Combining Biocontrol Agents with Conventional Pesticides

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Compatibility Check

• Which pesticide/application method?
• Residues? How persistent?
• What stage of the crop? Propagation? Later?

• Which BCA’s are you using?
• Established or establishing populations?
• What is the impact on the BCA system as a whole?

Compatible?
Questions to Ask Before You Load Up the Tank

• Is it really necessary to spray? Tipping point reached? How many BCA’s are you finding?
• What other options are there? Increase BCA numbers? Different BCA’s? Softer chemistries or bio-pesticides?

Questions to ask if you DO have to spray

• Do I need to apply everywhere or can I spot treat?
• What impact will this have on my pest management program as a whole?

Other Questions to Ask

• How did it get to this point?
• How can I avoid this situation in the future?
To Spray or Not to Spray?
To Spray or Not to Spray?

No Spray Required!

Tipping point has been reached

Control has been achieved
Some Reasons Why Biocontrol Fails

• Starting too late!
• Reactive vs proactive
• “Trying” biological control
• Not starting clean → pest and residues
• Scouting and monitoring!
• Not taking all pest and disease problem into consideration
• Poor planning → Supply of BCA’s (forecasting)
Some (more) Reasons Why Biocontrol Fails

- Poor management (application of BCA’s)
- No technical support
- Not checking quality of BCA’s
- Fear of loss ➔ bailing at tipping point ➔ Trust
- Expectations vs threshold
- Cost ➔ Reducing input
- Compatibility with traditional crop protection products
Pest Management and Residues

- 2011 – Canadian growers, poor results from biocontrol in poinsettias
- 2012 - 10 samples of unrooted cutting sent off for testing
- Found AI from 24 insecticides and 20 fungicides
- Half had Orthene (major contributor to failure of *Eretmocerus* – 16 wk residual)

- Abamectin (*Avid*®)
- Buprofezin (*Talus*®)
- Fenazaquin (miticide)
- Pyridaben (*Sanmite*®)
- Pyriproxifen (*Distance*®)
- Spinosad (*Conserve*®)
- Spiromesifen (*Judo*®)
- Thiacloprid (neonic)
- Thiamethoxam (Flagship®)
- Novaluron (*Pedestal*®)

- Acephate (*Orthene*®)
- Acetamiprid (*Tristar*®)
- Bifenthrin (*Talstar*®)
- Clothianidin
- Cyfluthrin (neonic)
- Imidacloprid (*Marathon*®)
- Lambda-cyhalothrin
- Methamidiphos (*Monitor*®)
- Methomyl (*Lannate*®)
- Omethoate
- Oxamyl (*Vydate*®)
Testing Compatibility BCA’s and Pesticides

- Laboratory test: < 30% Mortality Continue testing
- Semi-field test: < 25% Mortality Continue testing
- Field test: Safe or slightly harmful

Moderately harmful

Safe

harmful
### Testing Compatibility BCA’s and Pesticides

<table>
<thead>
<tr>
<th>SCALE</th>
<th>CATEGORY</th>
<th>LABORATORY</th>
<th>SEMI-FIELD</th>
<th>FIELD (%)</th>
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<tbody>
<tr>
<td></td>
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<td>INITIAL (% effect incl. Mortality &amp; Fecundity reduction)</td>
<td>PERSISTENCE (days)</td>
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<td>5-15</td>
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<td>3</td>
<td>MODERATE HARMFUL</td>
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<td>51-75</td>
<td>16-30</td>
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<td>4</td>
<td>HARMFUL</td>
<td>&gt;99</td>
<td>&gt;75</td>
<td>&gt;30</td>
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</tbody>
</table>

**SCALE**
- 1: Low persistence
- 2: Slightly persistent
- 3: Moderate persistent
- 4: High persistence

**CATEGORY**
- SAFE
- SLIGHTLY HARMFUL
- MODERATE HARMFUL
- HARMFUL

**PERSISTENCE**
- <5 days
- 5-15 days
- 16-30 days
- >30 days

**FIELD (%)**
- <25
- 25-50
- 51-75
- >75
Some Real Examples of BCA’s and Compatibility
Different Scenarios

Caution: Slippery Slope  Timing is Everything  Calculated Low Risk
Real situation in cut gerbera production ➔ Slippery Slope

BCA’s used in cut gerbera:

