Black Cutworm

- **First larval stage**
  - Feed briefly on **foliage**, then move &
  - Feed on **roots** and **crown** of plants

- **Second and third stage**
  - Feed at the **soil surface** mostly at night.

- **Wilted & cut plants** are visible indicators

- **Cutworm occurs:**
  - Following sod
  - Winter annual weeds
  - First along weedy margins
  - Damage scattered, rarely have to treat
Tob Field -- Cutworms

- **Baits**
  - Dylox, Proxol --------- 5 Bait

- **SPRAYS**
  - Proxol 80SP --------- 20 oz/25 gals
  - Orthene 97PE -------- 1 ½ lb (24 oz) / A
  - Lorsban 4EC, 15G ---- 2-3 qts / A, 13.5-20 lbs / A
  - Warrior 1CS --------- 1.92 – 3.84 fl oz / A
  - Karate 2.08CS ------- 0.96-1.92 oz / A
  - Capture 2EC --------- 2.56-6.4 fl oz / A

- **Tray Dr**
  - Admire Pro4.6 (suppress) -- 0.8-1.2 oz./1000 plts

- **TPW**
  - Capture 2EC --------- 4.0-6.4 fl oz / A

- **PPI**
  - Mocap 15G --------- 13 lbs / A
  - Capture 2EC --------- 0.0624 – 0.1 lb ai / A
Insecticides for cutworms

- **Cutworms**  (Control = Range from Poor to Good)
  - *Foliar treatments late in the afternoon:*
    - *Good:* Orthene, Capture*
    - Poor-Fair: Assail
  - **Preplant soil treatments:**
    - Fair to Good: Capture*, Lorsban, Lorsban Advanced*, Mocap
  - **Transplant water treatments:**
    - Fair to Good: Orthene, Capture*
    - Poor to fair: Admire Pro??
Wireworms

- **Tobacco wireworm & the southern potato wireworm** occur throughout the south
- **Major soil insect** attacking tobacco
- **Most destructive** to newly transplanted tobacco
- **First sign** of problem is
  - stunting and uneven stand
Wireworms

Major soil insect
Occurs in tobacco following sod is damaged
Plants stunt & wilt & die
Cut off underground stems & roots
Wireworms - Tray, Drench, PTPlt

- Platinum 2SC TD/TPW 1.3 fl oz / 1000 plts
- Admire Pro 4.6SC TD/TPW 0.6–1.2 fl oz / 1000 plts
- Capture 2EC TPW/PPI 4.0-6.4 oz/A
- Di-Syston 15 G PPI 13.3-26.7 lbs
- Mocap 10G, 6EC PPI 20 lbs, 1/3 gal
- Lorsban 15G PPI 13.5-20 lbs
- Lorsban 4EC PPI 2qts to 1qt/A
- Lorsban Advanced 3.755 EC PPI 2pts/A
Lorsban 4E / Lorsban Advanced 3.755 EW (Emulsion in Water)

- **Controls** wireworms, cutworms & other soil insects
- Lorsban Advanced 3.755 EW (Emulsion in Water) replaced Lorsban 4E as of Jan ‘09
- **Labeled rate decreased** from 2 quarts/acre to 1 quart/acre
- Used to control pests in same way as Lorsban 4E
Lorsban 4E / Lorsban Advanced 3.755 EW (Emulsion in Water)

- **Lorsban Advanced**
  - Water-based formulation
  - Emits fewer volatile organic compounds (VOC) & has less odor

- **Lorsban 4E**
  - Emulsifiable concentrate
  - Contains a liquid a.i.
  - One or more petroleum-based solvents (which give EC formulations their strong odor)
Insecticides for wireworms

- **Wireworms**: (Controls fair to good)
  - **PPI**:
    - Fair-Good: Capture*, Lorsban, Lorsban Advanced*, Mocap
  - **Tray drench treatment**:
    - Fair to Good: Admire Pro, Platinum
  - **Transplant water**
    - Poor to fair: Orthene
    - Fair to good: Admire Pro, Capture*, Platinum
Flea Beetles

- **Larvae**
  - Feed 4-5 weeks on plant roots
  - Cuts off small roots & sometimes tunnel into the stalk

- **Adults**
  - Attack plants in seed bed
  - Feed on plants when set & damage throughout growing season
  - Weaken plant, devalue leaf
Flea Beetles / Black Shank Res Data Indicates

- Feeding by adult and larval flea beetles appears to increase plant susceptibility to black shank.
- Wireworms and nematodes are probably also important.
- Admire tray drench treatment
  - alone and in combination with two applications of Ridomil Gold
  - reduced incidence of black shank in susceptible varieties of flue-cured tobacco.
Plots treated with Admire applied as a tray drench treatment and the untreated check, 130 days after transplanting, 2005.
Tob Fields – Flea Beetles

**EARLY SEASON FB CONTROL**

- **Platinum 2SC** (thiamethoxam, N) 0.8-1.3 fl oz/1000plts  **Tray Drench**
- **Orthene 97PE** (acephate, OP) 1 ½ lb (24 oz)  **TPW**
- **Admire Pro 4.6 SC** (imidacloprid, N) 0.5/0.6 fl oz /1000plts  **TD/TPW**
- **Capture 2EC** (bifenthrin, P) 4.0-6.4 oz/A  **PPI / TPW**
- **Belay 16 WSG** (clothianidin, N) 5-10 oz/A  **TPW or TD**
- **Vydate 2L** 1 ¾ pts/7900 plants/A  **TPW**
- **Lorsban 3.755EW Ad.** (chlorpyrifos, OP) 2 pt/A  **PPI**
# Tob Fields – Flea Beetles

