

BioControl in the Greenhouse Sponsored by:




2:00 to 2:25 Eastern

PESTICIDES- ARE THEY EVER COMPATIBLE WITH A BIOCONTROL PROGRAM?



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Pesticides- Are They Ever Compatible with a Biocontrol Program?


Rick Yates
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 **Altogether. Better.**

Pesticides- Compatible with a Biocontrol Program?

Integrated Pest Management approach implies a variety of tactics that interact with each other.

- Cultural controls- nutrition, bloom date manipulation, optimizing growing environment, sanitation
- Scouting/monitoring- essential!
- BCA's- "Compatible" Pesticides




"Compatible" Pesticides

Just how compatible are they?

| Toxicity Legend | | |
|---------------------------------------|------------------|------------------|
| ■ | Toxic | >75% mortality |
| ■ | Moderately Toxic | 50-75% mortality |
| ■ | Slightly Toxic | 25-50% mortality |
| ■ | Safe | < 25% mortality |


What about sub-lethal effects?



Sub-lethal Effects on BCA's


- Residual activity
 - ▶ Residues may have repellent activity thus influencing the ability of parasitoids or predators to locate a food source.
 - ▶ Residues on a potential host may make them unacceptable to a parasitoid or predator.

Adapted from: "Compatibility Conflict: Is the Use of Biological Control Agents with Pesticides a Viable Management Strategy?"- R. Cloyd, Kansas State University



Sub-lethal Effects on BCA's

- ▶ May affect reproduction such as sterilizing females, reducing egg laying or impact the ratio of females vs. males.
- ▶ Foraging behavior may be modified and reduce the ability of a parasitoid or predator to find a host (Elzen 1989).



Compatible Pesticides

Why even use them??

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Why BCA Compatible Pesticides?

- Weather changes abruptly from cool to warm and the pest population ramps up faster than the BCA's.
 - ▶ Ex- aphids, thrips in the typical spring greenhouse.
- BCA suppliers run into shortages and transportation difficulties and miss shipments at crucial times.

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Why BCA Compatible Pesticides?

- Incoming plant material has an unacceptably high level of pests.
- Sometimes there are so many overlapping pests that it is difficult to control all with only BCA's.
- An unanticipated pest arrives.
- Stuff happens!

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Compatible Pesticides- Where are the Resources?

- Biocontrol companies
- University and extension researchers
- Pesticide companies
- Grower anecdotes- Careful with this...

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What are the Challenges?

- So many BCA/pesticide combos to test
 - ▶ Needed data often lacking
- Difference in testing techniques can cause apparent contradictions
 - ▶ Greenhouse vs petri dish?
 - ▶ Was it tested as a spray, drench or both?

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Minimizing Pesticide Risks to BCAs

- Pesticide records available for incoming plant material?
- Use lowest rates and least BCA toxic products that will give effective control
- Spot treat where practical


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Choosing Compatible Pesticides

- Identify compatible pesticides when the crops are being planned. (This is planning to succeed, not planning to fail!)
- Consider all BCA's that might be used in the course of production.
 - ▶ Need ability to react quickly to save the BCA program.
- Determine acute toxicity to BCA's & length of residual.
 - ▶ Don't forget fungicides and PGR's.


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BCA "Hit List"

- **Synthetic pyrethroids:** ≥ 8 wk residual
 - ▶ Ex: Decathlon (cyfluthrin), Talstar (bifenthrin), Tame (fenpropathrin)
- **Organophosphates:** avg 4-8 week residual
 - ▶ Ex: Acephate/Orthene, Dursban/Duraguard (chlorpyrifos)
- **Carbamates:** ≥ 8 wk residual
 - ▶ Ex- Mesuro (methiocarb), Sevin (carbaryl)

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What is a Biorational Pesticide?

- EPA definition for Biorational Pesticide
 - ▶ "Fundamentally different modes of action"


and

- ▶ "Lower risks of adverse effects"

When compared to conventional pesticides (i.e. neurotoxin).

- Exs- IGR's, insecticidal soaps, horticultural oils, microbial insecticides.


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Examples of Biorational Pesticides

| Fungicides | Insecticides |
|-----------------|-----------------------|
| • Actinovate SP | • Aria/Endeavor |
| • Affirm | • Azatin/Azaguard |
| • Cease | • Botanigard/Mycotrol |
| • Companion | • Conserve |
| • Milstop | • Dipel |
| • Oxidate | • Essential oils |
| • Rootshield | • IGR's |
| | • M-Pede |


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<http://extension.umass.edu/fruitadvisor/nc-small-fruit-management-guide/biorational-pesticides>



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| • Rootshield | • IGR's |
| | • M-Pede |


Red font = known BCA toxicities
<http://extension.umass.edu/fruitadvisor/nc-small-fruit-management-guide/biorational-pesticides>



Biorational = BCA safe?

