

Managing & Controlling Whiteflies, Aphids & Thrips in High Tunnels

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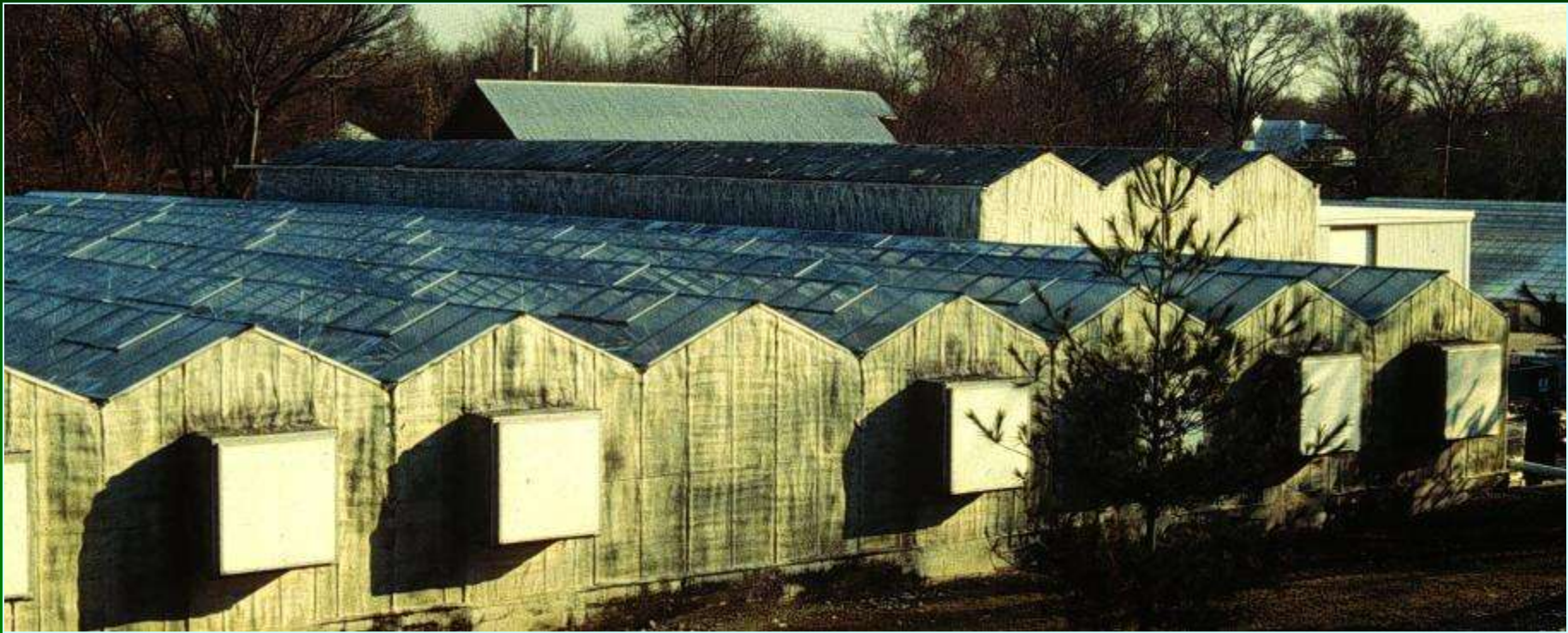
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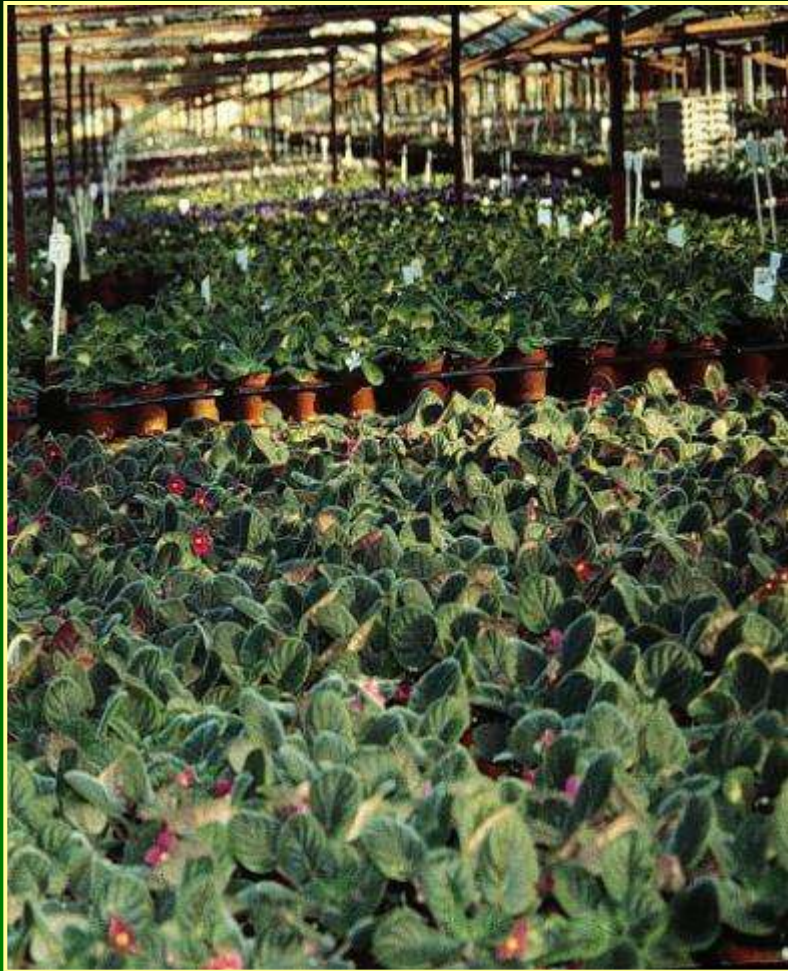


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EXTENSION



Green and Hoop houses are 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**

IPM = Integrated Pest Management

IPM: is a decision-making process considers and utilizes ALL available pest management options or strategies to prevent economically-damaging pest outbreaks below an acceptable, pre-determined injury level or action threshold while reducing risks to human health and the environment

Components of an IPM Program

- **Monitoring and Sampling** (inspect)
- **Pest Identification** (what pest)
- **Decision-making** (what action)
- **Intervention** (take action)
- **Follow-up** (re-inspect)
- **Record-keeping** (write it down, history)
- **Education** (learn)

What IPM is NOT!