**DURING SEASON FB TREATMENTS**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Application Rate</th>
<th>Formulation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthene 97PE (acephate, OP)</td>
<td>1 lb (16 oz)</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Warrior 1CS (lambdacyhalothrin, P)</td>
<td>1.92-3.84 fl oz /A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Actara -- 25WG (thiamethoxam, N)</td>
<td>2-3 oz/A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Provado 1.6F (imidacloprid, N)</td>
<td>4 oz/A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Belay 50 WDG (clothianidin, N)</td>
<td>1.5-2.0oz/A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Nuprid 1.6F (imidacloprid, N)</td>
<td>4 oz/A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Capture 2EC (bifenthrin, P)</td>
<td>2.56-6.4 oz/A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Lannate 90SP (methomyl, )</td>
<td>¼ - 1 ½ pts/A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Lannate 2.4LV</td>
<td>¾ - 1 ½ pts / A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Karata 2.08CS (lambda-cyhalothrin)</td>
<td>0.96 – 1.92 fl oz / A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Sevin 80SP (carbaryl)</td>
<td>1 ¼ - 2 ½ lbs/A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Sevin , XLR Plus</td>
<td>1/0 – 2.0 qts / A</td>
<td>Foliar</td>
<td></td>
</tr>
<tr>
<td>Supracide 2EC</td>
<td>2-3 pts/25 gals</td>
<td>Foliar</td>
<td></td>
</tr>
</tbody>
</table>
Flea Beetle Control

- **Spraying Notes**
  - **Large plants** – use higher rates
  - **Thoroughly cover** the **lower leaves** with spray
Insecticide for tobacco flea beetles

- **Seedling tray** drench applications
  - ✭ **Good to Excellent**: Admire Pro, Platinum

- **Transplant water** treatments
  - ✭ **Fair to Good**: Admire Pro, Capture, Orthene, Platinum

- **Foliar** sprays
  - **Good**: Orthene, Actara, Assail, Provado, Lannate
Tobacco Aphid

- **ID Characteristics**
  - Small, soft-bodied, smooth-looking aphid
  - Pair of cornicles (tailpipe-like appendages)

- **Red Form** -- first occurred on tobacco in **1986**

- **Red Form VS Green Form:**
  - RF more tolerant of high temperatures
  - RF more resistant to several insecticides than green form
    - Developing resistance – major concern
  - RF reproductive rate faster than green form in hot weather
The **orange form** of the tobacco aphid is *more resistant* to Orthene and Lannate than the *red and green forms*.
Color Morphs of the Tobacco-Adapted Form of the Green Peach Aphid

Orange

Orange Form

Red

Green Form
Tobacco Aphid

- **Colonize** - Clusters on underside of leaves
- **Build up** in a short time
- **Several generations** per year

- **Suck plant juices**, making the leaves thin and light in weight
- **Transmit viruses** –
  - Tobacco etch & potato virus Y (PVY)
- **Ripens** prematurely
Tobacco Aphid

- **Deposit honeydew** on leaves
  - A sweet, stick substance
- **Black sooty mold**, fungus, develop on the honeydew
- **Poor quality** off color, leaves stick together
- **Dead areas** at the base of the leaves
- **Improper curing** results
Black Sooty Mold Started
Tobacco Aphid
Tobacco Aphid

- **With 6 to 8 weeks** of sap removal
  - Tob aphids can reduce yields by **300 to 500 pounds / A**
- **Late control applications** – NO! NO! NO! NO! NO!
  - Generally produce unsatisfactory results & the yield losses have already occurred
- **Most Effective aphid control**
  - Must begin as **small colonies** or clusters of aphid are seen on the **upper leaves of 10% of the plants** in the field
Rating of insecticides applied as greenhouse tray drench, soil, and transplant water treatments for aphid and flea beetle control on flue-cured tobacco. (PSemtner)

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Application method</th>
<th>Leaf feeding insects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Aphids</td>
</tr>
<tr>
<td><strong>Admire</strong></td>
<td><strong>TD</strong></td>
<td>★ 5</td>
</tr>
<tr>
<td><strong>Admire</strong></td>
<td><strong>TW</strong></td>
<td>★ 5</td>
</tr>
<tr>
<td><strong>Temik</strong></td>
<td><strong>Band</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>Lorsban</strong></td>
<td><strong>PPI</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Mocap</strong></td>
<td><strong>PPI</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Orthene</strong></td>
<td><strong>TW</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Platinum/TMOXX</strong></td>
<td><strong>TD</strong></td>
<td>★ 5</td>
</tr>
<tr>
<td><strong>Platinum/TMOXX</strong></td>
<td><strong>TW</strong></td>
<td>★ 5</td>
</tr>
</tbody>
</table>
Rating of FOLIAR insecticides for control of aphids, flea beetles and grasshoppers on tobacco.

