**Pest Management**

Pest: any living thing that competes with us for food, fiber, or space, or that threatens the health of people or domestic animals.

**What is a pest?**

- Insects
- Diseases (fungi, bacteria, Viruses)
- Weeds
- Wildlife

**Integrated Pest Management**

A decision-making process that utilizes all available pest management strategies to prevent economically-damaging pest outbreaks and reduces the risks to human health and the environment.

**Pest Management**

- To control within a tolerable range
  - Prevent damage
  - Stop damage
  - Protect “crop” from damage
  - Limit damage

**Tolerance**

- How much damage can your plants tolerate?
- How much can you tolerate?
- What are the consequences of doing nothing?
Do you use IPM?

Control Strategies
1. Cultural
2. Physical/ Mechanical
3. Biological
4. Chemical

IPM Process
- Prevention
- Monitor
- Identify plants & pests
- Choose strategy

Know the key pests

Monitor (Scouting)
Monitor

Phenology

Growing Degree Days

• Helpful websites:
  - http://www.aos.wisc.edu/~sco/clim-history/7cities_eau_claire.html#GrowDeg
  - http://www.soils.wisc.edu/uwex_agwx/thermal_models/degree_days
  - http://datcpservices.wisconsin.gov/pb/index.jsp

Accurately diagnose/identify

“Have a pest. I have some pesticide in my garage. I’ll just use that.”

Identify

What kind of pest is this?
A. Generalist
B. Specialist
C. Opportunistic

CO Potato Beetle
Management strategies

**Integrated Pest Management**

1. Cultural
   - Resistant varieties
   - Right placement
   - Proper planting
   - Proper care – mulching, watering, fertilizing
   - Sanitation
   - Rotation

Cultural: resistant varieties

Do you know some other examples?

Cultural: proper placement

What are some other factors to consider?
Cultural: proper planting

Cultural: proper care

Name some other cultural practices we use to care for our plants.

Cultural: sanitation

Cultural: rotation

How many years should a full rotation cycle be?
**Integrated Pest Management**

2. Mechanical/Physical
   - Remove and/or destroy
   - Physical barriers

Physical: remove/destroy
- Knock off plant with a strong blast of water

Physical: remove/destroy
- Rake and remove diseased leaves

Physical: remove/destroy
- Prune out diseased branches

Physical: remove/destroy
- Pick off insects by hand

Physical: remove/destroy
- Bait & Trap insects and wildlife
Are Japanese beetle traps effective?

Physical: remove/destroy
- Hoe or pull weeds

Physical: barriers
- Mulch to suppress weeds

Physical: barriers

Integrated Pest Management

3. Biological
- **organisms**
- **“Beneficials”**
  - Types:
    - Predators
    - Parasites
    - Pathogens
  - Methods:
    - Introduce
    - Augment
    - Conserve
Biological control

• Predators
  – Birds, amphibians, reptiles, mammals
  – Invertebrates
    • spiders & mites
    • Insects
• Parasites & parasitoids
  – Parasitic flies and wasps
    • Attack eggs, larvae, nymphs & pupae
    • On outside of pest or inside pest

Biological Control

– Pathogens = microbials
  • “B. t.” – Bacillus thuringiensis (bacteria)
    – Var. kurstaki (Btk) – infects caterpillars
    – Var. san diego & var. tenebrionis – infects CO potato beetle & elm leaf beetle
    – Var. israelensis (Bti) – infects mosquitoes, black flies, fungus gnats
**Biological control**

- **Gypsy moth**
  - Gypchek – Nucleopolyhedrosi - NPV (virus)
  - Entomophaga maimaiga (fungus)
- **Nematodes** – for iris borers, etc. as soil drench
- **Milky spore disease** - *Bacillus popilliae* or *lentimorbus* (bact.)
  - Japanese beetle – not hardy in WI so pops. do not build

**Integrated Pest Management**

4. **Chemical** – “The Last Resort”

*ALWAYS read & follow label recommendations!*

**Organic**
- oils
- soap
- sulfur
- copper
- baking soda & water
- hot pepper wax

**Synthetic**
- carbaryl (Sevin)
- diazinon, malathion, acephate, chlorpyrifos

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**Pesticides**

- **Herbicides**
- **Insecticide**
- **Fungicide**
- **Rodenticide**

- A. Fungus
- B. Creeping Charlie
- C. Japanese beetle
- D. Mouse
Chemical control

- Organic
  - Biopesticides
    - Organisms – pathogens (e.g., Bt, spinosad)
    - Botanicals – derived from plants
  - Biorationals
    - Insecticidal soap
    - Horticultural oils
    - Inorganics
      - Sulfur

Integrated Pest Management

- Biological Botanicals
  - Rotenone
  - Pyrethrum
  - Neem oil (azadirachtin)
  - Corn gluten meal

Remember, botanicals are toxic when applied but degrade quickly.