- IPM does NOT preclude the use of pesticides!
- IPM is NOT merely a biological or “organic” pest control program
- IPM is a decision-making process, NOT a stringent or rigid management regime

Sampling or Scouting

Relative methods- tells the type and areas infested by certain pests

Examples- sticky cards, indicator plants

Absolute Methods- tells the number of a given pest per plant

Requires inspection of plants



Not scouting could cost you money because of unnecessary pesticide applications and plants lost to unnecessary pest damage.

Sampling or Scouting – Relative Measures

Sticky cards



Indicator plants



Sampling or Scouting

Absolute or Direct Sampling

- Visual inspections, use a hand lens
- blowing (exhaling) on flowers (thrips)
- sweeping or brushing a plant over a white piece of paper

Control Measures

Cultural- exclusion, inspection, sanitation, resistant cultivars, fallow

Chemical-the use of pesticides to suppress or eliminate pests; narrow or broad spectrum

Biological-the use of pathogens, or other arthropods for suppression of a targeted pest

Cultural Control

Exclusion -Screening



Inspection, Quarantine,
and Sanitation



Cultural Control

- ❖ **Weed control** - inside and out
- ❖ **Fallow** – crop free period



Chemical Control



Chemical controls are rather inexpensive usually adding only 1-2¢ per plant

Preventive approach

Curative approach

Chemical Control

•Worker Protection
Standards

•Phytotoxicity

•Resistance Management

JUDO **ohp** Formaldehyde

Miticide / Insecticide **SPECIMEN LABEL**

Greenhouse and Nursery Ornamental Insecticide / Miticide

ACTIVE INGREDIENT:
Imidacloprid, 2.0% (2,6-Dichlorobenzyl Dimethylcarbamate)
INERT INGREDIENTS: 98.0%

NET WEIGHT: 1.00 lb (453.6 g) (16.0 oz) (453.6 g)

EPA Reg. No. 400-78-1 (M) **EPA Reg. No. 400-78-1 (M)** **EPA Reg. No. 400-78-1 (M)**

STOP - READ THE LABEL BEFORE USE
KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS - HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION - Irritant to eyes, skin, and clothing. Avoid contact with eyes, nose, mouth, and skin. Wash thoroughly after use. Avoid breathing dust or mist. Do not eat, drink, or use tobacco products while using or soon after handling this product.

Respiratory Protective Equipment (RPE):
Wash, washers, and other handlers must wear:
• A long sleeve shirt and long pants.
• A long sleeve jacket or coveralls with a minimum 90% efficiency rating.
• Goggles or eye shields.
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USE SAFETY PRECAUTIONS:
Visual Aids:
• Wear eye protection when mixing, diluting, or applying this product.
• Avoid contact with eyes, nose, mouth, and skin.
• Wash thoroughly after use.
• Do not eat, drink, or use tobacco products while using or soon after handling this product.
• Do not breathe dust or mist.
• Do not get on face, neck, or hands.
• Do not get on clothing or shoes.
• Do not get on hair or scalp.
• Do not get on children's clothing or toys.
• Do not get on pets or animals.
• Do not get on food or feed.
• Do not get on crops or plants.
• Do not get on water.
• Do not get on electrical equipment.
• Do not get on machinery.
• Do not get on vehicles.
• Do not get on boats.
• Do not get on aircraft.
• Do not get on power lines.
• Do not get on power poles.
• Do not get on power transformers.
• Do not get on power substations.
• Do not get on power lines, poles, or transformers.
• Do not get on power lines, poles, or transformers.

ENVIRONMENTAL HAZARDS:
This product is toxic to fish and aquatic invertebrates. Do not apply to water bodies or to areas adjacent to water bodies. Do not apply to areas where birds, bees, or other beneficial insects are present. Do not apply to areas where birds, bees, or other beneficial insects are present.

Biological Control

- General Considerations
- Problems



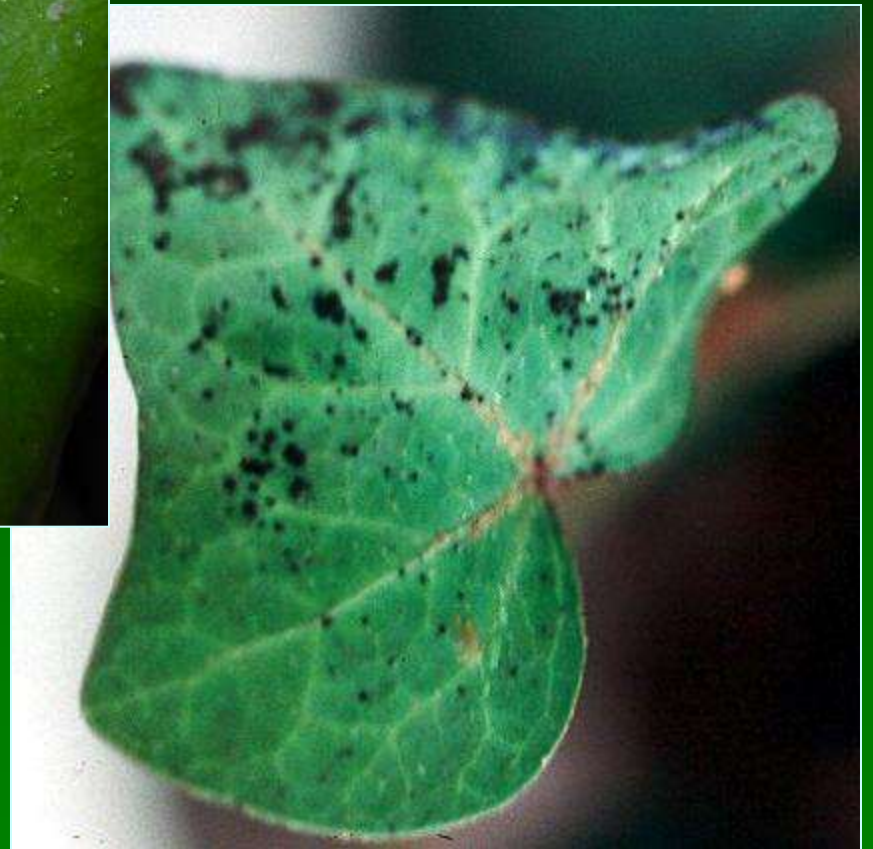
Aphids

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



- **Green Peach Aphid**
- **Cotton Aphid**
- **Potato Aphid**
- **Foxglove Aphid**
- **Melon Aphid**

