Integrated Pest Mananagement (IPM): New Tools and Proven Strategies

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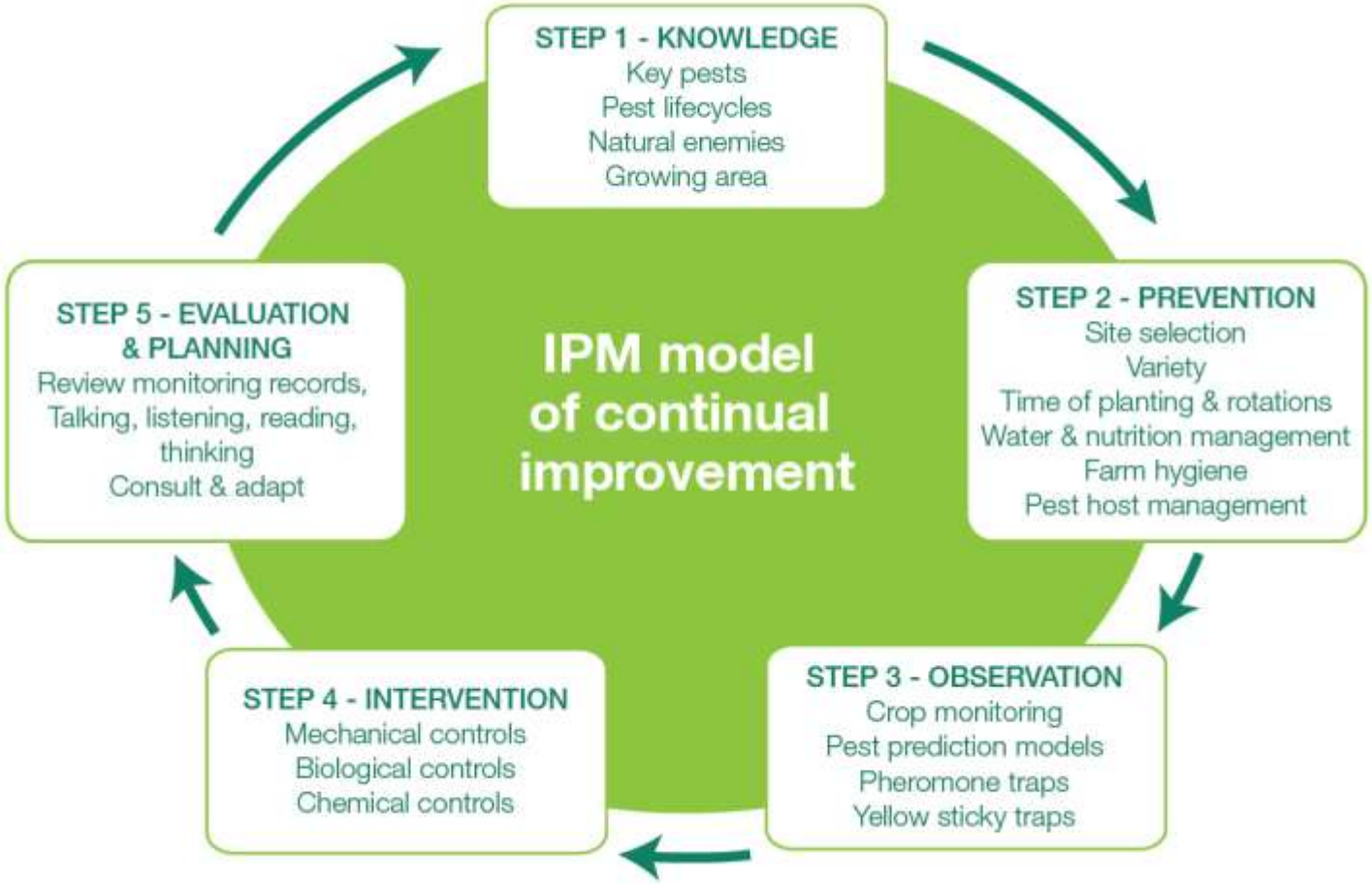
Prevent & Manage Pests with IPM

- Protect crop quality
- Maximize profits. Minimize costs, losses, disruptions
- Reduce environmental impacts
- Safeguard health (yours, customers, workers)

- Manage risks with IPM!

Integrated Pest Management



IPM starts with Good Sanitation

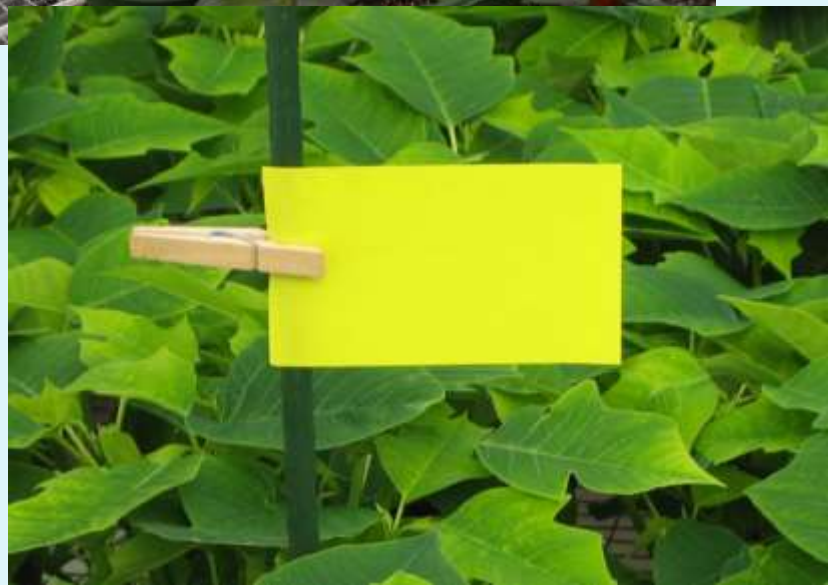
- Eliminate
  - weeds
  - plant debris
  - standing water
  - clutter
- Sanitize
  - floors
  - benches
  - cutting knives
  - pots and trays
- Keep watering nozzles off floor