- Conserve is a biorational pesticide
 - ▶ Safe for most mites
 - ▶ Toxic to *Aphidius spp.*, *Encarsia formosa*, *Eretmocerus spp.*, and *Orius*
- Pyganic (natural pyrethrin plus PBO)
 - ▶ Toxic to nearly all BCA's with an average one week residual effect


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Caution is needed... **BEWARE**

- PGR's??
 - ▶ Cycocel reduced spider mites for up to 6 months on hibiscus*
- “Inert” ingredients and formulations matter.
 - ▶ Example: *Beauveria bassiana* products


*Osborne and Chase. HortScience 25:648-650



Caution is needed... **BEWARE**

- Milstop fungicide
 - ▶ Labeled in NY to control: aphids, spider mites, mealybugs, whiteflies.
 - ▶ BCA's??
- Surfactants
 - ▶ CapSil gave 53% mealybug mortality in one study*, better than some of the tested insecticides.

*Raymond Cloyd, Pest Management, Vol 26 No2, “Consider Alternative Products for Pest Control”



Things to keep in mind

- Read and follow everything on the pesticide labels!!!
 - ▶ Caution- labels change!
- Not all mentioned pesticides are labeled in every state.
- Products other than those mentioned may be safe and effective.

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Short Residual- “Clean Up” Pesticides



Examples:

| Pesticide | Pests Controlled | Comments |
|--------------------|--|--|
| Botanigard ES, WP | Aphids, thrips, whiteflies | Toxic to some BCA's. 1 week or less residual |
| Horticultural oils | Mites, scale, mites, mealybugs, whiteflies | Toxic to many BCA's. 1 week or less residual |
| Insecticidal soaps | Aphids, mealybugs, mites, many others | Toxic to many BCA's. 1 week or less residual |
| Floramite | Mites | Toxic to some BCA's. 1 week or less residual |
| Pyganic | Flying insects, beetles, caterpillars, many others | Toxic to many BCA's. 1 week or less residual |


About the Pesticide/BCA Compatibility Tables

- Multiple sources used when available.
- Typically went with the most pessimistic.
- Table is revised as more data is found.
- Time on table refers to persistence.
- Immature life stages noted if different from adult.

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BCA Compatibility Ratings

| Toxicity Legend | | |
|-----------------|-------------------------|------------------|
| | Toxic | >75% mortality |
| | Moderately Toxic | 50-75% mortality |
| | Slightly Toxic | 25-50% mortality |
| | Safe | < 25% mortality |

“S” on following tables = Safe

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Pest Specific Compatible Pesticides

| Crop Key for Pesticide Use | |
|----------------------------|--|
| H | Harvest – Edible crops grown to harvest |
| T | Transplants – Edible crops as transplants for re-sale |
| O | Ornamentals – Non-edible crops |

Always check the product label for the list of edible crops as included crops vary.

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Pest Specific Compatible Pesticides

Disclaimer-

Recommendations for BCA compatible pesticides are made based on a compilation of published data but cannot be guaranteed under all circumstances. Growers need to test on a small scale before large scale applications.

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Compatible Pesticides- Aphids

| Pesticide | <i>Aphidius colemani</i> | <i>Aphidius ervi</i> | <i>Aphidioletes aphidimyza</i> | Lacewing <i>C. carnea</i> | H,T,O | OMRI |
|----------------------------|--------------------------|-------------------------|--------------------------------|------------------------------|-------|------|
| Azatin O, Azaguard, Molt-X | S | S | S | S | H,T,O | Yes |
| Endeavor | Slightly Toxic* 1 wk | Slightly Toxic* 1 wk | Slightly Toxic 1 wk | S | O | No |
| Flagship (drench only) | S | ? | S | ? | O | No |
| Grandevo PTO | S | ? | S | ? | H,T,O | Yes |

* Mummies safe

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Compatible Pesticides- Aphids

| Pesticide | <i>Aphidius colemani</i> | <i>Aphidius ervi</i> | <i>Aphidioletes aphidimyza</i> | Lacewing <i>C. carnea</i> | H,T,O | OMRI |
|------------------------|--------------------------|----------------------|--------------------------------|------------------------------|-------|------|
| Kontos (drench only) | S | S | S | S | T,O | No |
| Marathon (drench only) | S | S | S | S | T,O | No |
| Preferal | S | S | S | S | H,T,O | Yes |
| Safari (drench only) | S | ? | S | ? | O | No |