- Amblyseius cucumeris
- Amblyseius swirskii
- Phytoseiulus persimilis
- Aphidius colemani
- Aphidius ervi
- Diglyphus isae
- Orius insidiosus
- Delphastus spp
- Aphidoletes aphidimyza
- Encarsia formosa
- Eretmocerus eremicus
Real situation cut gerbera production ➔ Slippery Slope

- West coast grower using biocontrol successfully since 1996
- Registration of Floramite® insecticide ➔ presented as compatible product
- Owner/grower makes decision to reduce introduction rate for *Phytoseiulus persimilis* ➔ ‘safety net’ = Floramite
- New planting after Mothers Day ➔ 2 year crop

Regular introduction rate
6 to 8 mites per m$^2$ for 3 to 4 weeks

Reduced introduction rate
2 to 3 mites per m$^2$ for 2 weeks
Real situation in cut gerbera production ➔ Slippery Slope

TSSM control is not going well ➔ Floramite is used to reduce population however......

• *Amblyseius cucumeris*
• *Amblyseius swirskii* = Negatively affected by Floramite (60 – 70 % reduction)
• *Phytoseiulus persimilis*
• *Aphidius colemani*
• *Aphidius ervi*
• *Diglyphus isae*
• *Orius insidiosus*
• *Delphastus spp*
• *Aphidoletes aphidimyza*
• *Encarsia formosa*
• *Eretmocerus eremicus*
Compatible with BCA’s?
Compatible with MOST/SOME biological control agents!!!

A. swirskii
Eretmocerus eremicus.
Encarsia formosa
Delphastus spp
Aphidius spp
Aphidoletes aphidimyza.
Feltiella acarisuga
Phytoseiulus persimilis
Diglyphus isaea.
Orius insidiosus.

Imidacloprid (Marathon)
Pyridaben (Sanmite)
Pymetrozine (Endeavor)
Bifenazate (Floramite)
Cyromazine (Citation)
Abamectine (Avid)
Acetamiprid (Tristar)
Pyriproxifen (Distance)
Spinosad (Conserve)
Real situation in cut gerbera production → Slippery Slope

Whitefly control in cut gerbera:
- *Amblyseius swirskii*
- *Encarsia formosa*
- *Eretmocerus eremicus*

What happened next:
- Whitefly control is relying heavily on *A. swirskii* during summer months
- 3 weeks after Floramite application whitefly population explodes (life cycle)
- Not able to repair with BCA
- Next decision????

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**Bioline AgroSciences**
Real situation in cut gerbera production ➔ Slippery Slope

WF problem (3 Wks. later) ➔ What options?

- A. swirskii
- Eretmocerus eremicus
- Encarsia formosa
- Delphastus spp
- Aphidius spp
- Aphidoletes aphidimyza
- Feltiella acarisuga
- Phytoseiulus persimilis
- Diglyphus isaea
- Orius insidiosus

Compatible

Not compatible

Risky

Imidacloprid (Marathon)
Pyridaben (Sanmite)
Pymetrozine (Endeavor)
Bifenthrin (Floramite)
Cyromazine (Citation)
Abamectine (Avid)
Acetamiprid (Tristar)
Pyriproxifen (Distance)
Spinosad (Conserve)
WF problem (3 Wks. later) → Imidacloprid is used → easy to apply

A. swirskii
Eretmocerus eremicus
Encarsia formosa
Delphastus spp
Aphidius spp
Aphidoletes aphidimyza.
Feltiella acarisuga
Phytoseiulus persimilis
Diglyphus isaea.
Orius insidiosus.

Compatible
Not compatible
Risky

Imidacloprid (Marathon)
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Real situation in cut gerbera production → Slippery Slope
Real situation in cut gerbera production ➔ Slippery Slope

Imidacloprid was used to repair the whitefly situation, however........

• *Amblyseius cucumeris*
• *Amblyseius swirskii*
• *Phytoseiulus persimilis*
• *Aphidius colemani*
• *Aphidius ervi*
  • *Diglyphus isae*
  • *Orius insidiosus*
  • *Delphastus spp*
• *Aphidoletes aphidimyza*
• *Encarsia formosa*
• *Eretmocerus eremicus*

Note: Effect of imidacloprid on TSSM
Real situation in cut gerbera production ➔ Slippery Slope
Real situation in cut gerbera production → Slippery Slope

Thrips & Leafminer control in cut gerbera:
• *Diglyphus isae*
• *Orius insidiosus*

What happened next:
• Leafminer population increases rapidly
• Thrips population increases
• Looper population increases (side effect *Orius*)
• Not able to ‘repair’ with BCA →

Next decision is to stop bio-program all together 😞
Compatible with BCA’s?