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Aphids</th>
<th>Flea beetles</th>
<th>Grasshoppers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actara (thiamethoxam, N)</td>
<td>★4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Assail (acetamiprid, N)</td>
<td>★4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Fulfill (pymetrozine)</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lannate (methomyl, C)</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Orthene (acephate, OP)</td>
<td>★4</td>
<td>3</td>
<td>★☆ 4</td>
</tr>
<tr>
<td>Provado/Nuprid/ (Pasada (imidacloprid, N)</td>
<td>★4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Sevin (carbary, C)</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Tracer (spinosad, SB)</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Thiodan (endosulfan, CH)</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Warrior (lambda-chyalothrin, P)</td>
<td>1</td>
<td>★☆ 4</td>
<td>3</td>
</tr>
</tbody>
</table>

0 = not labeled or no control; 5 = excellent control
Mortality over time for tobacco aphids reared on leaf disks from field grown flue-cured tobacco treated with Admire 2F applied as a tray drench at 1.4 fl oz/1,000 plants.

<table>
<thead>
<tr>
<th>Post Treatment Interval</th>
<th>Control declined 8% per week</th>
<th>Control declined 10% per week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom leaf</td>
<td>Top leaf</td>
</tr>
<tr>
<td></td>
<td>T4 - Lower</td>
<td>T4 - Upper</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>90</td>
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<tr>
<td></td>
<td>88</td>
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<td>24</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>22</td>
</tr>
</tbody>
</table>

Field 06-07 leaf Position (T4)
Orthene, Lannate, and Warrior were applied as foliar sprays on July 3 and 17.
Influence of insecticide treatment for aphid control on the YIELD of flue-cured tobacco, 2008

Yield (lb/acre)
Yield of Burley Tobacco treated with Admire Pro and Plantimum for aphid and flea beetle control, 2008
Tobacco Field -- Aphids

- **Platinum 2SC** (thiamethoxam, N) 0.5-1.3 fl oz / 1000 plts Tray Drench/TPW
- **Admire Pro 4.6SC** (imidacloprid, N) 0.5/0.6 fl oz / 1000 plts Tray Drench/TPW
- **Orthene 97PE** (acephate, OP) Burley 1½ lb (2 Cans) TPW, Foliar
- **Belay 16 WSG** (clothianidin, N) 10 oz/A TPW, TD
- **Di-Syston 15G** (disulfoton, OP) 3.3-26.7 lbs **Soil Incorporate Pre-Transplant**
Tobacco Field -- Aphids

- Fulfill 50WDG (pymetrozine) 2.75 oz / A  
- Warrior 1CS (lambda-cyhalothrin, P) 1.92-3.84 fl oz / A Suppression Only!  
- Assail 70WP (acetamiprid, N) 0.6-1.7 oz/A  
- Assail 30SG (acetamiprid. N) 1.5-4.0 oz/A  
- Nuprid 1.6F (imidacloprid, N) 2-4 oz/A  
- Capture 2EC (bifenthrin, P) 2.56-6.4 oz/A  
- Belay 50WDG (Clothianidin, N) 1.5-2 oz/A  
- Actara 25WDG (thiamethoxam, N) 2.0 – 3.0 oz / A  
- Lannate 90SP, 2.4LV (methomyl) ½ lb / A, 1 ½ pt / A  
- Provado 1.6F (imidacloprid) 2.0 – 4.0 fl oz / A  
- Karate 2.08CS (lambda-cyhalothrin) 0.96 – 1.92 fl oz / A  
- Malathion 57EC 2/3-1 1/3 qts/25 gals
Generic brands of imidacloprid and thiamethoxam

- **Imidacloprid (Admire 2F)**-Several generic brands may be available
  - Alias 2F-Makhteshim Agan
  - Pasada 1.6F-Foliar treatment
  - Couraze 2F-Chemainova
  - Nuprid 2.0F and 1.6F foliar-NuFarm Americas
  - Others?

- **Thiamethoxam (Platinum 2SC)**
  - Platinum-rates similar to Admire Pro
  - TMOXX-rates similar to Admire Pro
  - Actara 25 WSG-Foliar treatment
Insecticide for tobacco aphids

- **Seedling tray drench applications**
  - Good to Excellent: Admire Pro, Platinum

- **Transplant water treatments**
  - Good to Excellent: Admire Pro, Platinum

- **Foliar sprays**
  - Excellent: Orthene, Actara, Assail, Provado
  - Good: Fulfill
  - Fair: Lannate
Phytotoxicity to tobacco treated with Admire Pro and other neonicotinoids
Causes of Admire Phytotoxicity

- **Application rate**
  - Too high, uneven distribution

- **Application with other chemicals:**
  - Actigard (fungicide) and others. **Apply Admire Pro first**, then apply the other chemicals.

- **Waiting too long after tray drench application to transplant**
  - The problem becomes worse over time in the trays.