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Compatible Pesticides- Fungus Gnats

| Pesticide | <i>Atheta coriaria</i> | <i>Hypoaspis miles</i> * | <i>Steinernema feltiae</i> | H,T,O | OMRI |
|----------------------------|------------------------|--------------------------|----------------------------|-------|------|
| Adept | Toxic larvae 2 wks | S | S | O | No |
| Azatin O, Azaguard, Molt-X | ? | S | S | H,T,O | Yes |
| Citation | Toxic larvae 2 wks | S | S | O | No |
| Distance | ? | S | S | H,T,O | No |
| Flagship (drench only) | Toxic 1 wk | Toxic | S | O | No |
| Gnatrol | S | S | S | H,T,O | Yes |
| Safari (drench only) | Toxic 1 wk | ? | S | O | No |


* AKA *Stratiolaelaps scimitus*

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Compatible Pesticides- Spider Mites

| Pesticide | <i>Amblyseius andersoni</i> | <i>Amblyseius californicus</i> | <i>Amblyseius cucumeris</i> | <i>Phytoseiulus persimilis</i> | H,T,O | OMRI |
|-------------------------|-----------------------------|--------------------------------|-----------------------------|--------------------------------|-----------------|------|
| Floramite | ? | S | S | Moderate Toxic 1 week | H,T,O tomato | No |
| Hexygon | S | S | S | S | O | No |
| Kontos (drench only) | S | S | S | S* | T,O | No |
| Ovation | S | S | S | S | O | No |
| Preferal | ? | S | S | S | P,T,O | Yes |
| Shuttle | ? | S | S | Slightly Toxic 1 week | H,T,O tomato | No |


* One study indicated slight toxicity but did not specify spray or drench

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Compatible Pesticides- Thrips

| Pesticide | <i>Amblyseius cucumeris</i> | <i>Amblyseius swirskii</i> | <i>Orius</i> | <i>Steinernema feltiae</i> | H,T,O | OMRI |
|----------------------------------|-----------------------------|----------------------------|-----------------------------------|----------------------------|-------|-----------|
| Aria | S | Slightly Toxic 2 wks | S | S | O | No |
| Azatin O, Azaguard, Molt-X | S | Slightly Toxic 1 wks | Nymphs Slightly Toxic 2 wks | S | H,T,O | Yes |
| Botanigard, Mycotrol | S | S | Slightly Toxic 2 wks | S | H,T,O | No Yes |
| Flagship (drench only) | S | S | Toxic 4 weeks | S | O | No |
| GRANDEVO PTO | *** | *** | S | ? | H,T,O | Yes |


** Slightly toxic to *A. californicus*, unknown for *A. cucumeris* and *A. swirskii*



Compatible Pesticides- Thrips

| Pesticide | <i>Amblyseius cucumeris</i> | <i>Amblyseius swirskii</i> | <i>Orius</i> | <i>Steinernema feltiae</i> | H,T,O | OMRI |
|-------------------------|-----------------------------|----------------------------|-------------------------------|----------------------------|-------|------|
| Kontos (drench only) | S | S | Slightly Toxic* 4 weeks | S | T,O | No |
| Overture | *** | *** | S | S | O | No |
| Pedestal | S | ? | S | ? | O | No |
| Preferal | S | S | S | S | H,T,O | Yes |
| Safari (drench only) | S | Toxic 2 wks | ? | S | O | No |

*Kontos, 3 sources said safe
** NoFly- currently unavailable
***Overture- safe on predator mites per grower reports, no data

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Compatible Pesticides- Whiteflies

| Pesticide | <i>Amblyseius swirskii</i> | <i>Encarsia formosa</i> | <i>Eretmocerus spp</i> | H,T,O | OMRI |
|----------------------------|----------------------------|-------------------------------------|------------------------|-----------------|-----------------|
| Aria | Slightly Toxic 2 weeks | S | S | O | No |
| Azatin O, Azaguard, Molt-X | Slightly Toxic 1 wk | Slightly Toxic 2 wks Larvae Safe | S | H,T,O | Yes |
| Botanigard | S | Slightly Toxic 1 wk | S | H,T,O | Mycotrol Yes |
| Kontos-drench only | S | S | ? | T,O | No |
| Pedestal | S | S | S | O | No |
| Preferal | ? | S | S | H,T,O | Yes |
| Safari-drench only | Toxic | Slightly Toxic 4 wks | S | O | No |
| Talus | Slightly Toxic 1 wk | Slightly Toxic 1 wk Adults Safe | S | H,T,O Tomato | No |

BioControl in the Greenhouse



Coming Up Next:
2:30 to 2:55 Eastern

The Fundamentals of Biocontrol of Fungal and Bacterial Diseases

Margery Daughtrey



| Time | Topic |
|--------------|--|
| 3:00 to 3:25 | Case Studies of Using Biocontrol for Disease Control in Greenhouse Crops |
| 3:30 to 3:45 | Wrap-up/Questions |