Managing & Controlling Insect Pests in Leafy Greens

Southern Wisconsin Vegetable Workshop
February 1, 2013

Russell L. Groves
Department of Entomology
1630 Linden Drive
Madison, WI 53706

groves@entomology.wisc.edu

http://www.entomology.wisc.edu/vegento
Hoop houses can be ideal for the build-up of pest populations
Insects are difficult to manage

- Multiple generations - up to 12-15 / year
- Limited natural enemies to reduce populations
- Almost unlimited food
- More consistent / constant environmental conditions
- Some life stages are not susceptible to treatment
- Major insecticide and miticide resistance
Options for Insect Pest Management – *More than ever before!*

- Cultural controls
- Natural enemies
- Baits and baiting systems
- Host plant resistance
- Population disruption
- Transgenic plants IR traits
- Reduced-Risk Chemical Insecticides
- Entomopathogens
Long Distance Migrations - 2012

Where did all these bugs come from and where might they be going?

HYSLIT air parcel trajectory model

Variegated cutworm, black cutworm, yellow-striped armyworm, fall armyworm, and Loopers.

- Tomatoes, soybeans, alfalfa, potato
- Hostas, petunias, and lots & lots of other things
Reduced-Risk Foliar Registrations (2008-12)

- **Radiant®SC (spinetoram)**
  - Macrocyclic 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 - 5 oz (Lepidoptera) + MSO 5% v/v
  - 14+ days persistence
  - Very low impact on beneficials and low toxicity
  - Ovicidal activity
Entrust® SC (spinosad)

- Macrocyclic lactone (spinosad: MoA group 5)
  - Use rate 1.25 - 2 oz / A
  - Control of onion thrips
- 7-10 days persistence (photostability)
- Very low impact on beneficials
- Low mammalian toxicity

Reduced Risk Foliar Options
Registration 2006 - OMRI
Aster yellows

Disease incidence: 1%-15% in intensively managed carrot fields

Variable symptoms:

*Above ground* - leaf yellowing and reddening, twisting, witches' brooming

*Below ground* – stunted and malformed roots, adventitious root growth

Crops affected: Lettuce, celery, cilantro, coriander, endive, escarole, and many more!!!
Vector: Aster leafhopper (ALH)

- *Macrosteles quadrilineatus* Forbes (Hemiptera: Cicadellidae)
- Approximately 4 mm long
- Light greenish-yellow in color (seasonally variable)
- Widely distributed in the U.S.
Aster yellows phytoplasma (AYp), *Ca. phytoplasma asteris*

Small (0.4 μm diameter), wall-less prokaryotic organism of the provisional genus *Candidatus*

Infects > 350 species in 38 plant families

Obligately associated with host (insect and plant) and not mechanically transmissible
Aster leafhopper migratory behavior

Early season migration of the ALH from the Gulf-states to the Upper Midwest

Early prediction of aster yellows risk – road trip to determine the abundance and trajectory of the migratory route

Probable Aster Leafhopper Spring Migration Routes

Chiykowski, L.N. and R.K. Chapman. 1965
Early season AY risk assessment (1971)

Assess magnitude of spring migration
- Sweep net sampling in wheat

Assess leafhopper “infectivity”
- Bioassay (insects on single plants)

Determine the AYI for migrants:
% ALH infectivity * ALH # / 100 sweeps

Make arrival prediction based on where ALH encountered on trip

Report to WI vegetable growers

Chiykowski, L.N. and R.K. Chapman. 1965
# Plant-to-plant transmission of AYp

<table>
<thead>
<tr>
<th>Acquisition</th>
<th>Latency</th>
<th>Transmission and Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>hours - days</td>
<td>days - weeks</td>
<td>weeks - lifetime</td>
</tr>
<tr>
<td>~ 8 hours</td>
<td>2-3 weeks</td>
<td>Inoc. 4-8 hrs; Retention - lifetime</td>
</tr>
</tbody>
</table>

For AYp
Current AY management


**Carrot**

- **Planting**
- **Crop growth**
- **Harvest**

**Aster Leafhopper**

- **Migratory**
- **Local**
- **1st – 3rd Generation**

- Foliar insecticide applications (or row cover!!!!!!)
- Pyganic, Azera
- Synthetic pyrethroids (RUP requirement)
- Systemic neonicotinoids
Flea beetle Management in Leafy Greens

Flea beetle (several species)

**Appearance**
- Small, shiny black beetles
- Hind legs enlarged for jumping
- Overwinter as adults
- 2 generations per year

**Damage**
- Adults chew small circular holes
- Can kill small plants
- Larvae in soil are not damaging
Flea Beetle Management

