

Biological Control

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Common Myths about Biological Control

- More expensive
- Plants not as nice
- Cannot use pesticides

Pricing a Pest Program

Biocontrol Agents	Pesticides
Bug costs	Pesticides
Shipping	Maintaining license
Training	Training
Application equipment	Spray equipment
Scouting	Protective equipment
	Respirators
	Scouting

Pesticide Compatibility

- AgroBio www.agrobio.es
- BASF <http://betterplants.basf.us/products/related-documents/nemasys-chemical-compatibility-guide.pdf>
- BioBest Biological Systems <http://www.biobestgroup.com/en/side-effect-manual>
- BioLine AgroSciences <http://biolineapp.com/>
- BotaniGard and Biocompatibility <http://www.bioworksinc.com/products/shared/botanicgard-and-biocompatibility.pdf>
- IPM Impact <http://www.ipmimpact.com/>
- Koppert Biological Systems <http://side-effects.koppert.nl/>
- Pesticide active ingredients database from University of California <http://www.ipm.ucdavis.edu/PMG/menu.pesticides.php>

Nematodes

- Compatibility chart for NemaShield from BioWorks <https://www.bioworksinc.com/products/shared/compatibility-chart.pdf>
- Nemasys Chemical Compatibility Guide from BASF <http://betterplants.basf.us/products/related-documents/nemasys-chemical-compatibility-guide.pdf>
- Can you safely mix nematodes and pesticides? <https://onfloriculture.wordpress.com/2016/04/06/can-you-safely-mix-nematodes-and-pesticides/>

Aphids

Common greenhouse aphids

- Peach aphid (*Myzus persicae*)
 - Light greenish-yellow, but it can be a darker green or sometimes a pink/rose color.
 - Cornicles same color as the body but dark at the tips.
 - Have indentation between antenna on head
- Cotton or melon aphid (*Aphis gossypii*)
 - Smaller species.
 - Green to very dark (almost black) or yellow.
 - Cornicles short and darker.
- Potato aphid (*Macrosiphum euphorbiae*)
 - Often has a darker stripe down the middle of its back
 - Cornicles are long and thin
 - Solid pink to green and pink mottled to light green
- Foxglove aphid (*Aulacorthum solani*)
 - Green
 - Glossy looking
 - Dark around base of cornicals

Mites

- Tetranychidae (Spider Mites)
 - Twospotted Spider *Tetranychus urticae*
 - Lewis *Eotetranychus lewisi*
- Tarsonemidae
 - Broad *Polyphagotarsonemus latus*
 - Cyclamen *Phytonemus pallidus*
 - Bulb scale *Steneotarsonemus laticeps*
- Eriophyidae (Bud, rust, gall)
 - Tomato Russet Mite *Aculops lycopersici*
 - Hemp Russet Mite *Aculops cannabicola*

Commercially available biological control agents for Spider Mites, Tetranychidae

- Predatory Mites
 - *Phytoseiulus persimilis*
 - *Neoseiulus californicus*
 - *Amblyseius fallacis*
- Beneficial Insects
 - *Stethorus punctillum*
 - Adults need 50 mite eggs per day or 75 to 100 pest mites per day
 - *Chrysoperla rufilabris*
 - *Dicyphus hesperus*
 - *Feltiella acarisuga*

Broad Mites, *Polyphagotarsonemus latus*

- Female 0.2 mm long and oval
- Males 0.11 mm
- Females are slow moving
- Males fast moving
- Eggs oval with pattern

- Mechant, E., Luypaert, G., Van Delsen, B., Pauwels, E., Witters, J., Van Huylenbroeck, J. and Gobin, B. (2015), Development and validation of a three-step detection protocol for broad mites (*Polyphagotarsonemus latus*) in pot azalea (*Rhododendron simsii* hybrids). *Entomol Exp Appl*, 156: 99–104. doi:10.1111/eea.12315
- Predatory mites for control of broad mites
 - *Amblyseius swirskii*
 - *Neoseiulus cucumeris*
 - *Neoseiulus californicus*

Newer Research

Biological Control of Multiple Aphid Species Using Aphidoletes

- Sarah Jandricic, Floriculture IPM Specialist for the Ontario Ministry of Agriculture and Food and Rural Affairs (OMAFRA)

Dipping Cuttings

- Vineland Research and Innovation Centre. Michael Brownbridge, Rose Buitenhuis, Taro Saito, Angela Brommit, Paul Côté & Graeme Murphy
- Best Dip Treatments
 - BotaniGard + 0.5% soap
 - 0.1% Suffoil-X
 - NOT THE SAME AS SPRAY RATES
- Dipping and Disease
 - Take Your Poinsettia Cuttings for a Dip, Rose Buitenhuis
<http://www.ballpublishing.com/GrowerTalks/ViewArticle.aspx?articleid=22903>
 - Buitenhuis et al. 2016, “How to start with a clean crop: Biopesticide dips reduce populations of *Bemisia tabaci* (Hemiptera: Aleyrodidae) on greenhouse poinsettia propagative cuttings.” *Insects* 7 (48).

Fogging Microbials

- Michael Brownbridge and Bernhardt M. Steinwender at the Vineland Research and Innovation Centre
- Canadian trial
- Dramm Mini AutoFog
- K-22 Bio Portable PulsFOG
- Results

- Cold foggers safe for BotaniGard and Cease
- K-22 Bio Portable PulsFOG unsuitable for BotaniGard
- Bacillus subtilis spores are more robust and can survive through PulsFOG

***Amblyseius swirskii*, Western Flower Thrips or Spider mites?**

- Xu X, Enkegaard A. Prey Preference of the Predatory Mite, *Amblyseius swirskii* between First Instar Western Flower Thrips *Frankliniella occidentalis* and Nymphs of the Twospotted Spider Mite *Tetranychus urticae*. *Journal of Insect Science*. 2010;10:149. doi:10.1673/031.010.14109.

Thrips egg predation by phytoseiids: an overlooked pest control mechanism

- Dominiek Vangansbeke, Juliette Pijnakker, Yves Arijs, Felix L Wäckers. *Biobest Sustainable Crop Management*. June 2017

Biological Control Quality

- Grower Guide: Quality Assurance of Biocontrol Products
http://www.vinelandresearch.com/sites/default/files/grower_guide_pdf_final.pdf