

Biological Control Options in Vegetable Production

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What is Biological Control?

Pest management using natural enemies

Predators



Parasitoids



Pathogens



The ultimate goal is to use less or no pesticide

Upcoming eOrganic webinars



United States Department of Agriculture National Institute of Food and Agriculture

Date	Торіс	Speakers and affiliations
February 10	Insect-Vectored Viruses and their Management in Vegetables	Babu Srinivasan, Bhabesh Dutta and Tim Coolong Univ. Of Georgia
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Your most valuable tool – handlens (a.k.a. jeweler's loupe, pocket magnifier)

- Regular monitoring
- Pest identification Choose the right biological control agent based on pest identification







Release biological control agents

Augmentation biological control

- Release large number of commercially reared biological control agents.
- Not all biological control agents are suitable for releasing in the field.





Photos: Bill Lewis, Delray Plants; UFL

Situations when releasing make sense

- Biological control agents are less mobile predatory mites, immature insects.
- Enclosed environment high tunnel, hoop house, isolated field.
- Release early in the crop as preventive.
- Don't expect the biological control agents to last forever.

Ladybird Beetles

- Both larvae and adults eat pests
- Efficient against several aphid species







Spider Mite Destroyer (Stethorus punctillum)

- Both adult and larvae eat
- Control all stages of spider mites





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Image by Anatis Bioprotectio
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Green Lacewings

- Adult eats nectar, pollen and honeydew
- Larvae provides effective aphid and psyllid control









Image by Yong Kiet and Dragonfli

Minute Pirate Bug (Orius spp.)

- · Both immature stages and adults feed
- Control thrips, spider mites, aphids and small caterpillars







Predatory Mites

- Feeds on spider mites, whiteflies and thrips
- Many predatory mite species are commercially available







Parasitoids

- Adult lays egg within host
- Larvae eats the host body inside out
- Eventually resulting in the death of the host









Photos: greenmethods.com; Biopla

How practical is it to release biocontrol agents?

- Some biocontrol agents can run away in open fields
- Predators usually lag behind pest curves and sometimes you need to act quickly





e by Trandem et al., 2015

Biopesticides – the gateway drug to biological control

Pathogens that had been mass produced and formulated to spray

Fungus

- Spores penetrating through the insect cuticle
- Once inside, fungus grows throughout the body
- · Produce toxins and increase the killing speed

Best practices

- Cover plants thoroughly
- Need humid conditions
- · Prolonged exposure to sunlight can inactivate spores

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Fungi	Trade names	Main targets
Beauveria bassiana	Botanigard, BioCeres, Mycotrol, etc.	Many – thrips, whiteflies, etc.
Isaria fumosorosea	Preferal, Ancora, PFR-97	Many – whiteflies, spider mites, etc.
Metarhizium anisopliae	Tick-X, No-Fly, etc.	Many – thrips, whiteflies, etc.
Nosema locustae	Nolo bait	Grasshopper



Bacteria

- Infection occurs when bacteria are ingested by susceptible insect hosts
- Midgut paralysis and death



ge by Valicente et al., 201,and

Virus

- Viruses need to be ingested (better for chewing mouth parts)
- Damage gut
- Infected larvae climb higher in the plant canopy



Bacteria and viruses	Trade names	Main targets
Bacillus thuringiensis (Bt)	Crymax, Dipel, Xentari, etc.	Caterpillars (armyworms, loopers, moths)
Chromabacterium subtsugae	Grandevo	Many – aphids, caterpillars, thrips, whiteflies, etc.
Heat-killed Burkholderia	Venerate	Many – caterpillars, curculio, thrips, stink bug, mites, etc.
Nuclear polydehrosis virus	Gemstar	Caterpillars

Nematodes

- Small round worms that kill insects but are harmless to other organisms
- Upon entering insect, nematodes kill their host by releasing bacteria into it



Nematode	Trade names	Main targets
Steinernema feltiae	Nemasys	Fly maggots (fungus gnats, shore flies, onion maggot), thrips pupae
Steinernema carpocapsae	Millenium, etc.	Beetles (flea beetles, weevils, etc.), Caterpillars
Heterorhabditis bacteriaphora	NemaSeek	Beetle larvae, grubs
Phasmarhabditis hermaphrodita	Nemaslug	Slugs and snails

Some tips on using biopesticides

- Choose biopesticide based on target pest.
- They work better against younger insects, and when population is smaller.
- Need to plan your disease control program carefully because some fungicides may be interfering with biopesticides.
- Store and apply biopesticides as directed.



What kind of farms are favored by natural enemies?

- 1. Small farms surrounded by lots of natural vegetation.
- 2. Farms that have a diverse plant species.
- 3. Farms with minimal agrochemical inputs.
- 4. Farms with soil that is high in organic matters or biological activity.



Companion planting

Grow plants in and around farms that are

- Attractive to natural enemies.
- Provide food (non-pest organisms, pollen, nectar) to natural enemies.
- Provide shelter or refuge to natural enemies.



Incorporate flowering plants to attract natural enemies



Incorporate flowering plants to attract natural enemies



Plants that attract natural enemies

Plant name	Natural enemies attracted
Sunflower	Various wasps and predators
Goldenrod	Predatory flies, hover flies, predatory beetles
Sweet fennel	Hover flies, parasitoids, predatory bugs
Dill	Hover flies, lacewings, predatory beetles
Sweet alyssum	Hover flies, parasitoids, predatory bugs
Faba bean	Predatory bugs and beetles
Buckwheat	Predatory bugs, beetles, lacewings, parasitoids
Oleander/ milk weed?	Parasitoids, lady beetles (aphids)

http://ipm.uconn.edu/documents/raw2/555/Plants%20that%20attract%20beneficial%20arthropods.pdf

What if you have an outbreak and absolutely have to spray a pesticide?

Even an organic or OMRI-listed insecticide can kill when in direct contact!



Want to combine biological and chemical control?

- If you are going to do biological control, it is best to eliminate and greatly reduce the use of insecticides and miticides.
- If it must be done, find out the compatibility of biological control agents and insecticides:

Biobest Side Effect Manual

Koppert Side Effects



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Some take-home messages

- 1. Start small start with biopesticides.
- 2. Try improve plant diversity on your farm.
- 3. Release biological control agents before infestation.
- 4. Make sure your agrochemical you used do not interfere greatly with biological control.
- 5. Call JC or your local extension agents.

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