IPM Modules: Greenhouses

Note: IPM learned and practiced in this module should be successfully reinforced with a field trip to a local greenhouse, or if possible in the school agriculture greenhouse. Additionally, an interview with a knowledgeable greenhouse manager will help students understand IPM more completely.

Resources
Integrated Pest Management (IPM) for school Greenhouses – Manual 2003
Maryland Cooperative Extension, University of Maryland
Ed Crow, Maryland Department of Agriculture: CrowEA@MDA.STATE.MD.US

University of Vermont – Greenhouse IPM
http://www.uvm.edu/~entlab/?Page=greenhouseipm.html

University of Massachusetts – Greenhouse project
http://www.umass.edu/umext/ipm/ipm_projects/greenhouse.html

Growing Lifestyle – Greenhouse IPM
http://www.growinglifestyle.com/j/4002/

Rutgers University – Greenhouse Notes
http://www.rce.rutgers.edu/pubs/greenhouseipmnotes/2000/ghipmnotes10-02.pdf

Objectives
The Students will:

- Become familiar with the greenhouse environment
- Compare symptoms of healthy and unhealthy greenhouse plants
- Discover pest and disease symptoms that occur in a greenhouse
- Learn which pests are common in greenhouses, why they are pests, and which IPM tactics are employed to manage them
- Research key pest biology, damage caused, host plants, monitoring and management practices
- Participate in an IPM program designed by the students

Vocabulary

Insects
Aphids
Fungus Gnats
Mealybugs
Scale
Shore flies
Spider mites
Thrips
Whiteflies
Botrytis
Pythium root rots
Phytophthora root rots
Rhizoctonia root rots
Powdery mildew
Leaf spot (bacterial disease)
Tomato Spotted Wilt Virus
Tobacco mosaic virus
Frass
Sticky cards
Cultural control
Insecticides
Fungicides
Miticides
Pesticides
Diseases
Soil Sample

Activity

Step One, Discussion:
Talk with the students about experiences they may have had in a greenhouse.

- Have they ever visited a greenhouse?
- What did it look like?
- What kinds of plants were there?
- Did they see any pests, insects or diseases?
- What kind of watering system did the greenhouse use?
- How large was the greenhouse?
- What was under the benches, rocks, soil, etc?
- What kind of shade was in or near the greenhouse?
- What kind of access was there to the greenhouse, several doors, one door, windows, etc?

Step Two, The greenhouse:
If the school has a greenhouse, visit it in this next step. If it is not possible to visit a school greenhouse, arrange for a field trip to a local commercial greenhouse. When inside the greenhouse have students take detailed notes about their findings. *Caution students to respect the greenhouse, and to be careful not to damage any plants and equipment*. They will need **hand lenses, rulers, pencils, and paper**. They should make notes about:

- Plants in the greenhouse
- Plants that look healthy, height, color, leaf shape
- Plants that look unhealthy, height, color, leaf shape
- Did they observe any insects, insect waste (frass) looks like black specks, cast skins (on the underside of leaves and along stems)
- Wilted or weakened plants
- Soil conditions, too wet, too dry, moist
- Lighting conditions in the greenhouse
- Temperature in the greenhouse
- Discolored leaves and stems
- Malformed leaves and stems (rosetting)
- Leaves and stems with yellow, brown, or black spots
- Chewed leaves
- Leaves with speckled yellow spots
- Leaves with a windowpane appearance

Step Three, Professional Greenhouse
This step may be easiest to accomplish while at a commercial greenhouse. However, if the class has not visited the greenhouse, or is not able to, ask a greenhouse manager to visit the class. You may choose to have the greenhouse manager present the IPM program he or she uses to the class, or have the class interview the greenhouse manager about the IPM program he or she uses. Points that should be addressed during the visit with the greenhouse manager are:

- What pest prevention techniques are used?
- What insects are common to greenhouses?
- Are these insects pests or beneficial?
- How are pest insects monitored?
- How are pest insects managed?
- What diseases are common in greenhouses?
- How are diseases monitored?
- How are diseases managed?
- What weeds are problems in greenhouses?
- How are they monitored?
- How are they managed?
- Are biological controls used?
- Are cultural controls used?
- Are physical and mechanical controls used?

Step Four, Greenhouse IPM discovery

Working in pairs students should use a variety of materials such as Internet resources, extension information, books and manuals to research the variety of pests that can occur in a greenhouse. Students must discover and report to the class:

- Name of a Pest
- Pest Host
- Pest Biology
- Pest Damage
- Monitoring/scouting methods
- At least one method for managing pest populations

Students may choose to investigate a major pest of their interest or a pest mentioned by the greenhouse manager. If students wish to investigate a pest of interest, encourage them first to decide on a plant they have interest in, then research the key pests for that plant. Groups of students should research insects and diseases respectively. Below is an abbreviated list of common greenhouse pests.

Insects: Aphids, Fungus Gnats, Mealybugs, Scale, Shore flies, Spider mites, Thrips, whiteflies

Diseases: *Botrytis, Pythium* and *Phytophthora* root rots, *Rhizoctonia* root rots, Powdery mildew, Leaf spot (bacterial disease), Tomato Spotted Wilt Virus, Tobacco mosaic virus

Step Five, Greenhouse IPM in practice:

Now that your students are much more familiar with a specific pest, allow them to revisit the commercial greenhouse or school greenhouse and begin looking for their specific pest. *Note: If students perform this step in a commercial greenhouse, permission must be obtained first, and scouting should be done with the supervision of greenhouse personnel.* Students should implement the scouting and monitoring techniques they researched. They should take detailed notes about pests that they find (location, number, and damage severity). Students should collect samples to bring back to the classroom for further identification

Once they have returned to the classroom, they must use the information they have researched (pictures, descriptions, etc.) to correctly identify their pest. Students should also use **microscopes and slides, hand lenses, and rulers** to aid in pest identification.

After students have verified their pest, they should be allowed to scout the area once again to make more notes about pest abundance, host plant, and pest location on host plant, life stage of pest, and pest quantities. They should then present a scouting report to the class. The scouting report should include if they found their pest, pest density (numbers of pests), pest life stage, pest location, and on which plant the pest found. The scouting report should also include if management tactics are necessary. What they recommend for management? Are there any other tactics that can be incorporated? How often is treatment necessary?

If students have access to the school greenhouse and are able to continue a full IPM program they should gain information about previous pest problems, management methods, and end of the year disinfecting procedures. This background information is necessary to predict potential pest problems that could occur during the students' time in the greenhouse. The students should research greenhouse monitoring programs that include scouting and sampling methods; this information will help students determine pest population densities and life histories. Allow the students to continue the greenhouse IPM program throughout the school year.

Step Six, Take Action:
This step may not be available to all teachers. However, if it is possible allow the students to implement their management methods (if necessary). Have the students continue scouting and making notes at regular intervals about pest densities, life cycles, and whether or not management practices are effective at managing pest populations. Periodically discuss their findings and have them report to the class. It may be necessary to re-evaluate and change management tactics.

Materials

Slides
Rulers
Hand lenses
Pencil
Paper
Sticky cards (for monitoring pest densities, may not be needed)
Flags
Gloves
Bags for sampling
Rulers
Microscopes
Thermometers
Tweezers
Transportation for field trip