- **Bad weather**
  - Hot, dry, windy conditions, very dry soils

- **Transplant water treatment**
  - May settle out.
Admire enhances maturity, tobacco grown on fumigated land, SPAREC, 2006.
Tobacco Budworm

- Eggs: White or cream color, subspherical with a flattened base.
**Tobacco Budworm**

- Feeding in bud
- Fecal pellets
- Tunneling in stalk will also tunnel in midrib of leaf
Tobacco Budworm

- Eggs laid near bud
- Larvae begin feeding in the unfolded leaflets
- *Leaves -- ragged or distorted
- *Bud may be destroyed
  - *Early sucker growth occurs
  - May cause plant stunting and greater difficulty in controlling suckers
  - Hard to control in bud
Tobacco Filed -- Budworms

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Description</th>
<th>Rate</th>
<th>Application Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthene 97PE</td>
<td>Acephate, OP</td>
<td>¾ lb/25 gals</td>
<td>Foliar</td>
</tr>
<tr>
<td>Denim 0.16EC</td>
<td>Emamectin benzoate, SB</td>
<td>8-12 fl oz / A</td>
<td></td>
</tr>
<tr>
<td>Tracer</td>
<td>Spinosad, SB</td>
<td>1.4-2.9 oz/A</td>
<td></td>
</tr>
<tr>
<td>Warrior</td>
<td>Lambda-cyhalothrin, P</td>
<td>1.92-3.84 fl oz / A</td>
<td></td>
</tr>
<tr>
<td>Dylox 80SP</td>
<td>Trichlorfon, OP</td>
<td>20 oz/25 gals</td>
<td></td>
</tr>
<tr>
<td>Dipel (Bt)</td>
<td>2XWP</td>
<td>10 – 25 lbs / A of bait</td>
<td></td>
</tr>
<tr>
<td>Sevin 80SP</td>
<td>Carbaryl, C</td>
<td>1 ¼ - 2 ¼ lbs/25gals</td>
<td></td>
</tr>
<tr>
<td>Lannate 2.4LV</td>
<td>Methomyl, C</td>
<td>½ lb/25 gals</td>
<td></td>
</tr>
<tr>
<td>Belay 50WDG</td>
<td>Clothianidin, N</td>
<td>2 oz/A (suppression)</td>
<td></td>
</tr>
<tr>
<td>Karata 2.08CS</td>
<td>Lambda-cyhalothrin</td>
<td>0.96 – 1.92 fl oz / A</td>
<td></td>
</tr>
<tr>
<td>*Assail 30SG</td>
<td>Acetamiprid</td>
<td>1.5 – 2.5 oz / A</td>
<td></td>
</tr>
<tr>
<td>*Assail 70WP</td>
<td></td>
<td>1.1 oz / A</td>
<td></td>
</tr>
</tbody>
</table>

* Ovicide, Adulticide, Larvicide
Tobacco Filed -- Budworms

- **New Labels**
  - **Belt 4SC** (flubendiamide)
    - 2.0 – 3.0 fl oz / A
    - 12 hrs REI
    - 14 dys PHI
  - **Coragen 1.67 SC** (chlorantraniliprole)
    - Suspension Concentrate
    - 5.0 fl oz / A
    - 4 hrs REI
    - 1 dy PHI
Budworm control on flue-cured tobacco treated with various foliar insecticides, 2007 (PSemtner)

All gave Significant Control

Source: Sterling Southern, NC State
Rating of foliar insecticides for control of budworm, hornworm and cutworm control on tobacco. (PSemtner)

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Budworm</th>
<th>Hornworm</th>
<th>Cutworm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belay, Assail</td>
<td>1-2</td>
<td>2-3</td>
<td>0</td>
</tr>
<tr>
<td>Bt (Dipel, etc)</td>
<td>2</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Denim</td>
<td>★4</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Lannate</td>
<td>3</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Orthene</td>
<td>3</td>
<td>★5</td>
<td>★4</td>
</tr>
<tr>
<td>Sevin</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Capture</td>
<td>3</td>
<td>★5</td>
<td>3</td>
</tr>
<tr>
<td>Tracer</td>
<td>★4</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Warrior</td>
<td>3</td>
<td>★5</td>
<td>3</td>
</tr>
</tbody>
</table>

0 = not labeled or no control; 5 = excellent control
Tobacco budworm control on flue-cured tobacco, Blackstone, Virginia, 2008

Insecticide

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Test 1</th>
<th>Test 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warrior 3.2 fl oz</td>
<td>72</td>
<td>83</td>
</tr>
<tr>
<td>Tracer 1.5 fl oz</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Orthene 0.77 lb</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>*Coragen 6.4 fl oz</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>*Coragen 3.2 fl oz</td>
<td>81</td>
<td></td>
</tr>
<tr>
<td>Capture 4 fl oz</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Denim 8 fl oz</td>
<td></td>
<td>96</td>
</tr>
<tr>
<td>*Belt 3 fl oz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percent budworm control
Belt 4SC: Flubendiamide

- **Company:** Bayer CropSciences
- **Chemical class:** benzene dicarboxamides (phthalic acid diamide)
- **Labeled for tobacco:** August 2008
- **Controls:** budworms and hornworms
- **Unique mode of action**
  - Paralyzes insects’ muscles
  - Insects stop feeding immediately
  - Ovi-larvicidal activity
- **Labeled rates:** 2.0 to 3.0 fl oz per acre
Belt 4SC: Flubendiamide

- Excellent residual control
  - 21-day residual control of tobacco hornworms, similar to Capture
- Budworm control similar to Tracer
- 12-hour reentry interval
- 14 day preharvest interval
- Excellent worker safety
- Limited impact on beneficial arthropods
Coragen/Rynaxypyr
Chlorantraniliprole