Start Clean

- Thoroughly inspect incoming plant material BEFORE bringing it into the greenhouse
- Quarantine incoming plant material long enough to ensure it is pest-free

Pest Monitoring

- Yellow Sticky Cards
  - Fungus gnats
  - Shore flies
  - Thrips
- 1-2 cards/1000 ft^2
- 1-5” above plants



Pest Monitoring

- Indicator Plants
  - Highly attractive to certain pests
  - Early pest warning system
  - Remove or treat when infested
  - Examples: eggplant in poinsettias for whitefly, spider mites, petunia for viruses

Marigold in bedding plants for monitoring thrips

Pest Monitoring

- Scout crop 1-2 times/week
- Look for pests, off-color plants, damage, wilting
- Use pest ID guides, hand-lens, UMCE Pest Diagnostic Management Lab

Pest Monitoring

- Keep records!
- Predict and solve recurring pest issues
- Evaluate effectiveness of pest controls
- App available!

Sample Greenhouse Scouting Form

Date:_____ Greenhouse:_____ Scout:_____ Weather:_____

General Scanning Inspection															
	Insects and Mites									Diseases & Nutrient Problems					
Bench/ Plant Type	FG	SF	WFT	Other Thrips	GPA	Other Aphids	SM	Beneficials	Other:	PM	BO	PY	INSV	Other:	Other:
Total															

Sticky Cards															
	Insects and Mites									Diseases & Nutrient Problems					
Bench/ Plant Type	FG	SF	WFT	Other Thrips	GPA	Other Aphids	SM	Beneficials	Other:	PM	BO	PY	INSV	Other:	Other:
Total															

Plant Inspections															
	Insects and Mites									Diseases & Nutrient Problems					
Bench/ Plant Type	FG	SF	WFT	Other Thrips	GPA	Other Aphids	SM	Beneficials	Other:	PM	BO	PY	INSV	Other:	Other:
Total															

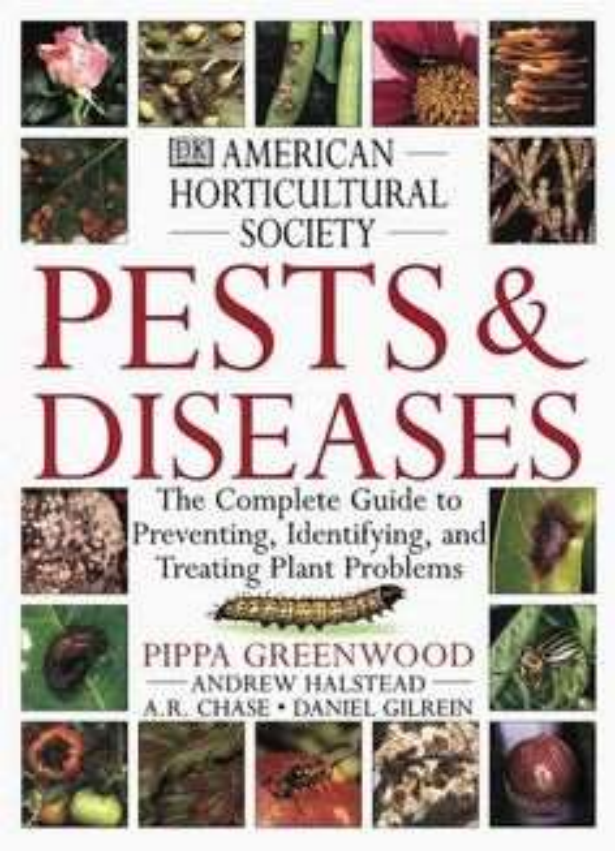
General Comments and Proposed Actions

Key to abbreviations:

FG	fungus gnats	SF	shore flies	WFT	western flower thrips
GPA	green peach aphid	SM	spider mites	PM	powdery mildew
BO	botrytis	PY	pythium	INSV	impatiens necrotic wilt virus

Form available at: www.uvm.edu/~entlab/

Know How to Identify Common Pests



Learn About Common Pests

Green Peach Aphid
Yellow-Green, Green or Red

- Large host range
- Antennae slightly shorter than body
- Black-tipped cornicles

Thrips

- Western Flower Thrips
- Eggs laid in plant tissue
- Larvae found on the undersides of leaves, in flowers or in plant crevices.
- drop into the soil to pupate
- Adult has fringed wings

Fungus Gnats

- Feeds on roots
- Wounding leads to plant diseases
- Eggs laid in the top layer of moist potting media
- Management: Don't overwater

Manage Pests with Combinations of IPM Methods

- Cultural
  - Sanitation (extreme clean, weed-free, no standing water)
  - Optimize growing conditions (, pH, fertili water, EC, temperature, light, humidity)
- Biological
  - Encourage native predators/parasitoids
  - Release beneficials
- Mechanical/Physical
  - Barriers (screened vents, doors closed), heat/cold
- Pesticides (chemical, microbial) if/where/when needed, using carefully selected product.

Give Pests the 1-2 Punch!

Consider Biocontrol Options

- Do some research. Find out which biocontrol agents and strategies are good fit for your operation.
- Ask for help (UMCE, biocontrol suppliers)

Photo: Whitney Cranshaw, Colo State Univ. Bugwood.org

Parasites or Predators? Or Both?