Honey Dew & Sooty Mold



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 weeds inside and outside of greenhouse
- **Screen vents and windows**
- **Limit the use of quick-release fertilizer**
- **Beneficial Insects**
 - Green lacewings
 - Ladybeetles
 - Parasitic wasps



UNIVERSITY OF WISCONSIN EXTENSION
the learning store

<http://learningstore.uwex.edu/>

Aphid Chemical Control

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

Marathon (imidacloprid) – drench / drip best

Endeavor (pymetrozine) - slow kill - but stop feeding

Avid (abamectin) – aphid suppression

Thiodan (endosulfan)

Orthene (acephate)

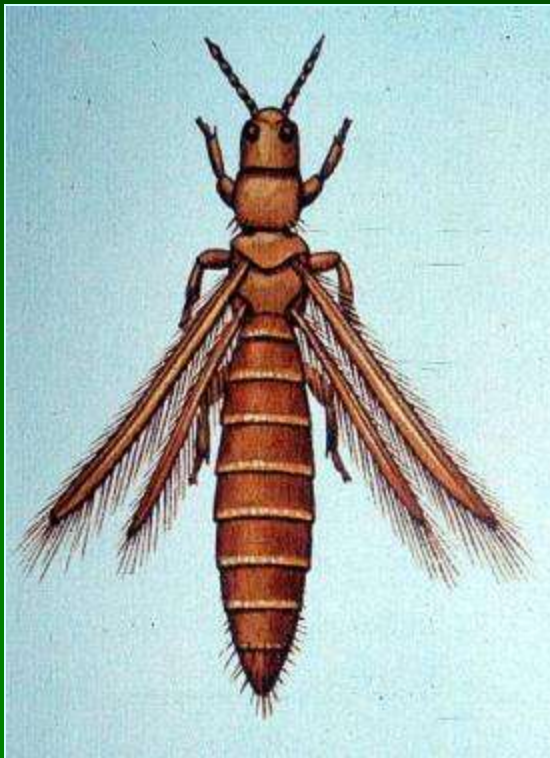
Talstar (bifenthrin)

Beauvaria bassiana (Botanigard)

Aza-Direct (azadiractin)

Order Thysanoptera

- Thrips, complete metamorphosis
- 4 narrow, fringed wings
- Tube-like 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'.**
- **Blossoms become brown and petals are distorted.**
- **Buds fail to open.**

Thrips Damage – Virus Infection



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.
- **Screen windows, vents, and fans.**
- **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 (imidacloprid)
 - Flagship (thiamethoxam)
 - Safari (dinotefuran)
 - predacious mites (*Amblyseius cucumeris*)
 - *Beauveria bassiana* (Botanigard)
 - M-pede (insecticidal soap)
 - Azatin (azadiractin)
 - Entrust (spinosad)

Order Diptera



- **Flies, gnats, mosquitoes, midges**
 - Fungus gnats
 - Shore flies
- **Only 1 pair of wings – second pair are modified**
- **Adults have sponging mouthparts**
- **Larvae have chewing mouthparts and feed on roots, stems, fruit.**

Fungus Gnats

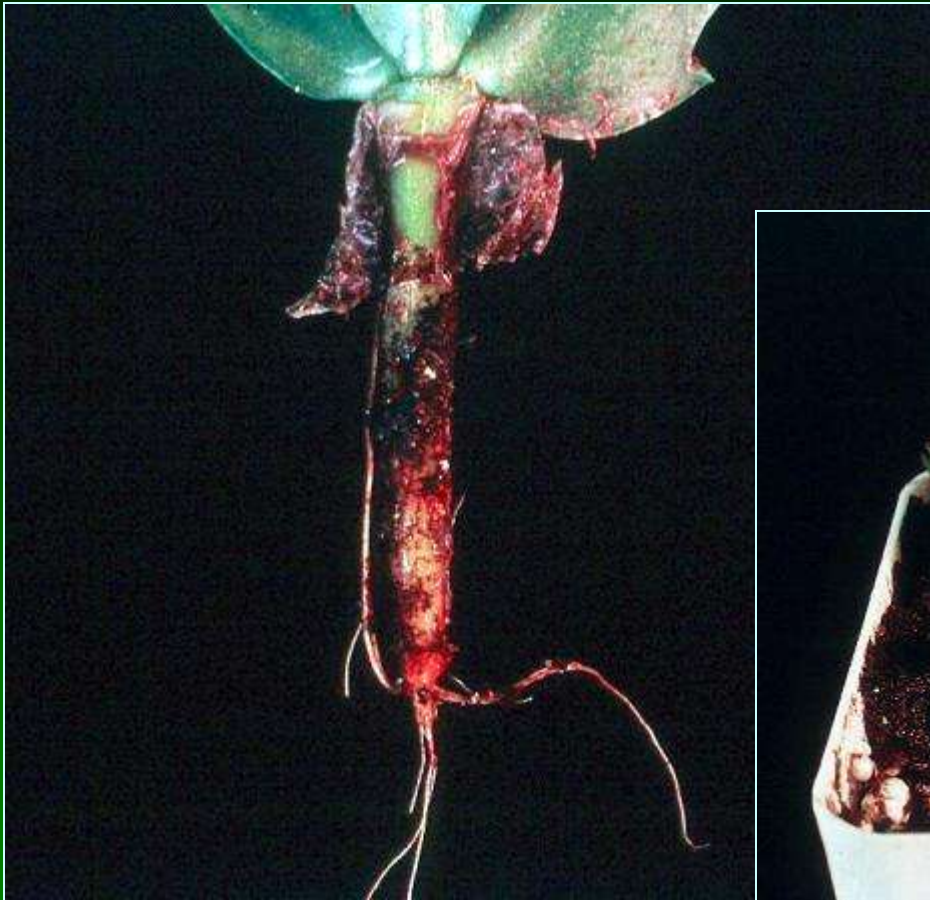
- Distinguished by the long, many-segmented antennae.
- Weak flier
- Feed on decaying organic matter in potting mix, decaying plants

Fungus Gnat
Adult



Fungus Gnat
Larvae

Fungus Gnat Damage



Fungus Gnat Monitoring

- Monitor with sticky traps placed horizontally at the crop canopy.
- Place potato wedges on growing medium surface to monitor larval populations.
 - Leave in place for 3-4 days then look for larvae feeding on cut surface.