- DuPont 24C label in TN
- Chem Class – Anthranilic diamide
- Application Rate: 5 fl oz/acre
- Insects controlled: Hornworms & budworms
- Similar mode of action as belt (muscle paralysis)
- Long-lasting control
- REI: 4 hours
- PHI: 1 day
- Control caterpillars when injected through drip irrigation systems
Insecticides for budworm control

- **Very Good:** Belt*, Denim, Tracer, Coragen*
- **Fair:** Lannate, Orthene, Bt
- **Poor:** Assail
Tobacco Hornworm

Curved red horn

Tomato Hornworm

Straight black horn
Tobacco Hornworm  Fecal Pellets, Larva & Damage
Tobacco Hornworm

- **Generations** -- 2 ½ gen / year
- **Early generations**
  - Potentially damaging to marketable tobacco (June & Aug)
- **Later generations**
  - Feed after harvest on noncommercial suckers
- **Last generation** important – produce OW pupae
- Pupae enter **diapause** after 2\textsuperscript{nd} wk of Aug
- **Turn up soil** after harvest – destroys pupae
Hornworms on burley tobacco in the curing barn

1. **Very high populations** of hornworms can develop on burley tobacco in the **curing barn**.
2. **Check** tobacco **before harvesting** for both hornworm and hornworm eggs.
3. **If exceed one worm**, an inch or longer per **10 plants**, apply Dipel or another Bt to control them.
<table>
<thead>
<tr>
<th>Product</th>
<th>Rate/Unit</th>
<th>Application</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthene 97PE</td>
<td>½ lb / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Denim .16 EC</td>
<td>8-12 fl oz / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Warrior</td>
<td>1.92-3.84 fl oz / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Tracer</td>
<td>1.4-2.9 oz/A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Dylox</td>
<td>2 oz/25 gals</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Dipel (Bt)</td>
<td></td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Belay 50WDG (clothianidin) (Suppression)</td>
<td>1.5-2oz/A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Karata 2.08CS</td>
<td>0.96 – 1.92 fl oz / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Lannate 90SP</td>
<td>¼ - ½ lb / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Lannate 2.4 LV</td>
<td>¾ - 1 ½ pt / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Belt 4SC (flubendiamide)</td>
<td>2.0 – 3.0 fl oz / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Coragen 1.65SC(chlorantraniliprole)</td>
<td>5.0 fl oz / A</td>
<td>Spray</td>
<td></td>
</tr>
<tr>
<td>Insecticide</td>
<td>Budworm</td>
<td>Hornworm</td>
<td>Cutworm</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>Bt (Dipel, etc)</td>
<td>2</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Denim (emamectin benzoate)</td>
<td>★4</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Lannate</td>
<td>3</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Orthene/A97UP</td>
<td>3</td>
<td>★5</td>
<td>★4</td>
</tr>
<tr>
<td>Sevin</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Thiodan</td>
<td>3</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Tracer</td>
<td>★4</td>
<td>★5</td>
<td>0</td>
</tr>
<tr>
<td>Warrior</td>
<td>3</td>
<td>★5</td>
<td>3</td>
</tr>
</tbody>
</table>

0 = not labeled or no control; 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent control
Hornworm control on tobacco with various foliar insecticides, 2007

Days after transplanting

Hornworms/20 plants

- Capture
- Tracer
- Orthene
- Belt
- UTC
Insecticides for hornworm control

- **Excellent**
  - Early to Late: Belt, Bt (Dipel & others), Coragen, Lannate, Orthene
  - Within 2 weeks of harvest to prevent infestations in the curing barn: Bt, Orthene, Coragen (if labeled), Tracer

- **Very good**: Denim

- **Good**: Tracer, Sevin

- **Poor-Fair**: Assail
Thrips

Very small
Size of a speck of dirt
Thrips Damage
(Thripidae: *Frankliniella fusca* (Hinds))

**Feeding** usually follows **minor veins**
**Silvery outlines** around veins peppered with **minute black spots** underside
Similar in appearance to etch
**Heavy feeding** gives **leaves** a shiny or **silvery appearance**
**Suck sap**
**Transmits** TSWV
**No practical control**
Thrips

- **LC** (egg to adult) – 16 dys (NC)
- **Gen.** -- 5 overlapping generations
- **Control**
  - **Heavy rainfall** -- most effective *natural* control
  - **Predaceous** insects -- some value
  - **Systemic insecticides** applied at planting time controls
Thrips Control

- Platinum 2SC  1.3 oz/1000 Plts  TD/TWS
- Capture 2EC  2.56-6.4 oz/A  Foliar
- Warrior 1CS  1.92 – 3.84 fl ozs / A  Fol
- Karate 2.08CS  0.96 – 1.92 fl oz / A  Fol
Grasshopper Damage
Grasshopper Control

- Malathion 57EC  1qt/s5 gals/A  Foliar
- Orthene 97PE (acephate)  ¼-1/2 lb/25 gals  Foliar
- Warrior 1CS (lambda-cyhalothrin)  1.92-3.84 oz/A Foliar  (Suppression)
- Capture 2EC (bifenthrin)  2.56-6.4 oz/A  Foliar
Resistance management for the tobacco aphid on tobacco

- **Scout fields** and **use thresholds**
  - To ensure insecticides are **applied only when necessary**.
- Use
  - The **correct label rates** and **application procedures**.
- **Alternate**
  - Between insecticide groups.
- **Suspect** **control failures**
  - Treat crop with an insecticide from a **different chemical group**.
# Resistance management for the tobacco aphid on tobacco