Parasites:

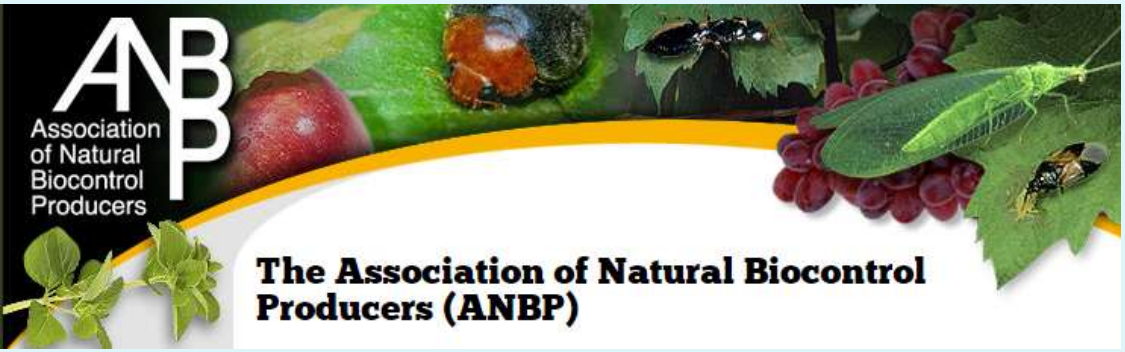
- Kills pest by laying eggs inside it
- Mostly pest-specific: specialize in killing one kind of pest
- Generally better searchers
- Used as a first line of defense, in combination with banker plants.

Predators:

- Eat pests
- Better/faster in cleaning up hot spots
- Not as pest-specific

Sachet of predatory mites for thrips control on hanging basket

Shop Smart



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IPM-146

Guidelines for Purchasing and Using Commercial Natural Enemies and Biopesticides in North America[1]

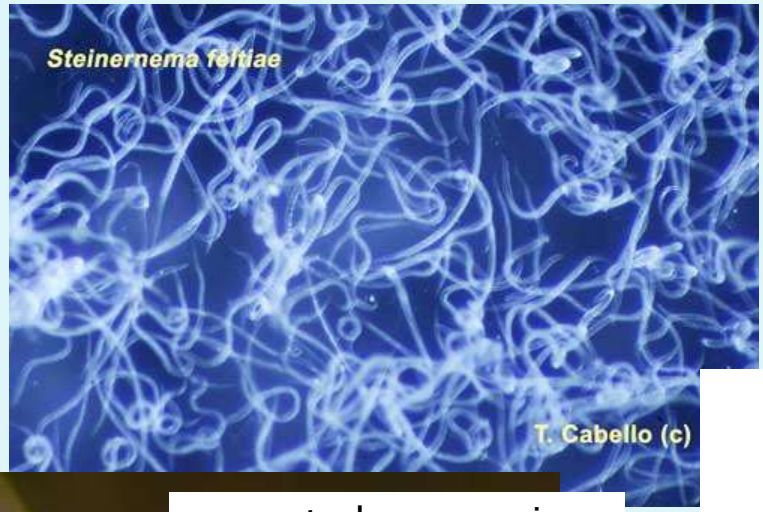
Lynn M. LeBeck and Norman C. Leppla[2]

Grower Guide:
Quality Assurance of Biocontrol Products

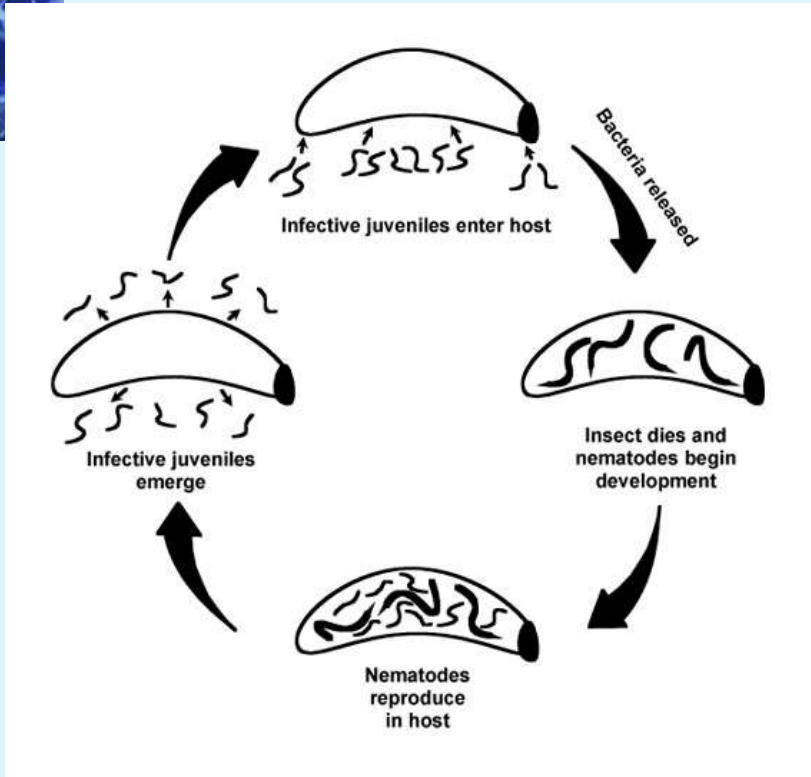
Compiled by Rose Buitenhuis, PhD, Research Scientist, Biological Control, Vineland Research and Innovation Centre, 2014

Find resources and suppliers at **www.anbp.org**

Beneficial Nematodes are a Good Place to Start: for Thrips, Fungus Gnats, Shore Flies



nematodes emerging from dead Western flower thrips larva



Beneficial Nematodes for Thrips Control

- Easy to ship and store
- Dip or drench plug trays or cuttings in water solution of beneficial nematodes
- Can add beneficial fungi for disease suppression

Aphid Biocontrol

Aphid Predator

Aphidoletes aphidimyza:

- Very mobile midge/predator
- Not picky in what they eat!
- Adults attracted to honeydew → lays eggs
- Larva kill up to 80 aphids per day
- Kill by paralyzing toxin
- Larva are sneaking up onto their prey, paralyze it, and then suck the aphid dry
- Works better on hot spots

Aphid Biocontrol

Parasitic Wasps

Aphidius colemani

- Good mobile searcher
- Effective against green peach and melon aphids
- Suitable with aphid banker plants