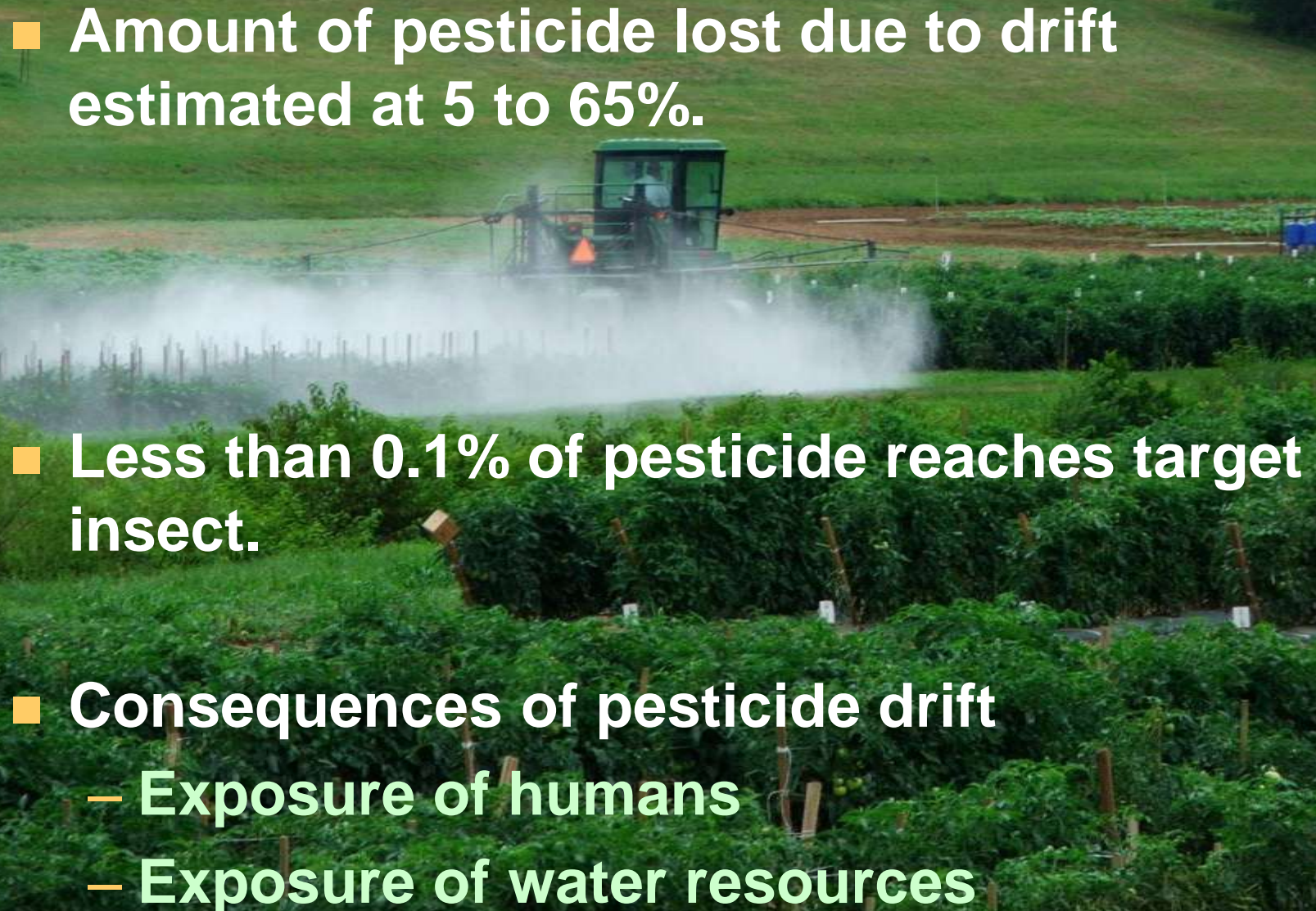
Factors Influencing Insect Pest Management

'Water Quantity and Quality'

- **Decreasing availability of water for agriculture**
 - **Agriculture is the overwhelming user of fresh water.**
 - **Increasing urban demand will drive irrigation efficiency.**
- ***Drip irrigation, micro-sprinklers***
- ***Targeted application of water increases opportunity to use irrigation as a delivery system.***



Pesticide Drift

- Amount of pesticide lost due to drift estimated at 5 to 65%.
 - Less than 0.1% of pesticide reaches target insect.
 - Consequences of pesticide drift
 - Exposure of humans
 - Exposure of water resources
- 
- A photograph of a green tractor with a large spray boom, moving through a field of young green plants. The tractor is emitting a thick mist of white spray that drifts across the field. The background shows a green hillside under a clear sky.

Advantages of Drip Application of Insecticides

- **Reduced risk to environment and farm workers**
 - Drift to non-target areas is eliminated
 - Farm workers do not come into contact with residues on exterior of plant
 - Beneficial organisms not directly exposed
- **Longer residual activity**
 - Not subject to loss from rain and UV light
 - Not subject to plant growth dilution effects
- **More cost-effective**

Drip Irrigation of Insecticides



What Insecticides Can Be Applied in Drip Irrigation Systems

- Must move systemically through plant.
- Label must specifically state that product can be applied via drip irrigation

