Organic Agriculture

- Is an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity
- Is based on minimal use of off-farm inputs and on management practices that restore, maintain or enhance ecological harmony
- Has a primary goal of optimizing the health and productivity of interdependent communities of soil life, plant, animals and people.

Expectations

Successful organic gardeners understand:

- Insect pests and diseases are a fact of life. Some damage may result in lower quality produce.
- Lower yields may be experienced because of insect damage or disease.
- It takes time and effort to protect produce from pests without synthetic insecticides.

Insect Management

Control Tactics

- Keep plants healthy
- Biological controls
  - Conservation and/or augmentation of natural enemies
- Cultural controls
  - Preventative practices to minimize pests by altering the environment
- Mechanical/physical controls
  - Direct or indirect measures that kill pests or disrupt their activities
- Insecticidal controls (organic pesticides)

Insect Management

Things to Consider

- Insect Identification
  - To identify which insects are pests and which are beneficial.
  - To recognize developmental stages and understand the seasonal life cycle of each pest.
- Scouting and Monitoring
  - To detect insect pests early before they have caused noticeable and irreversible damage.
    - Requires knowledge of specific pests and good observation skills.
    - Can be time consuming.
    - Good record keeping is important.

Insect Management

Control Tactics

- Biological controls
- Predatory insects
- Parasitoids
- Diseases
- Birds and bats
**Insect Management**

**Control Tactics**

- Cultural controls
  - Crop rotation
  - Sanitation
  - Tillage
  - Crop selection / resistant varieties
  - Timing of plantings
  - Trap crops
  - Companion planting

**Insect Management**

**Control Tactics**

- Mechanical/physical control
  - Handpicking
  - Barriers
  - Traps
  - Water

**Insect Management**

**Control Tactics**

- Insecticidal controls (organic pesticides)
  - Microbial insecticides (Bt, Beauveria bassiana, spinosad, nematodes)
    - Contain living organisms or toxic substances they produce
  - Botanical insecticides (pyrethrums, azadirachtin)
    - Natural toxicants from plants
  - Horticultural oils
    - Highly refined, petroleum or plant-based
  - Insecticidal soaps
    - Derived from the salts of fatty acids
  - Inorganic insecticides (kaolin clay, diatomaceous earth)
    - Elemental or carbon-free compounds

**Lettuce**

Hosts: lettuce (leaf, head, romaine, etc.)

**Slugs**

- Several different species
- Cosmetic damage to leaves and seedlings
- Thrive in moist conditions wherever living or recently dead plant material is present
- Feed mostly at night
- Worse in wet years

**Control Strategies**

- Cultural control
  - Avoid mulch, permanent ground covers, plant debris, weeds
  - Encourage good air circulation
  - Encourage natural enemies
  - Monitor for ragged holes in leaves and slime trails
- Mechanical/physical control
  - Handpicking – most effective at night
  - Traps – wood boards, beer
  - Barriers – dry and sharp materials, copper
  - Iron phosphate baits, kaolin clay, or spray directly with vinegar
Natural Enemies

Brassicas

Hosts: Brassica crops (cole crops, crucifers)
- broccoli, Brussels spouts, cabbage, cauliflower, collards, kale, kohlrabi, mustard, radish, turnip, many weed species, etc.

Imported Cabbageworm

Imported cabbageworm, *Pieris rapae*

Overwinter as pupae in plant debris; adults emerge and mate in spring; females lay eggs on leaves

Larvae feed on leaves

Small holes enlarged until entire leaf is consumed

Larvae pupate attached to leaves or nearby objects

2 to 4+ generations per year
Floating Row Cover

Control Strategies
- Cultural control
  - Fast-maturing cultivars sustain less damage
  - Cruciferous weed control
  - Sanitation – Till or remove plant debris after each crop
  - Encourage natural enemies
  - Monitor for white adult moths flying around, holes in leaves, green larvae on leaves, dark green fecal pellets
- Mechanical/physical control
  - Floating row covers to prevent egg laying
  - Handpick larvae
- Pesticides
  - Use *Bacillus thuringiensis* (*Bt aizawi* or *Bt kurstaki*) for young larvae
  - Spinosad or azidarachtin (neem)

Solanaceous Crops

Hosts: Solanaceous crops
- eggplants, peppers, potatoes, tomatoes, many weed species, etc.