Compatible with MOST/SOME biological control agents → Looks complicated ????

- A. swirskii
- Eretmocerus eremicus
- Encarsia formosa
- Delphastus spp
- Aphidius spp
- Aphidoletes aphidimyza
- Feltiella acarisuga
- Phytoseiulus persimilis
- Diglyphus isaea
- Orius insidiosus

- Imidacloprid (Marathon)
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Not compatible
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Compatible with BCA’s?

Compatible with **MOST/SOME** biological control agents → Looks complicated ????

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Pepper Crops and Compatibility – Timing Is Everything

Major Pest Issues: Thrips and Aphids

BCA’s Used:
- *Amblyseius cucumeris*
- *Amblyseius swirskii*
- *Phytoseiulus persimilis*
- *Aphidius spp* and other aphid BCA’s
And very important is *Orius insidiosus* as generalist:

- Released in March → 4 introductions - 1 per m² (10 ft²)
- Aphid control with BCA’s critical during this time! **WHY?**
- Effect of Pymetrozine (Endeavor®) on *Orius* → reduction of 50% + 1 week residual
- 50% loss during establishment time = reduction and delay of establishment
Pepper Crops and Compatibility – Timing Is Everything

- Released in March → 4 introductions - 1 per m² (10 ft²)
- No interruption due to proactive approach for controlling Aphids
- July → > 100 Orius/m² (10 ft²)
- Aphid outbreak
- Effect of Pymetrozine on Orius → reduction of approx. 50%, however...
- 50% loss of 1 OR 100 per m²
- Remaining Orius will maintain control of thrips → Timing is Everything
Ornamental Propagation – Calculated Low Risk

Seed and Liners

• Typical pest problems → Fungus gnats, thrips, aphids, whitefly.

BCA’s used during propagation:

• *Amblyseius cucumeris* (sachet on stick)
• *Hypoaspis miles/Stratiolealaps scimitus* (Hypoline)
• *Atheta (Dalotia) coriaria* (Staphyline)
• *Steinernema feltiae* (Exhibitline sf)
• *Aphidius colemani* (with banker plants)
Ornamental Propagation – Calculated Low Risk

Seed and Liners
Some safer choices during propagation!

- Botanigard WP
- Cease (*Bacillus subtilis*), Rootshield
- Citation®, Endeavor®, Mainspring GNL®, Talus, Beleaf
Ornamental Propagation – Calculated Low Risk

• Take your plants for a dip... Mix of Botanigard, Rootshield, and Nematodes
Bioline App – More Info about BCA’s and Compatibility

- Apple, Android, and Microsoft compatible – free download
- Technical information per pest, BCA and strategies
- Compatibility data
- Trade name and A.I.
# Bioline App:

<table>
<thead>
<tr>
<th>Filter by Trade</th>
<th>Amblyseius swirskii</th>
<th>Phytoseiulus persimilis</th>
<th>Orius spp.</th>
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**Disclaimer:**

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Bioline 

Disclaimer
Compatibility - Keys to Success

• Think carefully and investigate before jumping the (spray) gun

• Is it really necessary to spray or are there other options?

• Is the situation close to or past ‘tipping point’?

• Determine → ‘Slippery Slope’, ‘Timing Is Everything’ or ‘Calculated Low Risk’ with choice of pesticide

• When successful with BCA’s, **stick with appropriate release rates!**
Compatibility - Keys to Success

- Propagation is an important part of production process for biocontrol and integrated approach - Foundation of rest of the crop!!
- Often more complex systems (cut gerbera situation)
- Calculated low risk products - Resistance management!!
- Try to think about entire IPM system
- If absolutely necessary, choose the best possible option and think about what the possible outcome might be on other pest problems and BCA’s
Biological control is preventing problems, not fixing them!

Biocontrol works!

It is people (managing) that makes biocontrol an effective strategy!
Questions & Discussion?

Thank You!

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