(Insecticide Resistance Action Committee, IRAC)

<table>
<thead>
<tr>
<th>Insecticide Class</th>
<th>IRAC Grouping</th>
<th>Brand Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbamate</td>
<td>1A Acetylcholine esterase inhibitors</td>
<td>Sevin, Lannate, Temik</td>
</tr>
<tr>
<td>Organophosphate</td>
<td>1B Acetylcholine esterase inhibitors</td>
<td>Orthene, Acephate, Di-Syston, Dylox, Lorsban, Malathion, Mocap, Supracide</td>
</tr>
<tr>
<td>Neonicotinoid</td>
<td>4A Nicotinic Acetylcholine receptor agonists/antagonists</td>
<td>Admire, Platinum, Belay, Assail, Nuprid, Actara, Provado</td>
</tr>
<tr>
<td>Feeding blocker</td>
<td>9A Unknown or non-specific mode of action</td>
<td>Fulfill (Pymetrozine)</td>
</tr>
<tr>
<td>Pyrethroids</td>
<td>3 Sodium channel modulators 3</td>
<td>Warrior, Capture Pyganic</td>
</tr>
</tbody>
</table>

Avoid using more than one insecticide in the same class in back-to-back treatments.
# Resistance management for the tobacco aphid on tobacco

(Insecticide Resistance Action Committee, IRAC)

<table>
<thead>
<tr>
<th>Insecticide Class</th>
<th>IRAC Grouping</th>
<th>Brand Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological or bacteria</td>
<td>11A2</td>
<td>Bt, Ketch</td>
</tr>
<tr>
<td>Soil bacterium</td>
<td></td>
<td>Denim</td>
</tr>
<tr>
<td>Aerobic fermentation of soil bacterium</td>
<td></td>
<td>Tracer (spinosad)</td>
</tr>
<tr>
<td>Phthalic acid diamide</td>
<td>28</td>
<td>Belt</td>
</tr>
<tr>
<td>Muscle paralysis</td>
<td></td>
<td>Coragen</td>
</tr>
<tr>
<td>Carboxamide</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Muscle paralysis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Control Summary
Before Transplanting

- **Wireworms**
  - *Systemics*: Platinum or Admire –
    - Wireworms, early season FB, Aphids & Thrips
  - **Contacts**: Lorsban, Mocap –
    - Wireworms. Use only if high risk of pests

- **Cutworms**
  - Scattered, rarely damage enough to treat
    - Orthene, Dylox, Lorsban, Warrior
Examples of rotations for managing the tobacco aphid on tobacco

- Pretreatment with **Admire** (4A Neonicotinoid)
  - Follow up treatment with **Orthene** (1B OP) or **Fulfill** (9A Feeding Blocker)
- Foliar treatment with **Orthene** (1B OP)
  - Rotate with **Fulfill** (9A Feeding Blocker), or a 4A neonicotinoid (**Actara**, **Assail**, or **Provado**) and then **Orthene** (OP) again, if necessary.
Suggestions for managing insects on burley tobacco

1. Apply foliar insecticides at economic thresholds

2. **Control early season aphid infestations** with
   - AdmirePro, or Platinum (4A Neonicotinoid)

Control late season aphid infestations with
   - Orthene (1B OP), or Fulfill (9A Feeding Blocker)

Control Budworm and hornworm with
   - Orthene (1B OP), Tracer (Bact.), Belt (28 Phthalic acid diamide)
   - or Denim (Soil Bacterium)

3. **Control flea beetles with**
   - Orthene in the transplant water.

Manage late season aphid infestations with
   - Orthene or Fulfill and hornworm

Control budworm infestations with
   - Belt, Bt, Tracer, or Denim
Maintaining low insecticide residues on tobacco

- Do not use Thiodan or other brands of endosulfan.
- Observe **preharvest intervals** for all insecticides
  - Be careful when you apply the **pyrethroids**.
  - **PHI** for **Warrior** is 40 days and **Capture** should not be applied after layby
  - **Orthene** PHI is 3 days, but wait longer.
  - Late applications of **Tracer**, **Dipel** and **other Bts** for hornworms is a safe option.
Conclusions

- Lorsban 4E labeled rate on tobacco reduced from 2 quarts/acre to 1 quart per acre.
- Lorsban Advanced EW has been introduced
- Belt is registered to control Lepidoptera (hornworms and budworms) on tobacco
- Coragen will be available for hornworm and budworm control in 2009. DuPont has applied for a State 24c special local needs label.
- If aphids or other insects become persistent problems, do not continue to apply the same insecticide, but rotate among insecticide classes.
- Follow practices that minimize insecticide residues.
TOBACCO INSECTS

THE END

Gene Burgess
2-08
Control Summary -- Aphids

- **Tray or TPW**
  - Platinum or Platinum + Orthene – Tray / TPW
  - Admire – Tray / TPW
  - Orthene – TPW

- PAO – Wireworms, Aphids, early season flea beetles

- P -- Thrips
Control Summary

- **Practice IPM** – Scout and spray at economic threshold only!
  - Reduces *unnecessary sprays*
  - Helps control *resistance*
  - Conserves *beneficials*
  - Minimizes cost and *increases* profits
Control Summary -- Aphids

Foliar – Spray at ET Level

- **ET -- Before Topping:**
  - 10% plts wi 50 aphids on any upper leaf.