Natural Enemies

Colorado Potato Beetle

Overwinter as adults in the soil; emerge in the spring and crawl to new hosts to eat, mate, lay eggs
Colorado Potato Beetle

Voracious larvae (and adults) feed on leaves, twigs and fruit

CPB can quickly defoliate a crop

Prefer potatoes and eggplants but can also be a problem on tomatoes and peppers

Larvae drop to the ground to pupate

Early emerging 1st generation adults produce 2nd generation; Late emerging 1st generation adults overwinter

Control Strategies

- Cultural control
  - Crop rotation / trap crop (eggplant, ‘Superior’ potato)
  - Solanaceous weed control
  - Spring and fall tilling
  - 2”-3” layer of straw mulch
  - Encourage natural enemies
- Monitor for yellow egg clusters on leaf undersides, and larvae and adults feeding on leaves
- Mechanical/physical control
  - Handpick – often
  - Floating row covers through spring
- Pesticides
  - Use Bt var. tenebrionis for young larvae
  - Spinosad or azidarachtin (neem)

Natural Enemies

Adult spotted pink lady beetle, Coleomegilla maculata

Parasitoid wasp, Edovum puttleri

Two-spotted stinkbug, Perillus bioculatus

native ground beetle, Lebia grandis

http://www.teachinggarden.org/PTGphotos.htm
Hornworms

Tomato hornworm, *Manduca quinquemaculata*

Tobacco hornworm, *Manduca sexta*

Overwinter as pupae in the soil; adults emerge in spring; females lay eggs singly on leaves

Voracious larvae feed on leaves, stems and fruit

Mature larvae drop to the ground to pupate in the soil; 1 to 2 generations per year

Natural Enemies
**Natural Enemies**

- **Trichogramma spp. wasps**

**Hornworms**

- **Control Strategies**
  - Cultural control
    - Spring and fall tilling
    - Encourage natural enemies
  - Monitor for light feeding on plant tops, later entire leaves and stems eaten, dark BB-sized frass pellets, green larvae
  - Mechanical/physical control
    - Handpick
    - Leave parasitized larvae on plants
  - Pesticides – (rarely warranted)
    - Use Bt var. kurstaki for young larvae
    - Spinosad or azadirachtin (neem)

**Cucurbits**

- **Hosts: Cucurbit crops**
  - cucumbers, summer & winter squash, melons, pumpkins, gourds, etc.

**Squash Vine Borer**

- **Squash vine borer, *Melittia cucurbitae***

  Overwinter as pupae in the soil; emerge as adults in the spring; females lay eggs on stems near base

  Larvae bore within the stem and push out frass
**Squash Vine Borer**

Infested plants wilt and eventually die; Prefers summer & winter squashes, pumpkin

“**You know you’re a gardening nerd when . . .**

...you do surgery for borers.”

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**Control Strategies**

- Cultural control
  - Butternut squash, cucumbers, and melons are resistant
  - Later planting
  - Remove and destroy infested plants
  - Spring and fall tilling
  - Encourage natural enemies
- Monitor for flying red/black adults, flat brown eggs laid singly on stems, frass pushed out of stems, wilting plants
- Mechanical/physical control
  - Vine surgery
  - Floating row covers until flowering
- Pesticides
  - Bt. spinosad, azadirachtin (neem), kaolin clay sprayed or dusted on the stem bases before egg laying

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**General Pests**

Hosts: Just about everything in the garden!

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**Crucifer Flea Beetle**

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**Eggplant Flea Beetle**
Eggplant Flea Beetle

Potato Flea Beetle

Palestriped Flea Beetle

Flea Beetles

- Control Strategies
  - Cultural control
  - Clean up and remove garden debris
  - Weed control
  - Spring and fall tilling
  - Monitor for small, shot holes in leaves
  - Mechanical/physical control
  - Floating row covers until flowering
  - Pesticides
  - Spinosad, azadirachtin (neem), pyrethrum, kaolin clay

Questions?

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