**Cultural**
- Exclude adults with row cover
- Attract adults to alternate trap crop (Indian mustard)
- Avoid early planting

**Biological**
- No effective controls

**Chemical**
- Spray to control adults (synthetic pyrethroids)
- DO NOT disrupt biological controls of other pests (aphids)
- Neonicotinoid or spinosad insecticides
- Entrust WP, SpinTor SC,
Seed corn maggot Lifecycle

**Adult**
- Small grey black fly

**Eggs**
- Small, white, laid on soil

**Larvae**
- White maggots
- 4 instars
- 3-4 generations/year
- 200, 600, 1000, DD$_{39}$

**Pupae**
- Brown, oval, in soil
Occurrence

- Overwinter in soil as pupa
- Adults emerge in spring
- 1st generation weeds

Damage

- Larvae hatch and tunnel in germinating seeds
- Cool weather, which delays plant emergence
- Green manure incorporation
- Plants compensate well for damage
Seed corn maggot Management

Cultural

- Planting dates (fly-free periods)
- Speed up germination: pre-sprout, mulch, warm soil
- Avoid green manure

Biological

- Fungal epidemics / soil insects

Chemical

- In-furrow treatments
- Broadcast treatments
- Seed treatments (registered & experimental)
Insecticide Seed Treatment

**Entrust** (spinosad) – Registered 2010

*FarMoreFl500* (fludioxonil, mefenoxam, azoxystrobin, spinosad, and thiamethoxam)


**Sepresto**  (clothianidin+imidacloprid)

**Reseachable**
Aphids – Green Peach Aphid

- Soft-bodied insects
- Wings present or absent
- Cornicles (tail pipes)
- Honeydew
  - Sooty mold
- May transmit viruses
- Reduces plant vigor, stunting, malformation
Aphid Monitoring

- Check as many plants as possible
- Look at terminal buds and lower leaf surfaces
- Cast skins, honeydew, & sooty mold are indications of aphid infestation.
- Yellow sticky traps can monitor winged aphids
Aphid IPM

- **Sanitation**
  - Remove alternate hosts (weeds)

- **Limit the use of quick-release fertilizer**

- **Beneficial Insects**
  - Green lacewings
  - Ladybeetles
  - Parasitic wasps

http://learningstore.uwex.edu/Search.aspx?k=A3842
Aphid Parasitoids & Predators
Aphid Chemical Control

- Rotate chemicals every 2-3 applications to prevent insecticide resistance

  AdmirePro / Marathon (imidacloprid) - drench

  Fulfill / Endeavor – (pymetrozine) applied as a foliar with slow kill - but stop feeding fast

  Beleaf - (flonicamid) - foliar

  Azatin (azadirachtin) - foliar

  Botanigard (Beauvaria bassiana) - foliar
Thrips – Western flower thrips (WFT)

- Thrips, complete metamorphosis
- 4 narrow, fringed wings
- Raping-sucking mouthparts
- Virus vectors (TSWV & INSV)
Thrips Damage

- Rasping mouthparts puncture plant surfaces
- Egg-laying also damages plants
- Injury appears in streaks rather than spots ‘silvering’
- Buds fail to open.
Thrips Damage – Virus Infection

Tomato spotted wilt virus (TSWV)

Impatiens necrotic spot virus (INSV)
Blue – Yellow Sticky Cards to Monitor Thrips
Thrips IPM

- **Sanitation**
  - Remove weeds that act as a thrips (virus) refuge.
  - Remove and destroy crop residues and affected plants after harvest.
  - Remove all soil debris from greenhouse.

- Pasteurize soil to kill immature thrips.
Thrips Chemical Control

- Treat at 3-5 day intervals with very good coverage
- Rotate chemicals to prevent WFT resistance

- Conserve (spinosad)
- Radiant (spinetoram)
- Avid (abamectin)
- Pedestal (novaluron - IGR)
- Merit (imidacloroprid)
- Flagship (thiamethoxam)
- Safari (dinotefuran)

- Predacious mites (*Amblyseius cucumeris*)
- *Beauvaria bassiana* (Botanigard)
- M-pede (insecticidal soap)
- Azatin (azadiractin)
- Entrust (spinosad)
Vegetable IPM Resources

- Vegetable Insect Mgmt Web-page
  - http://www.entomology.wisc.edu/vegento

- Vegetable Disease Mgmt Web-page
  - http://www.plantpath.wisc.edu/wivegdis

- Wisconsin Pest Bulletin
  - http://datcpservices.wisconsin.gov/pb/index.jsp