Neonicotinoids

Admire
Platinum
Venom

Diamides

Coragen
Synapse
Verimark**

Carbamates

Vydate

Durivo

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graph TD; Durivo --> Neonicotinoids; Durivo --> Diamides;
```

** Not currently registered

Thiamethoxam & Imidacloprid



- **Platinum 75SG – Admire Pro**
 - Brassicas, Cucurbits, Fruiting Veg, Leafy Veg, Potat



- **Spectrum of Activity**
 - Cucumber beetles, squash bug, flea beetle, seed maggots, & CPB
 - Suppression of aphids, thrips, whiteflies



- **Systemic activity**

- Labeled for foliar and drip irrigation

Chlorantraniliprole (Rynaxypyr)



■ Coragen 1.67SC

- Brassicas, Cucurbits, Fruiting Veg, Leafy Veg, Potato



■ Spectrum of Activity

- Lepidopterans, some beetles (CPB)
- Whitefly suppression at higher rates



■ Systemic activity

- Labeled for foliar and drip irrigation application

Chlorantraniliprole + Thiamethoxam

■ Durivo 1.67SC

– 2:1 mixture of thiamethoxam
chlorantraniliprole

– Brassicas, Cucurbits, Fruiting Veg, Leafy Veg

■ Spectrum of Activity

– Lepidopterans, leafhoppers, cucumber beetle

– Aphids, Beetles, Plant & Stink Bug, Thrips, Mealybug, Whitefly

■ Drip application only, 1 application/year.

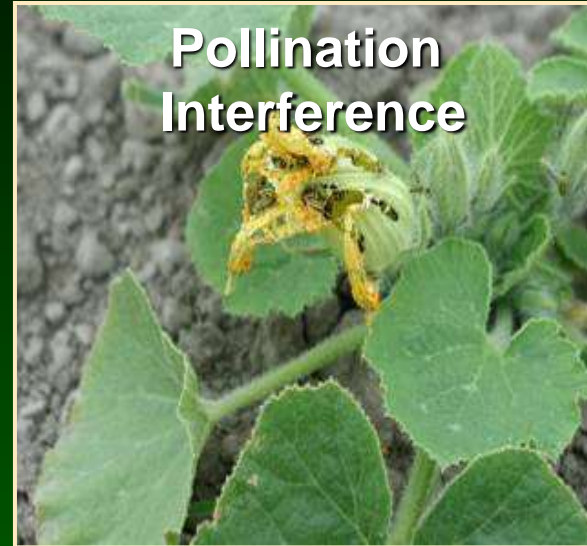


Cucumber Insect Pest Management Drip Irrigation Injection Trials, HAES 2010

Treatment	Insecticide	Rate	Application Type
1	chlorantraniliprole (Coragen [®] ** 	5.5 & 3.0 fl oz / A	Injection