Chemical Controls: Biopesticides

- Botanical pesticides
  - Advantages:
    - degrade rapidly; reduces potential exposure
    - fast acting – “knock-down”
    - low mammalian toxicity
    - low plant toxicity
    - selective effects on pests

- Pyrethrum
  - Derived from chrysanthemums
  - Pyrethrins are six compounds which occur naturally in pyrethrum
  - Pyrethroids are not botanical but synthetic compounds based on the pyrethrins
  - “knock down” properties
  - Combined with piperonyl butoxide
    - Not “organic”

- Neem
  - From seeds, leaves, fruits, and bark of the Neem tree
  - Azadirachtin is the active ingredient – extract of neem seeds
  - Very broad spectrum – insects, fungi and mites!
  - Many formulations available
**Chemical Controls:** Biopesticides

- **Sabadilla**
  - From seeds of a tropical lily

- **Ryania**
  - From seeds of a woody shrub

**Chemical Controls:** Biopesticides

- **Nicotine**
  - **EXTREMELY TOXIC!**
    - Home preparations strong enough to kill insects also strong enough to be toxic to humans.

**Chemical Controls:** Biopesticides

- **Miscellaneous**
  - Plant essential oils
    - Cedar, lavender, eucalyptus, citronella, canola, garlic, pepper, etc.
    - (15 plus EPA reg.)
  - Repellents
    - High concentrations can cause skin irritation
    - Pennyroyal and citrus are toxic if ingested
  - Baking soda (potassium and sodium bicarbonate)
  - Vinegar (acetic acid)
    - Needs to be 35% solution (cider vinegar is 5%)

**Chemical Controls:** Biopesticides

- **Biorationals**
  - Naturally occurring substances with pesticidal properties
    - Insecticidal soaps
    - Horticultural oils
    - Inorganics
      - Sulfur
      - Lime sulfur
      - Copper-containing pesticides
      - Iron phosphate

**Chemical Controls:** Biopesticides

- **Insecticidal soaps**
  - Kill soft-bodied insects
  - Low plant toxicity
  - Consistent formulation
    - Not household soaps
      - Soaps can be used as "spreaders"
    - Formulated to be used to kill insects on plants
      - Effective at killing insects
      - Low phytotoxicity

**Chemical Controls:** Biopesticides

- **Horticultural oils – petroleum based**
  - Dormant oil
    - Used on dormant plants not succulent tissue
  - Summer oil
    - Diluted dormant oil
  - Ultrafine oil
    - Highly refined to remove harsh residues
    - Safe for succulent, growing tissue
Chemical Controls: Biopesticides

- Inorganics
  - Sulfur
    - Oldest known pesticide (3,000 yrs. ago)
    - Wettable powder, dust or liquid
    - Insecticidal and fungicidal properties
      - Diseases – powdery mildew, rust, blights, fruit rots
      - Insects – spider mites, psyllids and thrips
    - Causes plant injury in hot, dry weather
    - Cannot be mixed with others

- Lime sulfur
  - Dormant spray
    - Diseases – blight, anthracnose and powdery mildew
      - Insects – scales, eriophyid mites and spider mites
    - Burns plants at high temps.
    - Irritates skin and eyes

- Copper-containing pesticides
  - Bordeaux mixture (not approved for organic production)
    - Copper sulfate and lime
      - Diseases – late blight; septoria and early blight of tomatoes; downy mildew; bacterial leaf spots, blights, anthracnose and cankers
      - Insects – repellent
  - Iron phosphate
    - Slug and snail control

Chemical Controls: Biopesticides

- Biopesticides
  - Lithium aluminum silicate
    - Safe use for organic production

Trade name and common name and active ingredient (ai)

- Bonide Daconil 2787
  - Controls diseases on vegetables, roses, flowers and lawns.
  - Makes 16 gallons.
  - Active ingredient: Lithium aluminum silicate

Resources

- [http://pmep.cce.cornell.edu/profiles/extoxnet/](http://pmep.cce.cornell.edu/profiles/extoxnet/)
  - EXTOXNET – Extension resource

Signal Words

- Danger
  - Highly toxic
- Warning
  - Moderately toxic
- Caution
  - Slightly toxic
Toxicity

<table>
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<th>Common name</th>
<th>Trade name</th>
<th>Field L50</th>
<th>Mortality</th>
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<tbody>
<tr>
<td>Glyphosate</td>
<td>Roundup</td>
<td>High</td>
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<tr>
<td>BHC</td>
<td>DDT</td>
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<tr>
<td>Methoxyflur</td>
<td>Malathion</td>
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<td>Sevin</td>
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<tr>
<td>Bendiocarb</td>
<td>Bendiocarb</td>
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</tr>
</tbody>
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Chemical control

- **Synthetics: Insecticides**
  - Carbamates
    - Sevin (carbaryl)
    - Bendiocarb
  - Organophosphates
    - chlorpyrifos
    - Diazinon
    - disulfoton
    - Malathion
  - Chlorinated hydrocarbons
  - Halogenated hydrocarbons

- **Synthetics: Fungicides**
  - Chlorinated hydrocarbons
    - Chlorothalonil
    - PCNB
  - Phthalimide
    - Captan
    - Benimidazole
    - Benomyl
  - Acylalanine
    - metalaxyl
  - Dithiocarbamates
    - Mancozeb
    - Maneb
    - Thiram

PPE

- Long rubber gloves
- Respirator
- Safety glasses
- Head-toe boots

Other considerations

- Pre harvest interval
- Restricted use pesticides
  - PAT
- Indirect affects
- Disposal
- Storage
- Mixing

Summary

- Evaluate problem and positively identify pest
- Consider the options
  - Including the consequences of not treating
  - Consider chemical control
  - If damage cannot be tolerated
  - And other methods are not sufficient to manage
- Select the least toxic option
- Observe all safety precautions when handling
- Store safely
- Dispose of properly