Aphidius ervi

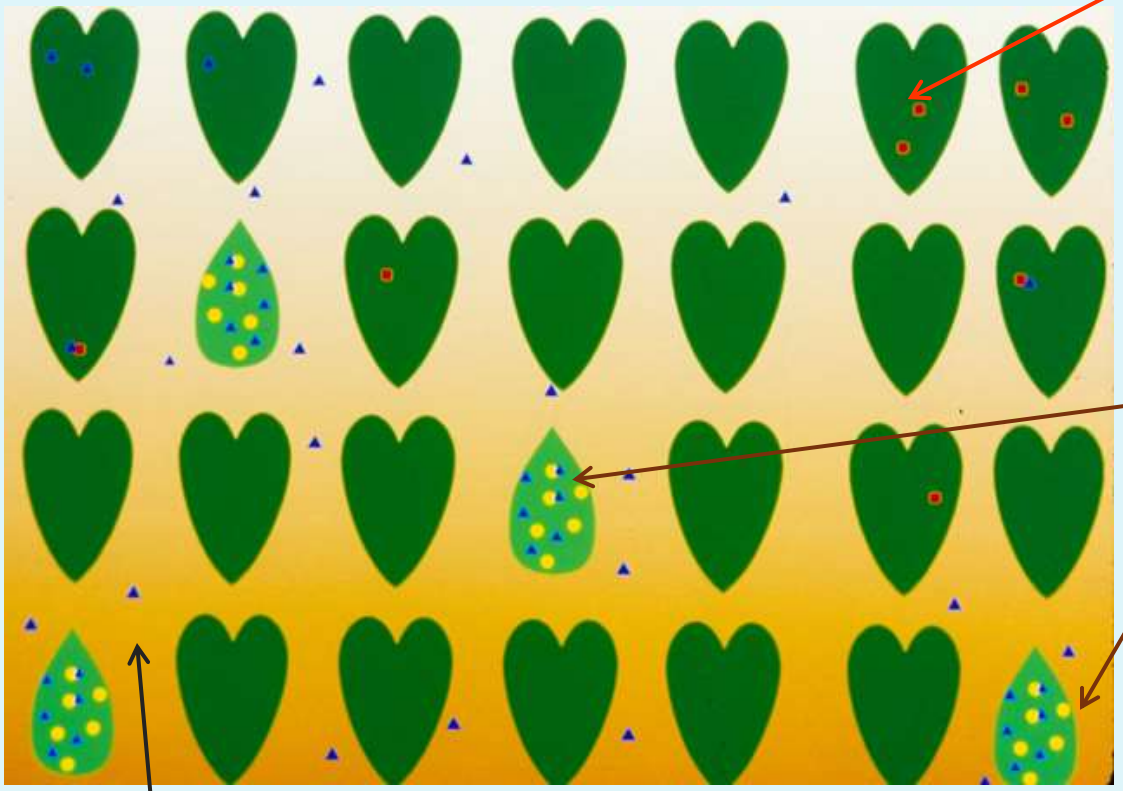
- Good mobile searcher
- Effective on potato and foxglove aphids

Aphelinus abdominalis

- Effective for potato and foxglove aphids

Banker Plants

Provide Pollen or Alternative Hosts to Increase Beneficial Insect Populations

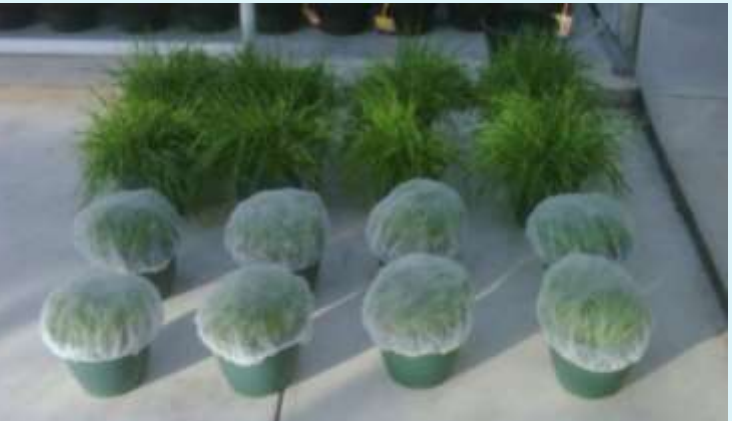


Crop pests on crop plant

Banker plants infested with alternative host for beneficial insect

Beneficial insects migrate from banker plant to crop plants to control pests

Aphid Banker Plant System



1. Plant cereal, keep in insect-proof cage to keep beneficials out. Repeat weekly for steady supply through

2. Infest with cereal aphids. Keep covered

3. Uncover and distribute infested banker plants throughout greenhouse.

4. Release aphid parasitoid throughout greenhouse

6. Scout for mummies

Banker Plants for Thrips Biocontrol

Ornamental pepper pollen enhances *Orius insidiosus* population to suppress thrips