- **ET -- After Topping:**
  - 20% or more of plants are infested with 50 aphids on any upper leaf

- **Chemicals:**
  - Orthene -- 3 dy PHI
  - Malathion --
  - Actara – 14 dy PHI
  - Lannate – 14 dy PHI
  - **Warrior** – **40 dy PHI**
Control Summary -- Budworms

- **ET** -- Foliar – (5 infested plants/50 plants (10%))
  - Orthene -- 3 dy PHI
  - Dipel -- 0 dy PHI
  - Tracer -- 0 dy PHI
  - Denim -- 14 dy PHI
  - Warrior -- 40 dy PHI  Suppression only!
  - Dylox -- 3 dy PHI
  - Lannate -- 14 dy PHI
Control Summary -- Hornworms

Foliar – Spray at ET Level

- **ET** -- 1” length – 5 worms/50 plants (10%)
- **ET** -- Parasitized – 25 worms/50 plts (50%)

**Chemical**
- Orthene – 3 dy PHI
- Denim – 14 dy PHI
- Bt – 0 dy PHI
- Warrior – 40 dy PHI
- Dylox – 3 dy PHI
- Tracer – 0 dy PHI
Ground Beetle –
Calosoma Sp -- Caterpillar Hunters
Wasps – Feed on Caterpillars
2 Tachinid Fly Species

- Lays Eggs On:
  - Hornworms
  - Budworms
  - Cutworms
- Kill HW pupae
Tobacco Hornworm

**Braconid Wasp**
(Apanteles congregatus)

*Parasitizes* 1\(^{st}\) & 2\(^{nd}\) instar hornworms

*Larvae develops* inside worm

*Emerge* from 4\(^{th}\) & 5\(^{th}\) instar

*Larvae spins cocoons* on back

*Adult emerges from cocoon* & searches for another hornworm.
Lacewing Adult – Larvae Feeds on Aphids
• Adult Wasp, *Campoletis sonorensis*, Lays Eggs Beneath Skin of Small Budworm
• Egg hatches & the Larva Develops Inside the Budworm
• When Development is Complete, the Parasitic Larva Emerges & Pupates Outside
• The Silken Cocoon is White, Oblong, About ¼ Inch Long & Attached to the Skin Of the Budworm
Stilt Bug

Feed on Hornworm & Budworm Eggs & Aphids
Syrphid Fly Larvae Feed on Aphids
Syrphid Fly Larvae

Feed on Aphids
Syrphid Fly Adult

Hover Over Plants
Lady Beetle Eggs & Aphids
Spotted Lady Beetle

Feeds on Aphids
Lady Beetle Larva

Feeding on an Aphid
Lady Beetle Eggs
Convergent Lady Beetle

Feeding on Aphids
THE END

ANY QUESTIONS
Apanteles congregatus
Braconid Wasp Parasite
Tobacco Budworm
(Noctuidae: *Heliothis virescens* (Fabricius))
Tobacco Budworm

Pale green with several
Longitudinal pale stripes
Brown head
Tobacco Budworm

- Light olive to brownish-olive
- 3 slanted, dark olive or brown bands

Corn Earworm

- Yellowish-olive
- Single dark spot near center of each forewing
Corn Earworm
Tobacco Hornworm
Tobacco Hornworm

- Greenish
- White bars on the sides
- Slender reddish curved horn
- Hard to detect
- Blends in with leaf
Tobacco & Tomato Hornworms

Tobacco Hornworm
- Curved red horn

Tomato Hornworm
- Straighter blue-black horn

- 7 Diagonal white lines
  - Edged with black
- 8 V-shape marks
Thrips

- **LC** (egg to adult) – 16 dys (NC)
- **Spring adults** migrate to host (NC)
- **FL:**
  - *Shortwinged adults* OW
  - *Longwinged forms* usually appear in late spring
- **NC:**
  - *OW* as adult females under ground litter
- **SC:**
Flea Beetles

- **O.W.** – As **adults** in litter & plant debris around fields

- **Early spring** lay eggs on soil surface near host plants

- Eggs hatch in about a **week**

- **Larvae feed** 4 – 5 weeks on plant roots & pupate in soil

- **Generations** - Approx. 4 gen.
Aphid control on flue-cured tobacco treated with various rates of Admire 2F, Admire PRO, Platinum, and Temik, SPAREC, 2006 (PSemtner)
Yield of flue-cured tobacco treated with various insecticides applied as tray drench transplant water, and band treatments, SPAREC, 2006 (PSemtner)

YIELD (lb/acre)

Yield (lb/acre)

<table>
<thead>
<tr>
<th>Location</th>
<th>LC50 (PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC-G</td>
<td>33.51</td>
</tr>
<tr>
<td>GA-G</td>
<td>23.6</td>
</tr>
<tr>
<td>VAFR-R</td>
<td>22.85</td>
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<tr>
<td>SC-R</td>
<td>11.09</td>
</tr>
<tr>
<td>TN-R</td>
<td>8.47</td>
</tr>
<tr>
<td>KY-R</td>
<td>7.29</td>
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<tr>
<td>MD-R</td>
<td>7.15</td>
</tr>
<tr>
<td>CT-R</td>
<td>4.62</td>
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<tr>
<td>NY-R</td>
<td>2.39</td>
</tr>
<tr>
<td>NCSU-R</td>
<td>1.91</td>
</tr>
<tr>
<td>SPC-Green</td>
<td>0.37</td>
</tr>
</tbody>
</table>
Admire Pro 4.6SC