2	Imidacloprid (AdmirePro [®]) 	5.5 & 5.0 fl oz / A	Injection
3	thiamethoxam (Platinum [®]) 	2.67 & 1.0 fl oz / A	Injection
4	dinotefuran (Scorpion [®]) 	5.5 & 5.0 fl oz / A	Injection
5	Untreated Control	N/A	N/A

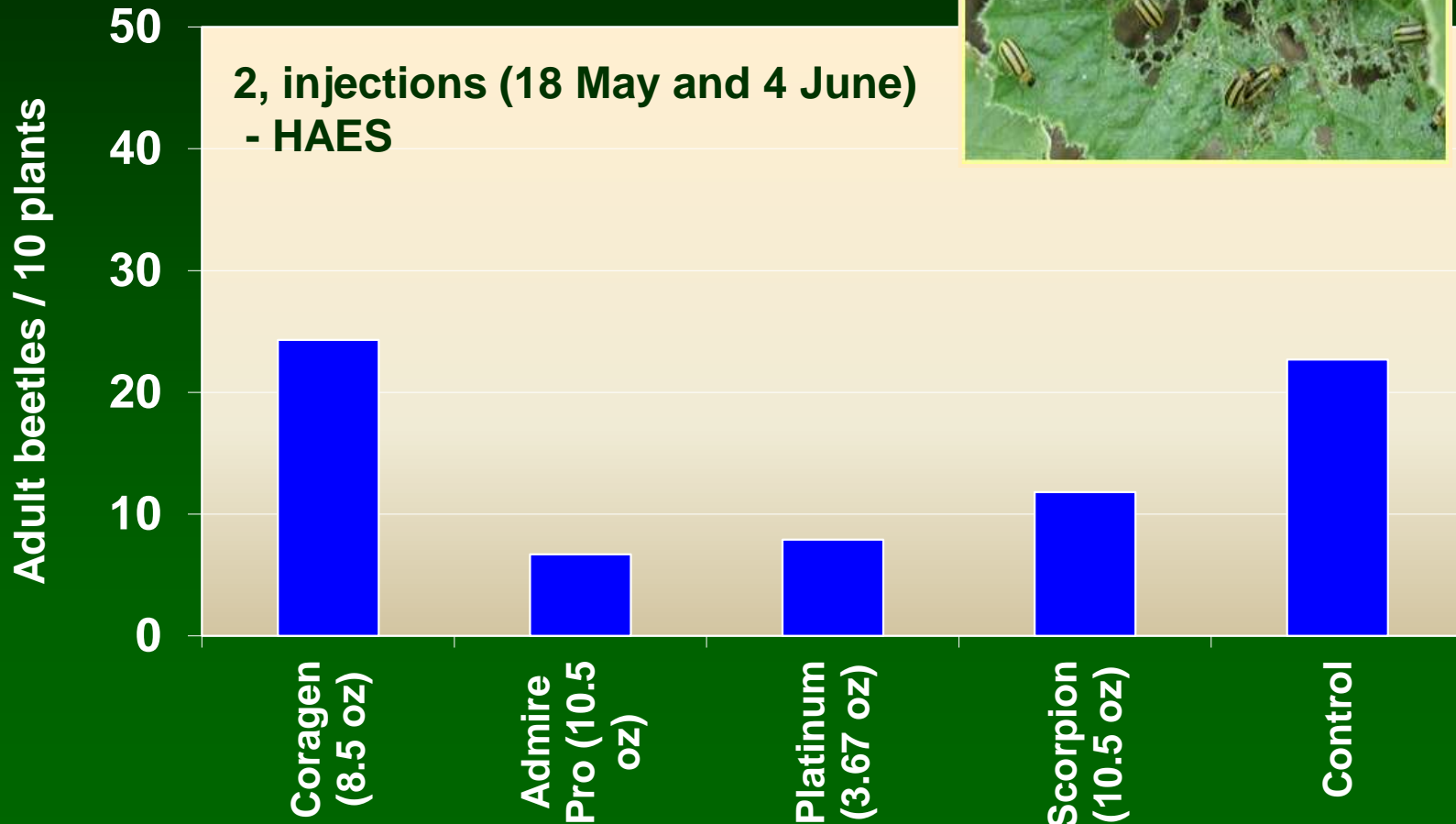
**Note: not currently registered

Cucumber Beetles: Damage



UGA1243177

Striped Cucumber Beetle Control (2010 - Cucumber)



Cucumber Beetles – Bacterial Wilt

- Most damage is from bacterial wilt, *Erwinia tracheiphila*
- Closely associated with beetle, vectored via posterior-
station
- No cure for bacteria, control
through vector
- Susceptibility:

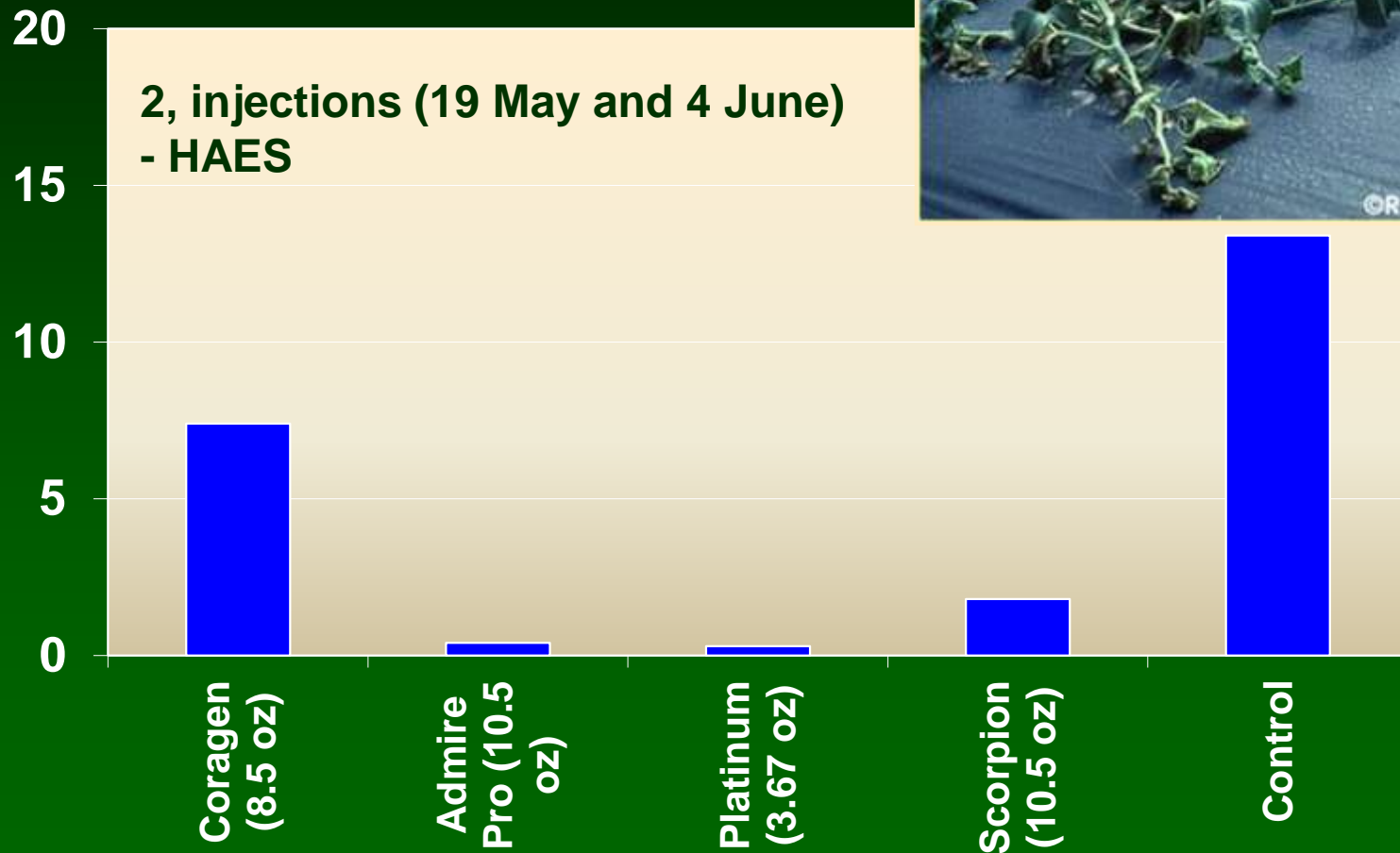
**Melons (not watermelon) >
cucumbers > butternut and
Hubbard squash**

***Avoidance of bacterial wilt is accomplished through effective
cucumber beetle control.***



Limiting Bacterial Wilt (2010 - Cucumber)

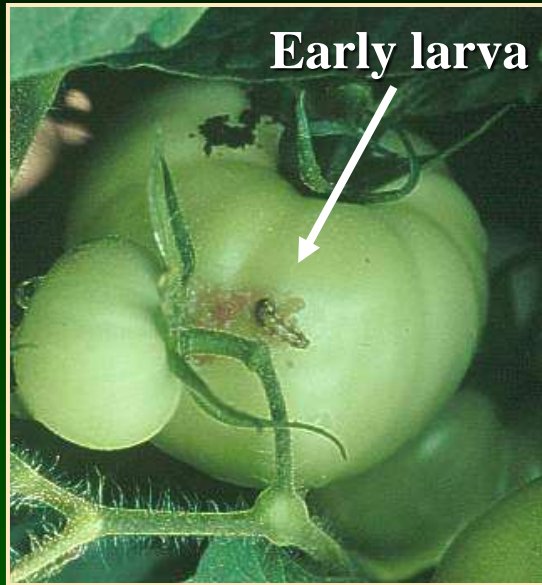
Mean Percent Symptomatic Plants



2, injections (19 May and 4 June)
- HAES



Tomato Fruitworm Damage



Occurrence





- 2nd generation only – Aug/Sept

Damage

- Small larvae feed on leaves
- Larger bore into fruit
- Develop internally
- Infested fruit may color early or rot
- Major pest in CA and FL

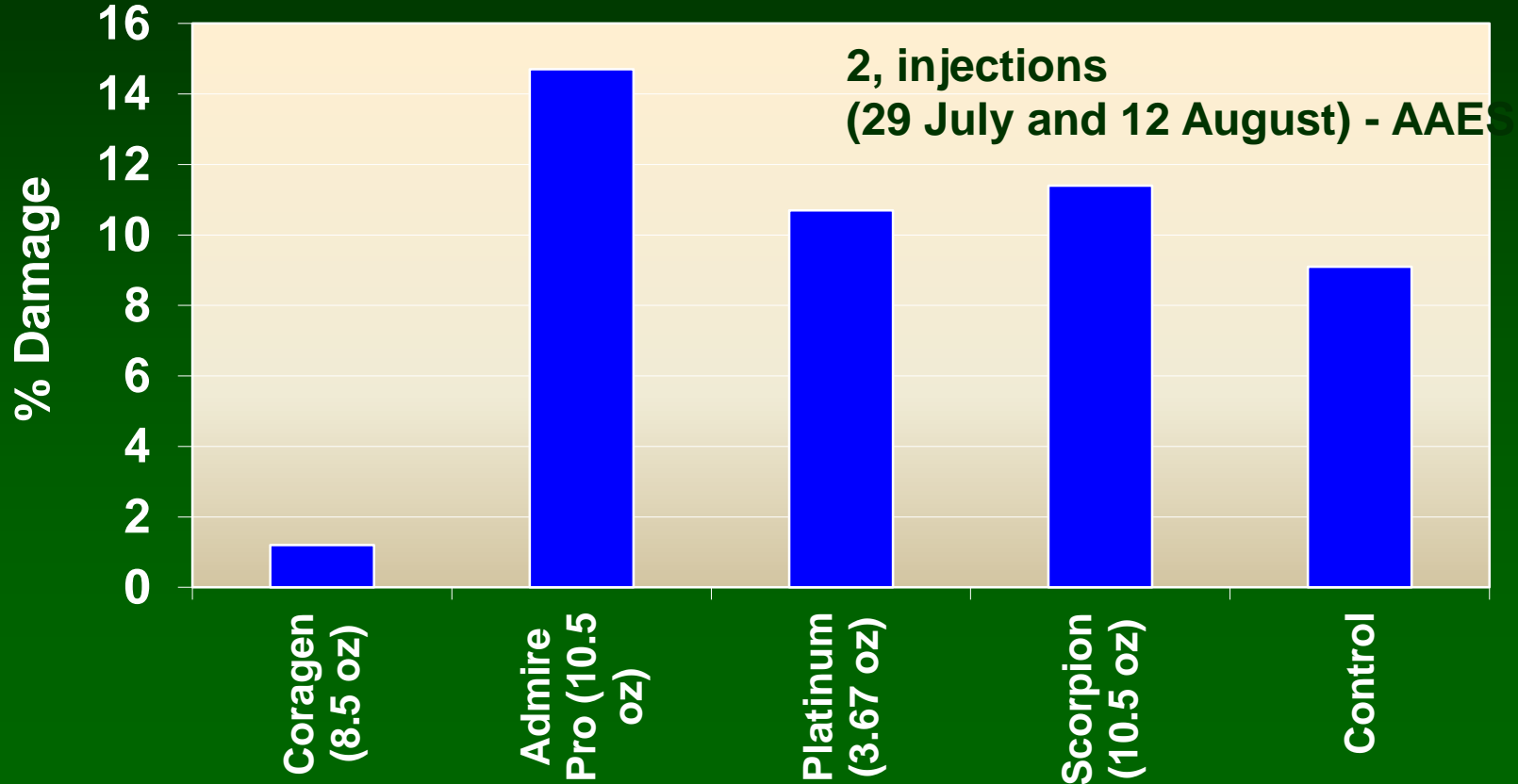


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5	Untreated Control	N/A	N/A

**Note: not currently registered

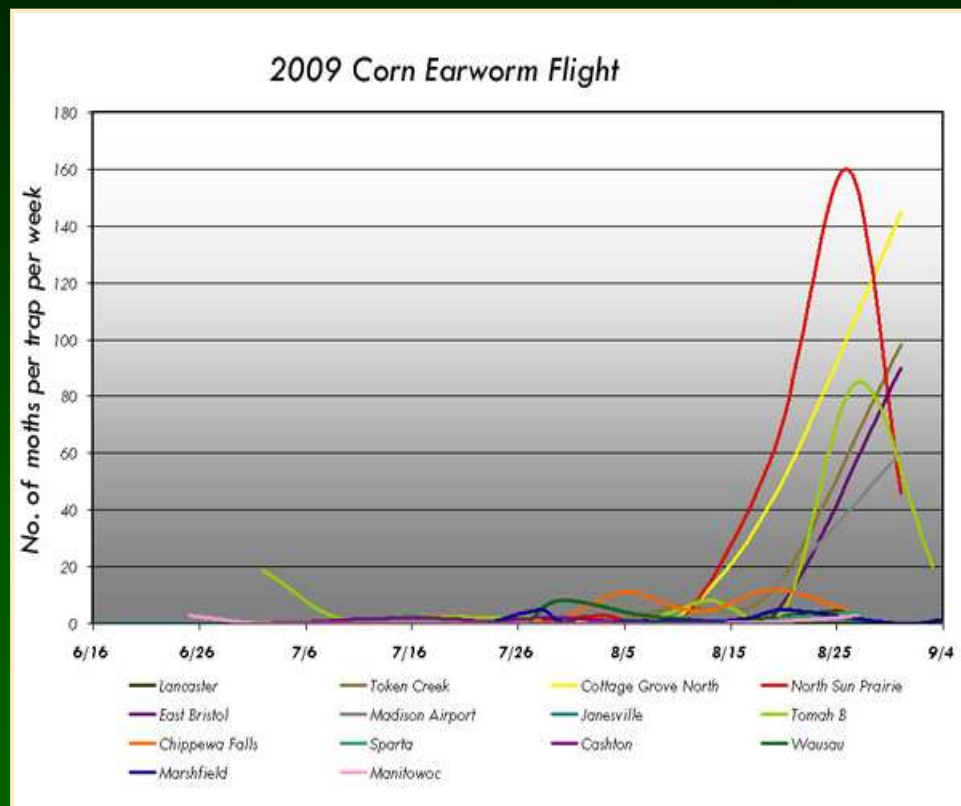
Tomato Fruitworm Control (2009 - Tomato)



Wisconsin Pest Bulletin



<http://pestbulletin.wi.gov/>