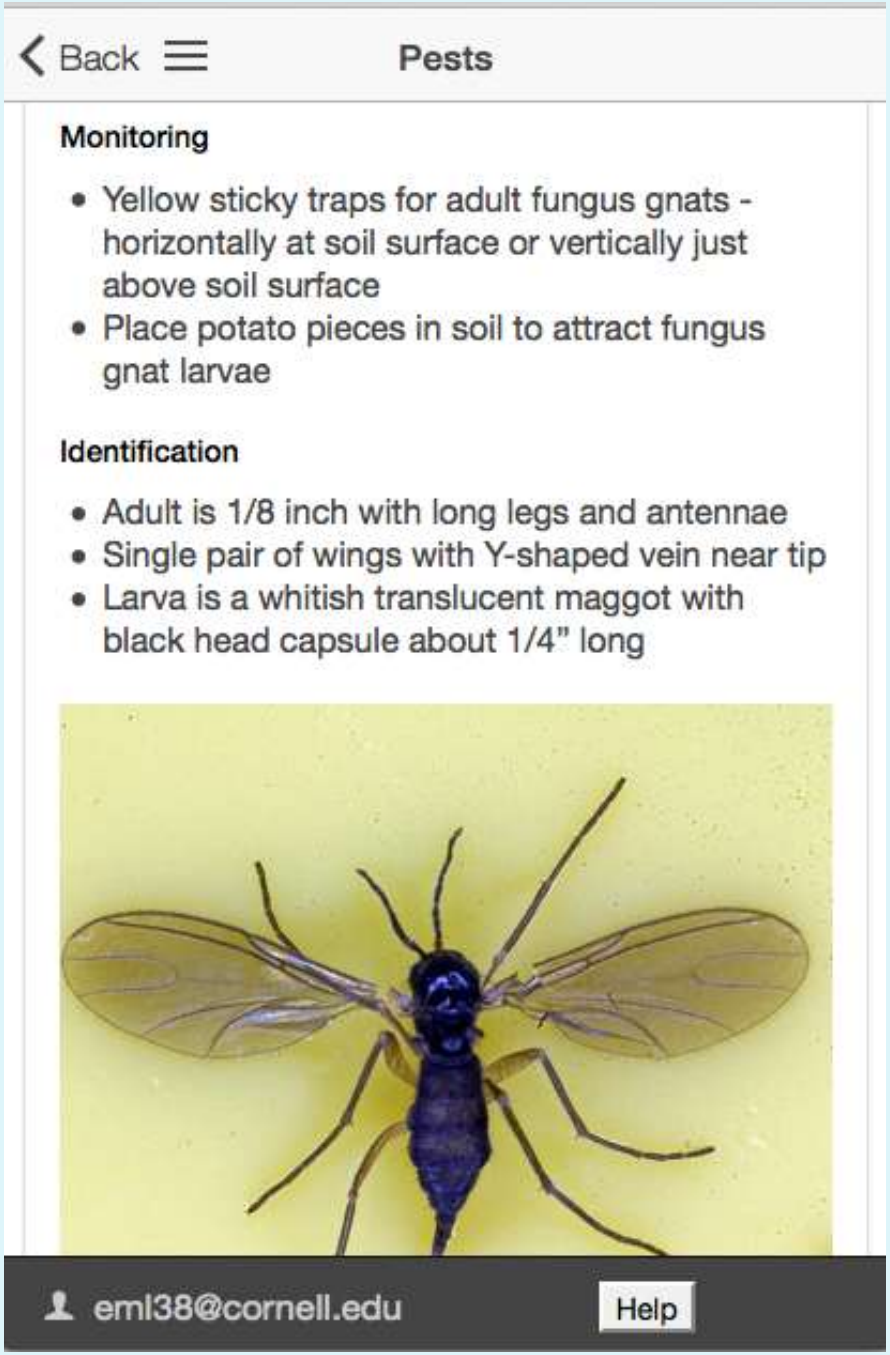
Purple Flash Pepper

Black Pearl Pepper

Greenhouse Scout Mobile App

- Pest identification guide
- Information on pests and beneficials – which bug is good for which pest
- Pesticide interaction and compatibility information
- Record and store your scouting and trap capture data
- Record pesticide applications

Find it at your favorite app store:
Greenhouse Scout on the App Store on iTunes
Greenhouse Scout—Android Apps on Google Play
Cost: $9.99
For more information contact:
Betsy Lamb, eml38@cornell.edu

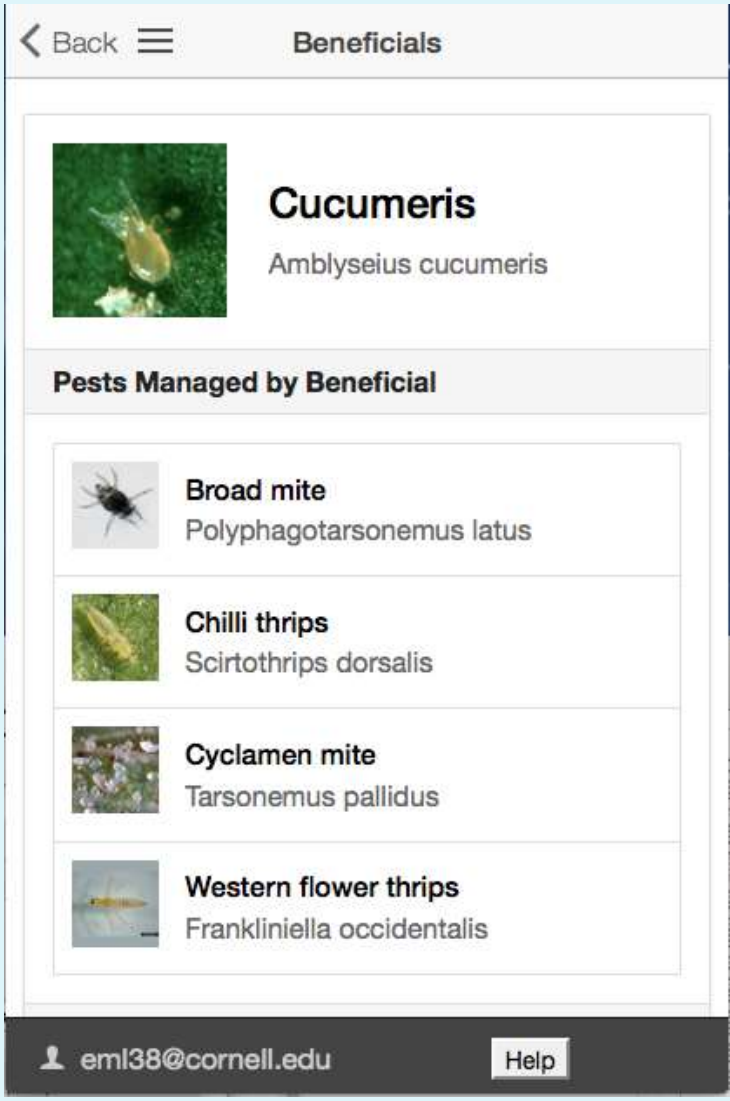


Pest Information and Tools

- Identification tools
- Monitoring guidelines

Beneficials

- Photos
- Insects controlled
- Biology and ID
- Life cycle and environment
- Application methods
- Check for viability
- Pesticide Interactions button