- 2.3 times more product per gallon than Admire 2F
Assail (acetamiprid) 30SG & 70WP (foliar)

- **Neonicotinoid class**
- **Disrupts** nerve transmission
- **Anti-feeding effect** which prevents pest damage to host plants well before death
- **Broad-spectrum control**
- **Reduced-risk** product & kinder to beneficials
Assail (acetamiprid)

- Eliminates both chewing & sucking insects
- Great rainfastness & Residual activity – 2-3 weeks
- Systemic & translaminar activity, gets pest where they feed & breed
- Absorbed into the plant tissue & moves through the leaf to protect tender new shoots
- Rapidly degrades in the soil
- No concerns about carryover
- Excellent tool for IPM
Generic Brands of Imidacloprid

- Imidacloprid (Admire 2F)-Several generic brands may be available
  - Alias 2F-Makhteshim Agan
  - Pasada 1.6F-Foliar treatment
  - Couraze 2F-Chemainova
  - Nuprid 2.0F and 1.6F foliar-NuFarm Americas
  - Others?
Admire Pro – Advantages
Low Viscosity / Thixotropic

- At rest, the product sets up like a gel. This allows for better suspension of the product versus other SC formulations that typically settle out. Slight agitation, it quickly returns to a viscous liquid state – called thixotropy (more liquid when agitated)
- Leaves less residue in container.
- Rinses easily.
Admire Pro – Fertilizers

- Increased compatibility with wide range of fertilizers. Enter & maintains suspension. No need to create a pre-mix slurry or dilute soln prior to adding. Does not tend to clabber & does not settle out
Admire Pro 4.6SC

- Compared with Admire 2F, Admire Pro 4.6SC has
  - 2.3 times more product per gallon
  - Increased dispersion, easier to mix, less settling out in the tank and in storage (still settles out)
  - No foaming
  - Blue color instead of beige (blue hands?)
  - Easier to rinse out of containers and to clean up, does not stick to containers
**Thixotropy** – Formulation sets up into a, gel-like state to suspend higher load of active ingredient.

Normal **shaking** of the container thins the formulation to a very liquid state similar to water.
Admire Pro – Enhanced Color & Packaging

- Makes product more visible when measuring & spills much easier to see.
- Spills dry & turn into a chalky blue substance that’s easy to clean
Admire Pro - Mixing Properties

- Blooms quickly & disperses thoroughly in water, easily creating a more homogenous solution. Stays in soln. longer with less settling & fewer precipitates.
Admire Pro – No Foaming

- Does not foam when combined with water.
  Makes measuring & mixing easier.
Cutworms

- **Second and Third Larval Stage:**
  - **Feed** – Night & cloudy days
  - **Daytime** – Hide under clods of dirt
  - **Most Damage** – Newly set plants
  - **Plants** – Cut off at the ground level
Cutworms

- **Foliar applications** of insecticides reduce populations of young larvae because early stage larvae that feed near the soil surface will feed on treated foliage at night.
Tobacco Wireworm

- 1 gen. per year. Ave LC = 348 dys.
- Lay eggs on or beneath soil surface in summer (10 dys)
- Larvae hatch & feed on roots of tobacco, corn or other plants
- OW in larval stage
Flea Beetle Damage

“Shot hole” appearance
Percent tobacco flea beetle control on flue-cured tobacco treated with various insecticides applied as soil or tray drench treatments, 2006 (PSemtner)

Treatment

Tobacco flea beetle feeding holes/10 plants
Emergence of adult tobacco flea beetles from tobacco root systems after treatment with Admire and Ridomil Gold, SPAREC, 2006

![Graph showing the emergence of adult tobacco flea beetles over time after treatment with Admire and Ridomil Gold.](image-url)
Incidence of black shank symptomatic plants in tobacco plots treated with Admire and Ridomil Gold, 2005.
Admire Summary

- **Admire Pro 4.6SC** – no longer Admire 2F
- In 2006, equivalent rates of **Admire Pro** (0.6 fl oz/1,000 plants) appeared to be slightly less effective than the old **Admire 2F** formulation.
- **Tray drenches** generally give better control of wireworms and flea beetles than transplant water treatments.
- **Transplant water** treatments provide better late season control of aphids.
- Some tobacco **aphid tolerance** to Admire.
Percent plants flowering, July 15

(PSemtner)

![Bar chart showing percent plants flowering]

- Untreated
- Temik 15G
- Platinum 2SC 0.8
- ADM PRO 0.8
- ADM PRO 0.6
- ADM PRO 0.5
- ADM 2F TPW

Percent flowering
Tobacco Hornworm

- **OW** – pupae
- Moths **emerge** in early June – August
- Nocturnal moths in habit
- Hover over plants at dusk
- Deposit eggs at night on underside of leaves
- Larvae **emerge** in about 4 days
Tobacco Hornworm

- Larvae feed for 3 weeks
- Hornworms burrow into the soil – stay 3 weeks
- New generation of moths emerge
- Heavy egg deposition in August & early September because
  - Peak of OW moths emerging &
  - Second & possibly third brood emerging