**** ONLY when the plants have green fruit and an average of 1 infested plant (larvae or fresh feeding damage) per 40 plants ** Monitor for damage carefully when trap catches exceed 7 moths per trap per week**

Drip Insecticide Program on Fruiting Vegetables

Time	Insecticide (PHI)	Rate/Acre
Pre-plant transplant	AdmirePro (21)	0.44 oz / 10,000 plants
28 days after planting*	Coragen + Admire Pro or... Platinum (30) or Durivo (30)	3.5 - 5 oz/acre 7 - 10.5 oz/acre 5 - 11 oz/acre 10 - 13 oz/acre

*Application of AdmirePro, Plantinum or Durivo must be timed not to violate PHI.

**Season scouting program to determine need for supplemental insecticide sprays should focus on thrips, mites and possibly stink bugs.

Drip Insecticide Program on Brassicas

Time	Insecticide (PHI)	Rate/Acre
Pre-plant transplant	AdmirePro (21)	0.44 oz / 10,000 plants
14-21 days after planting	Coragen (14)	3.5 - 5 oz/acre
30 days after planting*	Coragen + Admire Pro or... Platinum (30) or Durivo (30)	3.5 - 5 oz/acre 7 - 10.5 oz/acre 5 - 11 oz/acre 10 - 13 oz/acre

*Application of AdmirePro, Plantinum or Durivo must be timed to not violate PHI.

**Season scouting program to determine need for supplemental insecticide sprays should focus on thrips, mites and possibly stink bugs.

Drip Insecticide Program on Cucurbits

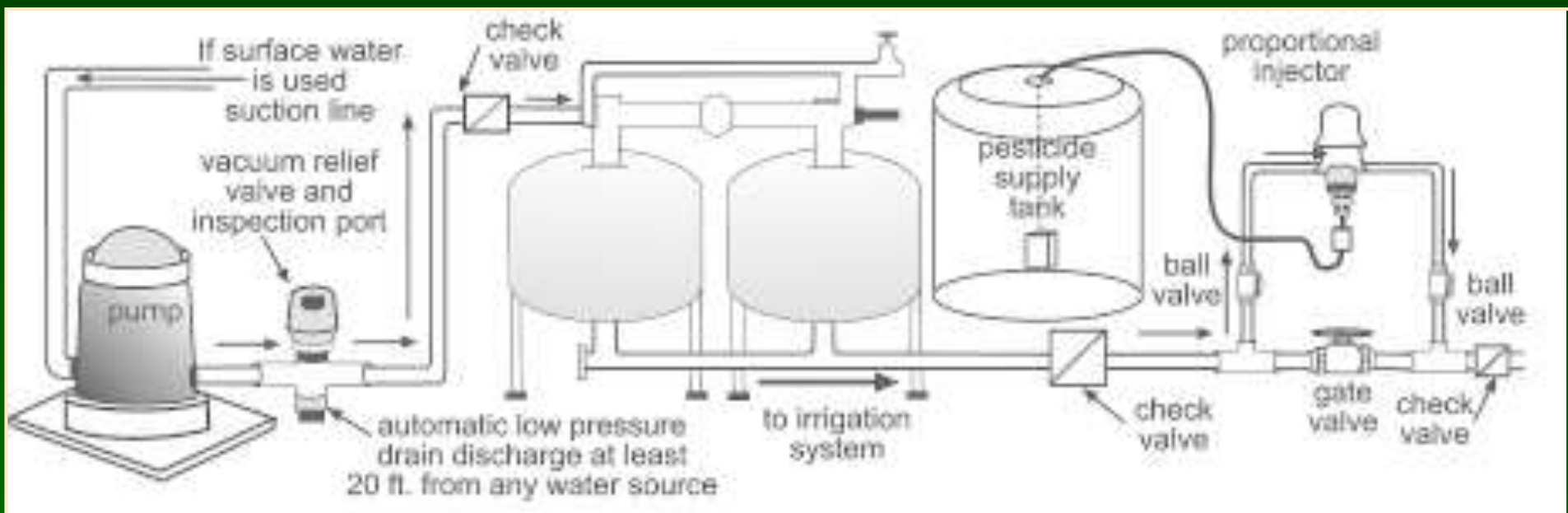
Time	Insecticide (PHI)	Rate/Acre
Pre-plant transplant	AdmirePro (21)	0.44 oz / 10,000 plants