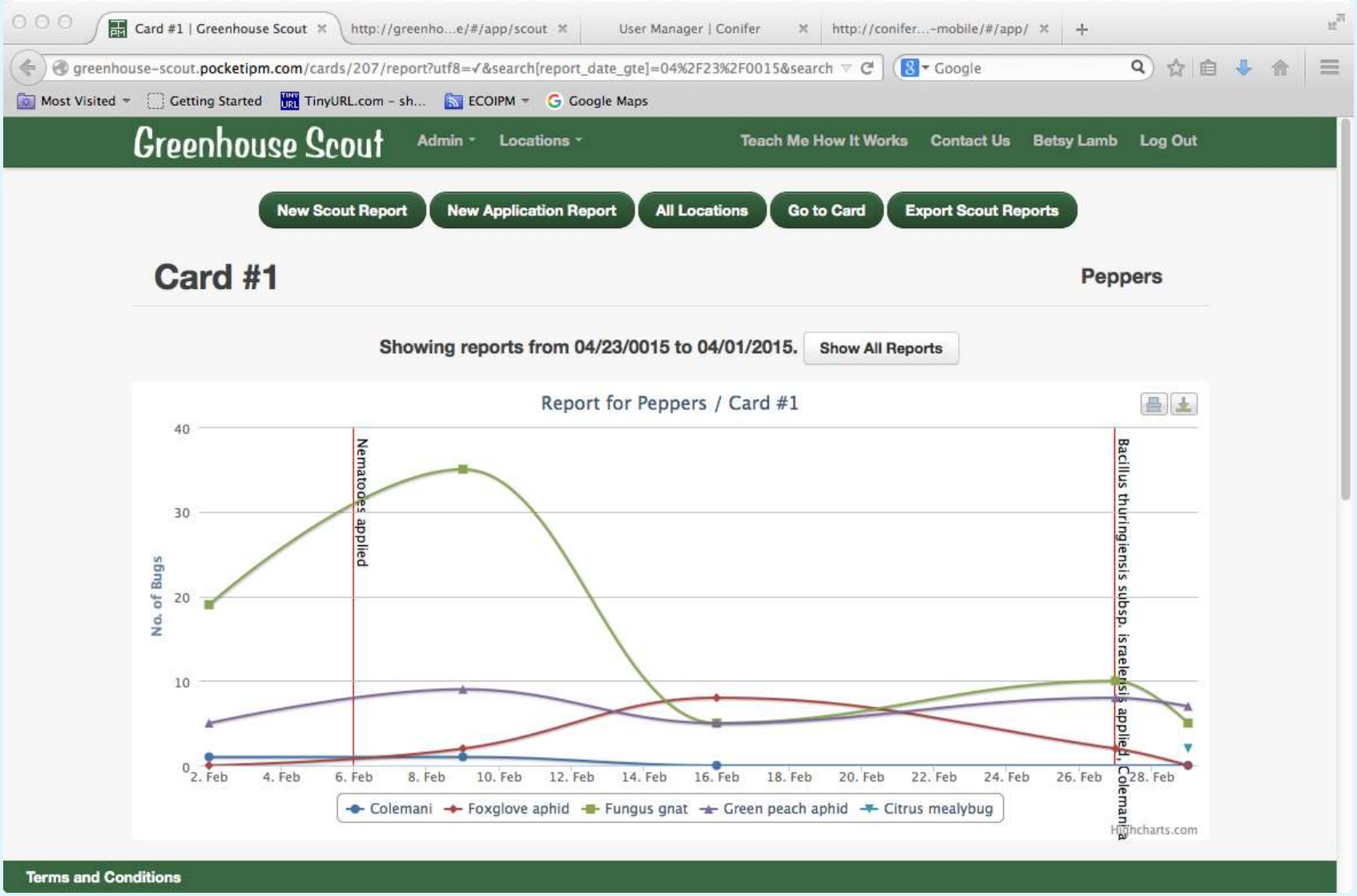


Record-Keeping Functions

1. Customize Reporting Forms on Website (easier to use a real computer and keyboard for this)

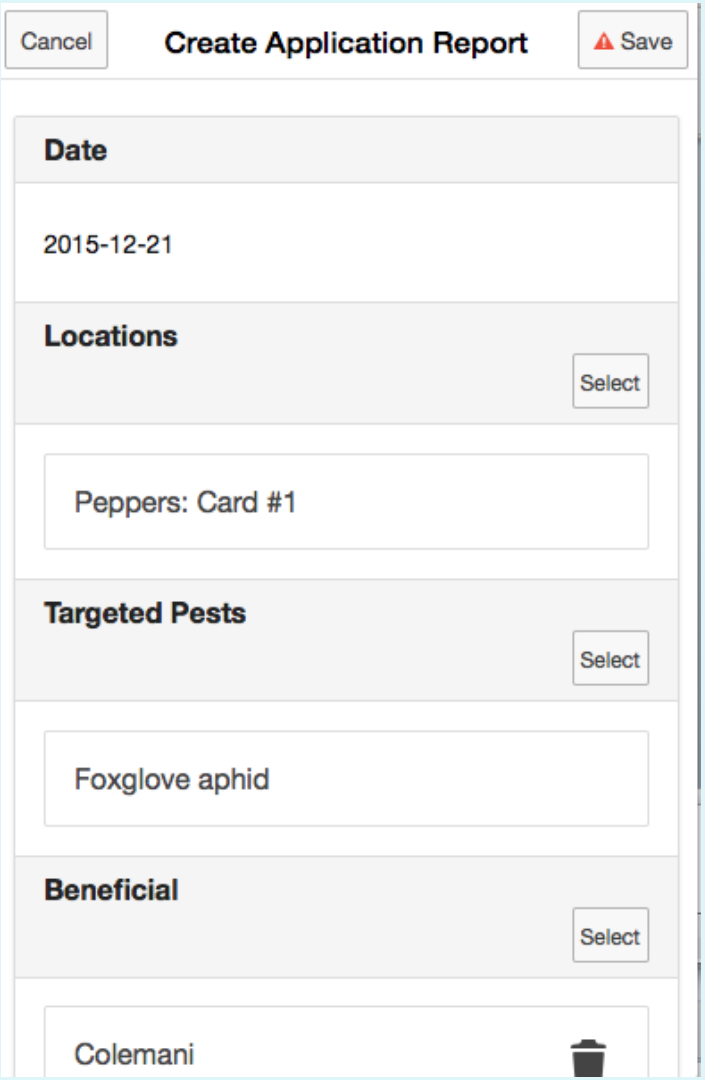
2. Use smart device to
   - Input real-time scouting data
   - Track beneficial releases and pesticide applications

