Insect Management for Organic Farms

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Organic Agriculture PDP Training
Insect Management Outline

• Ecological System Approaches
• “Therapeutic” Approaches
• Integrated Pest Management or “IPM”
Ecological System Approaches

- Insect susceptibility in relation to soil management
- Adding new beneficials to the system (classical biological control)
- Providing habitat and resources for beneficial organisms
- Advantages (and drawbacks) of system diversification
- Tinkering with the specifics: crop rotations, timing, crop mix, field layout
What Do We Know?

• Insect susceptibility and soil management: Larry Phelan’s work on oviposition preference of European corn borers – preferred to lay eggs on plants grown in conventional soil.

• Classical biological control – long history of introductions. Historically, greater success in perennial systems than annual cropping systems.
What Do We Know? (continued)

- Habitats and resources for beneficials: Specific needs are important – overwintering habitat? Daytime shelter for ground beetles? Flowers of particular kinds (e.g. Apiaceae for some tiny parasitic wasps). Flowers when resources are limiting (early in spring, late in fall).
- Understanding timing and movement important – especially if diversity provides alternate hosts/prey for beneficials.
- Scale is important – Organic farms in the NE are mostly small and diversified. Most of the research is from Midwest, South, or California on large monocrop farms.
Thrips adults
2001

- crimson clover
- oats/annual ryegrass
- oats/bare
- oats/oats
- oats/oat-field pea
- oats/rape
- none
- rye
- rye/vetch
- wheat

Number per 10 sweeps

Date:
- 6/1
- 6/8
- 6/15
- 6/22
- 6/29

Crops:
- Wheat
- Rye + vetch
- Rye
Types of Biological Control

- “Classical” -- Natural enemy is permanently established
- Conservation and enhancement of existing natural enemies
- Periodic releases of natural enemies
  - biological insecticides
  - inundative releases
  - inoculative releases
“Therapeutic” Approaches

- Barriers
- Resistant varieties
- Inoculative/Augmentative release of biological control agents
- Behavioral approaches: repellents, pheromone disruption, attract & kill, perimeter trap cropping
- Insecticides
Row Covers at New Leaf Farm

New Leaf Farm, Durham, ME
Row covers are used on:

- Cucurbits: 4 farms
- *Brassica* greens for salad mix: 1 farm
- Early spring radishes, 1 farm
- Tomatoes (low tunnels): 2 farms
- Eggplants: 1 farm
Insect resistant varieties

• Breeding programs for insect resistance in field crops have been standard for many decades. Recent development: alfalfa resistant to potato leafhopper with good forage quality and growth

• Breeding for insect resistance in fruits and vegetables has been much less developed. Most information is about differences in varietal susceptibility due to different growth patterns, phenology, waxes or hairs, or factors unknown.
Resistance to insects in potatoes. On the left is “Prince Hairy,” a variety with glandular hairs, resistant to potato leafhoppers and aphids, and partially resistant to Colorado potato beetle. On the right is “Superior” with potato leafhopper damage.
Inoculative/Augmentative biological control for insects and slugs

- In the greenhouse, *Aphidius* wasps (1 farm)
- Against Mexican bean beetles, *Pediobius foveolatus*, (2 farms)
- Against wireworms in potatoes, *Heterorhabditis bacteriophora* nematodes (1 farm)
- One farm collects their own *Harmonia* beetles in the fall to release in the greenhouse the next spring
- One farm uses chickens foraging in cover crop residue to reduce slug damage the following year
- Another successful use of biocontrol: *Trichogramma ostriniae* against European corn borer
Pediobius Advantages

• Non-toxic
• Easy to apply
• Spreads and multiplies on its own through the growing season
Pediobius Limitations

- Slow to act
- Timing critical
- Expense
- Reliability uncertain
- Control of other pests (potato leafhopper) may interfere
- Does not overwinter – has to be released again
Pediobius Results

• In first year of release, only limited, late control. Degree of control may depend on initial population of beetles

• In second year of release, control was much better. May be due to lower initial population. Weather may also be a factor
Pediobius Release Rates

- First year sites: 30-60/square meter or 120 K - 240 K per acre (2 or 3 releases)
- Second year sites: mostly 2-3/ square meter or 8 - 12K per acre (2 releases)
- Price: About $25 per K from the least expensive sources, plus shipping
- Try to make releases in small, early planting to limit expense – wasps then multiply and spread to later plantings
Cromwell
1998: 1st year of release

Mummies set out
June 25, July 2

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- **beetles**
- **small larvae**
- **large larvae**
- **mummies**
Cromwell 1999: 2nd year of release

Wasps released
July 15, July 22, Aug. 5

- MBB per m²
- beetles
- small larvae
- large larvae
- mummies

Dates:
- 9-Jun
- 21-Jun
- 6-Jul
- 19-Jul
- 2-Aug
- 16-Aug
- 30-Aug
- 13-Sep
- 4-Oct
Perimeter Trap Cropping

- Put plants highly attractive to the insects (trap crop) all around the perimeter of the field, surrounding the plants to be protected.
- Kill the pests on the trap crop with insecticides or other method such as propane flaming. Do this frequently enough to prevent spread into the main crop.
- Used for: pepper maggot, striped cucumber beetle. Testing for use on diamondback moth.
Other behavioral controls

- Mating disruption: massive release of sex pheromone across large contiguous area. Used for codling moth, being tested for Oriental moth, other pests.
- Attract and kill or mass trapping: Bait formulations of insecticides (Naturalyte for fruit flies), mass pheromone trapping being tested for Oriental beetle
What insecticides were used by NEON farmers?

- *Bacillus thuringiensis* insecticides (must not be genetically engineered): the most widely used, 7 farms, mostly on *Brassica* and tomatoes
- Entrust: Substituted for Bt against caterpillars on 2 farms
- Neem (various products): tomatoes, lettuce, cucurbits, 3 farms
- Rotenone: on squash, kale, tomatoes, lettuce against cucumber beetles, flea beetles, tarnished plant bugs, aphids, 3 farms (this may not meet NOP standards now)
- Surround: on cucurbits and kale against cucumber and flea beetles, 2 farms
- Pyganic: on squash against cucumber beetles, 1 farm
Integrated Pest Management or “IPM”

• What is “IPM” anyway?
• Could organic management be improved by use of IPM tools (i.e. scouting, trapping, adjusting timing of interventions based on weather information)?
• Are organic growers interested in this? Is it practical for them?