14 - 21 days after planting*	Coragen + Admire Pro or... Platinum (30) or Durivo (30)	3.5 - 5 oz/acre 7 - 10.5 oz/acre 5 - 11 oz/acre 10 - 13 oz/acre
28 - 35 days after planting*	Coragen (14)	3.5 - 5 oz/acre

*Application of AdmirePro, Platinum or Durivo must be timed to not violate PHI.

**Season scouting program to determine need for supplemental insecticide sprays should focus on thrips, mites and possibly stink bugs.

ATCP 29 Rule, Pesticide Use and Control, Revised September 2009. ATCP 29.54 Chemigation.

http://datcp.state.wi.us/cp/consumerinfo/cp/cp_laws/pesticides/pesticide_use.pdf



Example Fertigation – Chemigation Assembly

www.agriculturesolutions.com

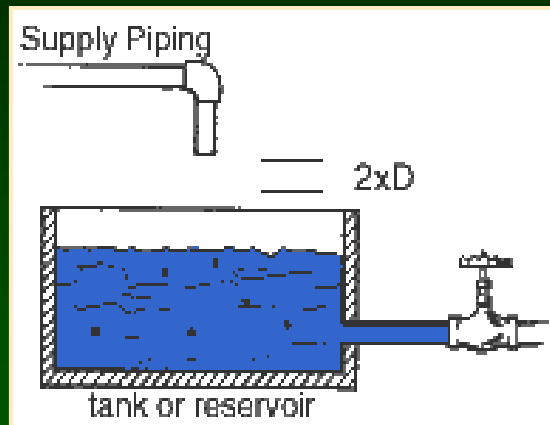


www.amiad.com/filters



Example Backflow Prevention

'Air Gap'



'Backflow Preventer'



For Best Results with Drip-Applied Insecticides

- Repair all leaks before chemigating.
- Before injection of insecticide begins, system must be fully pressurized.
- Minimum injection time should be time for water to move from injection point to most distant emitter.
- Water solubility and soil texture affects movement in soil, and timing of injection.
 - Low solubility = limited movement
 - High solubility = readily moves in soil

**Thank You, Questions, and
Always...**

Read and Follow Label Directions!

Pesticide Labels Change Frequently!

<http://www.entomology.wisc.edu/vegento/>

University of Wisconsin-Madison



Vegetable Crop Entomology



Extension and Research