Viewing data



Record Biocontrol or Pesticide Applications

- Choose targeted pest and biocontrol or pesticide
- Can be more than one on same date but need to be added separately



Pesticide–Biocontrol Compatibility

Back | Interactions

Aphidoletes

Aphidoletes aphidimyza

Abamectin

Egg	Imm.	Adult	Persistence
	4	4	1 week

Abamectin + bifenazate

Egg	Imm.	Adult	Persistence
	4	4	1 week

Acephate

Egg	Imm.	Adult	Persistence
	2	4	> 8 weeks

eml38@cornell.edu Help

Back | Interactions

Abamectin

Eremicus

Egg	Imm.	Adult	Persistence
		4	3 weeks

Aphidoletes

Egg	Imm.	Adult	Persistence
	4	4	1 week

Aphelinus

Egg	Imm.	Adult	Persistence
		4	

Ervi

eml38@cornell.edu Help

Final Thoughts on Biological Control

- Plan Well in Advance
  - Contact suppliers. Get technical recommendations specific to your system. Compare prices, shipping costs.
- Use them before you need them
- Keep them Alive
  - Store and release according to directions. Details are critical!
  - Avoid pesticide impacts (check compatibility charts, spot treat, time application to avoid direct impact on beneficials)

Don't Kill your Biocontrols with Pesticides!

Side-effects manual

Active ingredient | Commercial product

Filter

- 2.4.D
- abamectin
- acephate
- acequinocyl
- acetamiprid
- acrinathrin
- Adoxophyes orana Granulose Virus
- alachlor
- aldicarb
- alphacypermethrin

Beneficial organism:

- Amblyseius californicus
- Amblyseius cucumeris
- Amblyseius degenerans
- Amblyseius swirskii
- Anthocoris nemoralis
- Aphidius spp.
- Aphidoletes aphidimyza
- Bombus spp.
- Chrysopa carnea
- Coleoptera
- Dacnusa sibirica
- Diglyphus isaea

Legend

Toxicity on natural enemies

Class	Toxicity	Mortality
1	Non-toxic	< 25%
1-2	Values ranging between class 1 & 2	
2	Slightly toxic	25-50%
2-3	Values ranging between class 2 & 3	
3	Mod. toxic	50-75%
3-4	Values ranging between class 3 & 4	
4	Toxic	>75%

Toxicity on bumblebees

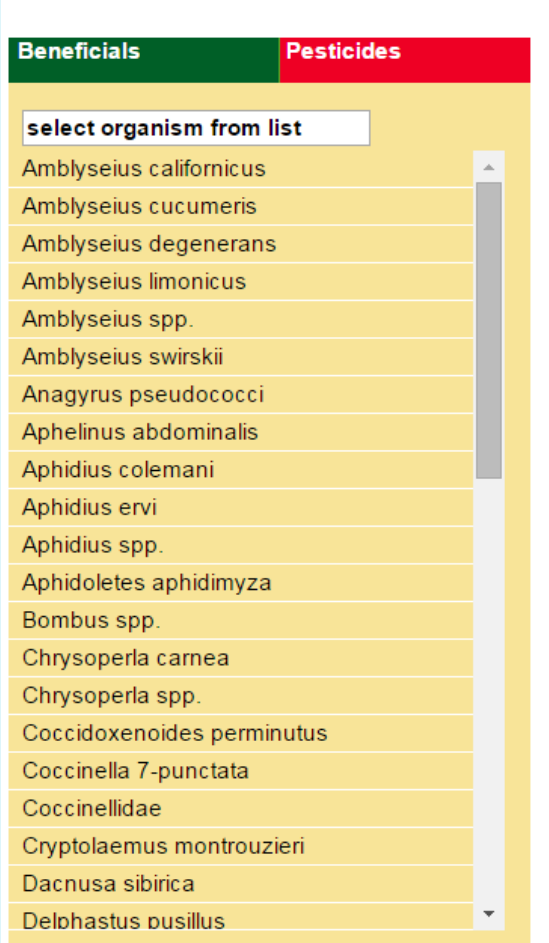
Method of application

Persist code

Greenlab

BioBestGroup.com

Another Biocontrol-Pesticide Compatibility Search Tool



KOPPERT
BIOLOGICAL SYSTEMS

Koppert.com (click on Side Effects)

Do You Need a Pesticide Applicators License?

- Required if you apply pesticides to plants or plant products intended for human consumption and have annual sales of $1000 or more.
- Includes growers of vegetable seedlings
- For more info: www.thinkfirstspraylast.org 207-287-2731

Strategies to Avoid Pesticide Resistance

- Minimize pesticide use
- Spot-treat
- Rotate use of chemicals with different modes of action
- Select products specific to pest
- Calibrate application equipment often
- Follow label PRECISELY. Double check your math

Pesticides & Pollinators

Biggest risks to bees from insecticides used on ornamental plants

- Spraying open flowers during the last few weeks before shipping (with any insecticide).
- Soil drenches in greenhouses with imidacloprid, primarily used in hanging baskets
- Soil drenches of flowering trees (*Tilia*) in nurseries or in yards for Japanese beetle, etc.

