</td>
<td>Radiant</td>
<td>Assail</td>
<td>Lannate</td>
<td>Baythroid</td>
</tr>
</tbody>
</table>
Thrips treatments in 2013:
Sequence of 4+ products @ 2 sprays, spray every 10 days

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Sprays 1 &amp; 2</th>
<th>Sprays 3 &amp; 4</th>
<th>Sprays 5 &amp; 6</th>
<th>Sprays 7 &amp; 8</th>
<th>Spray 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (standard)</td>
<td>Movento + Dipel</td>
<td>Radiant</td>
<td>Assail</td>
<td>Lannate</td>
<td>Baythroid</td>
</tr>
<tr>
<td>2</td>
<td>Movento + Dipel</td>
<td>Exirel</td>
<td>Assail</td>
<td>Lannate</td>
<td>Baythroid</td>
</tr>
<tr>
<td>3</td>
<td>Movento + Dipel</td>
<td>Radiant</td>
<td>Exirel</td>
<td>Lannate</td>
<td>Baythroid</td>
</tr>
<tr>
<td>4</td>
<td>Movento + Dipel</td>
<td>Radiant</td>
<td>Assail</td>
<td>Exirel</td>
<td>Baythroid</td>
</tr>
<tr>
<td>5</td>
<td>Radiant</td>
<td>Exirel</td>
<td>Assail</td>
<td>Lannate</td>
<td>Baythroid</td>
</tr>
<tr>
<td>6 (untrt)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Thrips control on cabbage
Fremont, Ohio
2013

Radiant/Exirel/Assail/Lannate

Movento/Radiant/Assail/Exirel

Movento/Exirel/Assail/Lannate

Movento/Radiant/Exirel/Lannate

Movento/Radiant/Assail/Lannate

untreated

Sum of injury rating on 10 leaves

P < 0.0001

A

B

2.3

2.4

1.2

1.8

2.4

6.8
Thrips control on cabbage
Fremont, Ohio
2013

Radiant/Exirel/Assail/Lannate
1.2 B

Movento/Radiant/Assail/Exirel
1.8 B

Movento/Exirel/Assail/Lannate
2.3 B

Movento/Radiant/Exirel/Lannate
2.4 B

Movento/Radiant/Assail/Lannate
2.4 B

untreated
6.8 A

Sum of injury rating on 10 leaves

P < 0.0001

‘standard’
Thrips treatments in 2015:  
Sequence of 4 products @ 2 sprays,  
spray every 10 days

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Sprays 1 &amp; 2</th>
<th>Sprays 3 &amp; 4</th>
<th>Sprays 5 &amp; 6</th>
<th>Sprays 7 &amp; 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (standard)</td>
<td>Radiant</td>
<td>Movento + Dipel</td>
<td>Assail</td>
<td>Lannate</td>
</tr>
</tbody>
</table>
Thrips treatments in 2015:
Sequence of 4 products @ 2 sprays, spray every 10 days

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Sprays 1 &amp; 2</th>
<th>Sprays 3 &amp; 4</th>
<th>Sprays 5 &amp; 6</th>
<th>Sprays 7 &amp; 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (standard)</td>
<td>Radiant</td>
<td>Movento + Dipel</td>
<td>Assail</td>
<td>Lannate</td>
</tr>
<tr>
<td>2</td>
<td>Radiant</td>
<td>Exirel (13.5 oz/A)</td>
<td>Assail</td>
<td>Lannate</td>
</tr>
<tr>
<td>3</td>
<td>Radiant</td>
<td>Exirel (16.9 oz/A)</td>
<td>Assail</td>
<td>Lannate</td>
</tr>
<tr>
<td>4</td>
<td>cyclaniliprole</td>
<td>cyclaniliprole</td>
<td>cyclaniliprole</td>
<td>cyclaniliprole</td>
</tr>
<tr>
<td>5 (untrt)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Thrips control on cabbage
Fremont, Ohio
2015

- Standard: 1.02
- Cyclaniliprole: 1.5
- Exirel high: 1.6
- Exirel low: 1.65
- Untreated: 3.82

$P = 0.01$
Conclusions: thrips on cabbage

- Intensive schedule gives good control
  - 10-day interval
  - 2 sprays Radiant
  - 2 sprays Movento + Dipel
  - 2 sprays Assail
  - 2 sprays Lannate
- Exirel fits well early or late
- Exirel lower rate is acceptable
- cyclaniliprole (Harvanta) will fit well
Resources on website

u.osu.edu/pestmanagement/

• Reports on Ohio insecticide trials
  – Bell pepper
  – Cabbage
  – Sweet corn
  – Apples
• IPM guidelines
  – Sweet corn
  – Apples
• Trap reports from Ohio locations
• Pictures of pests
Info on fruit & veg. pests
u.osu.edu/pestmanagement/

Questions?
e-mail: welty.1@osu.edu
office phone: 614 292 2803