From Smitley, D. Michigan State Univ

How Soon After Treatment Can Plants Safely be Shipped?

- Research to determine the last time that foliar sprays can be applied to open flowers, and still be safe for bumblebees
- Flowers were sprayed with imidacloprid at 4, 2 and 1 week before shipping.
- Flowers were sampled 1 week after the shipping date

D. Smitley, Michigan State Univ 2014

Weeks Before Shipping	Plant Type	Olefin (ppb)	Imidacloprid (ppb)
1	Portulaca	70	110*
1	Verbena	0	70
1	Salvia	20	200
1	Marigold	0	0.6
2	Portulaca	0	0
2	Verbena	30	430
2	Salvia	30	0
2	Marigold	0	0
4	Portulaca	0	0
4	Verbena	0	0
4	Salvia	0	0
4	Marigold	0	0

*means of 10 replications

Results

Dislodgable residues were measured on 4 types of flowers

- > 20 ppb were only found on dislodgable residue samples from flowers sprayed 1 or 2 weeks before shipping.

❖ Conclusion- Avoid spraying open flowers the last 2 weeks before shipping.

Note: Whole-flower tissue analysis pending

Recommendation

- When purchasing plants, get the supplier's treatment schedule and don't plan to sell them until 2-3 weeks after last imidacloprid spray
- Don't retail or ship plants until 2-3 weeks after last spray.

THE NEW EPA BEE ADVISORY BOX

On EPA's new and strengthened pesticide label to protect pollinators

PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at:
http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state/tribe, go to: www.aapco.org. Pesticide incidents can also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

The new bee icon helps signal the pesticide's potential hazard to bees.

Makes clear that pesticide products can kill bees and pollinators.

Bees are often present and foraging when plants and trees flower. EPA's new label makes it clear that pesticides cannot be applied until all petals have fallen.

Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

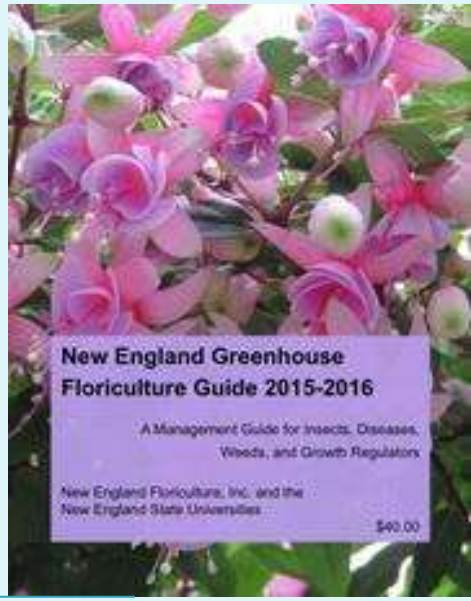
The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA's new label will help protect pollinators.

EPA

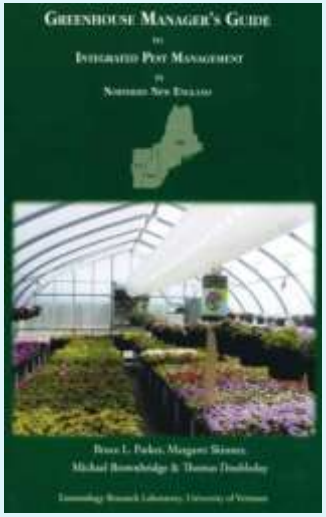
Read EPA's new and strengthened label requirements: http://go.usa.gov/jHH4

Resources

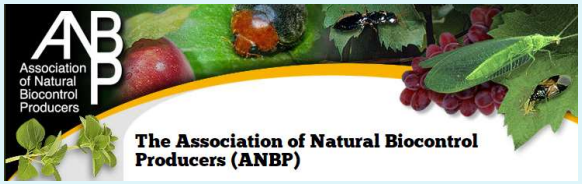
- New England Greenhouse Floriculture Guide--Complete IPM recommendations Available from UMASS Extension ($40):
  - https://umassextensionbookstore.com



- Greenhouse Managers Guide to IPM. Download at www.uvm.edu/~entlab



- Association of Natural Biocontrol Producers: www.anbp.org/ (Guidelines and Suppliers)



Learn and Network with Other Growers

- **TriState IPM Workshop** (January 19, 2016, Longfellows Greenhouses, Manchester, ME) **Deadline for Registration is Tomorrow!**
- Save the Date: **Maine Greenhouse Best Practices Workshop**: March 16, 2016. Half-Moon Gardens Greenhouses, Unity College, Unity, ME.
- Join GreenGrower listserv (contact Cheryl Frank Sullivan, cfrank@uvm.edu, 802.656.5440)

Maine Integrated Pest Management (IPM) Council

www.maine.gov/ipmcouncil
www.gotpests.org

- Established by Maine Legislature to promote, expand and enhance integrated pest management adoption in all sectors of pesticide use and pest management within the State.
- Administered and coordinated jointly by the Maine Department of Agriculture, Conservation and Forestry and the University of Maine Cooperative Extension.

Our Mission

The Integrated Pest Management Council will define, promote and enhance implementation of IPM practices that reduce or minimize harmful environmental and human health impacts of pesticides and other pest management practices. The Council will promote the education of the public regarding the need, benefit, and practices of IPM.

IPM Resources

- UMCE – Pest Management Office 1-800-287-0279 , www.umaine.edu/IPM
- Maine Department of Agriculture, Conservation and Forestry 207-287-3891, www.maine.gov/IPM
- Board of Pesticides Control 287-287-2731 www.thinkfirstspraylast.org