CHAPTER 1

PRINCIPLES OF PEST MANAGEMENT

LEARNING OBJECTIVES

After completely studying this chapter, you should:

- Know the goal of integrated pest management (IPM) programs.
- Be familiar with IPM tools and how they are used.
- Understand the concept of threshold levels as an IPM decision tool.
- Know the various IPM management strategies and under what circumstances they should be applied.
- Understand the importance of evaluating pest management strategies and what kind of information should be recorded.

INTRODUCTION

All parts of a tree—roots, stems, foliage, shoots and terminal leaders—are vulnerable to attack by pests. Pest damage can range from slight damage that has no effect on the value of the harvested product to severe damage that stunts or kills the trees or reduces their market value. Tree pests include insects and mites, diseases, weeds, vertebrates, and nematodes.

Managing tree pests effectively should be based on thorough consideration of ecological and economic factors. The pest, its biology, and the type of damage are some of the factors that determine which control strategies and methods, if any, should be used. Pest management decisions largely determine the degree and amount of pesticide used.

Ultimately, pest management decisions represent a compromise between the value of the product, the extent of the pest damage, the relative effectiveness and cost of the control measures, and the impact on the environment.

INTEGRATED PEST MANAGEMENT (IPM)

The goal of IPM is to use all appropriate tools and tactics to prevent economically important pest damage without disrupting the environment. Information gathering and decision making are used to design and carry out a combination of measures for managing pest problems. IPM is the best approach to manage pests of trees.

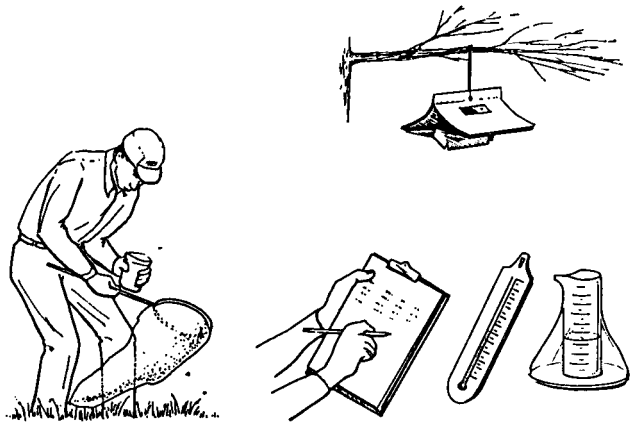
What are these IPM tools and how are they used?

Monitoring (scouting)

Monitoring (scouting) forests and newly established plantations will help detect problems early, while there is still time to take action. The information gathered through monitoring is a key element in any IPM program.

For example, when monitoring or scouting an area, examine the center of the area as well as the margins. Note competition levels among trees and other plants. Note types, quantity, and location of weeds. Look for signs of animal activity. Check a representative sample of trees for signs and symptoms of insect and disease problems. Inspect all parts of the tree, from top to bottom and from branch tips to trunk. Depending on the pest, the use of traps or microscopic examination may improve the infor-

mation gathered by visual examination. Record your observations. The destructive forms of many insect pests are generally most active from April through August, but infection by many disease organisms is more dependent on weather conditions than on calendar date. Scouting and monitoring for all pests and pest problems must be done regularly and frequently to avoid surprises.



Weather plays an important part in the development of most insect and disease pests. Keeping track of the daily weather conditions (high and low temperatures, humidity, and the amount of rain) will make you better at forecasting pest problems.

Identification

Identification of pests and the diagnosis of pest damage are key elements of IPM. If you find perennial weeds present and/or signs of insect, disease, or vertebrate presence or damage, try to determine:

- What kind of pest is present?
- What stage of the pest is present?
- What is the size of the pest population?
- How much damage has occurred?
- How much damage is likely to occur if no control measures are taken?
- Does the pest or damage require immediate attention, or can control measures be postponed until the trees are near harvest?

Certain tools are useful in carrying out an IPM program. A hand lens is essential for magnifying disease signs, insects, and weed plant characteristics. If pests are in the tops of trees, binoculars may be beneficial. Pruning shears and a pocket knife are needed when probing for insects or disease or collecting weed specimens. Field guides, Extension bulletins, or other references with pictures and biological information on tree ID, weed ID, insects, and diseases will help with identification. Have plastic bags, vials, and containers available in case you have to take samples of the pest or pest damage to someone else for identification. For weed ID, collect as much of the whole plant as possible, including flowers, leaves and stems.

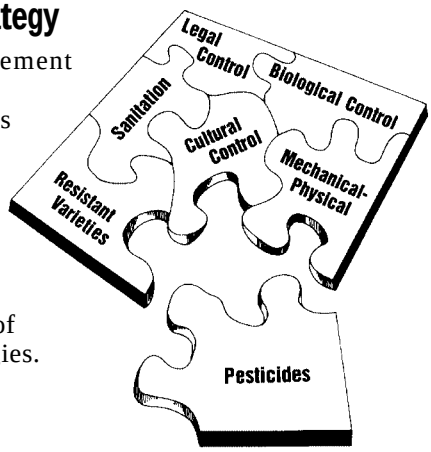
It is important to know where to find help in diagnosing pest problems. The local county Extension office can provide you with forms and instructions for sending samples to Michigan State University for diagnosis.

Threshold Level

Determine the ***threshold level***—the point at which the pest or its damage becomes unacceptable. The threshold level may be related to the beauty, health, or economic value of the tree crop. Once the threshold level has been reached, you must determine what type of control procedure is needed. This decision will be based on the size of the pest population, the kind of damage the pest is causing, and the control measures that are available. It is also very important to consider the cost effectiveness of potential controls. You must carefully weigh the cost of control, the value of the tree, and the impact of the pest damage on the value of the tree.

Management Strategy

Decide on management (control) strategies. Management options may be very different for high-value Christmas tree species than for other lower value trees. The following are some examples of management strategies.



Do nothing

In situations where the pest does not damage the crop value or the crop value is so low it is not cost effective to apply a control measure, no action is needed.

Cultural management

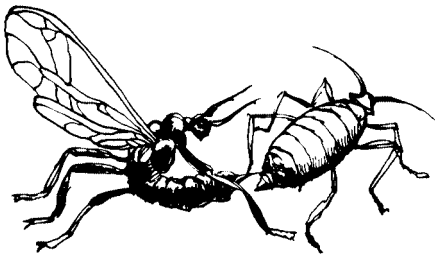
Cultural management manipulates the environment to make it more favorable for the plant and less favorable for the pest. Cultural controls such as good site selection, planting resistant varieties, or selective pruning make it less likely that the pest will survive, colonize, grow, or reproduce. Cultural management can be very effective in preventing pests from building to unacceptable levels.

Mechanical management

Some measures exclude or remove the pest from the habitat. Mechanical traps, screens, fences, and nets can remove the pest or prevent access by the pest. Tillage and mowing are used to mechanically manage weeds.

Biological management

Biological controls include the beneficial predators, parasites and pathogens that kill pests. There are many more known natural enemies of insect pests than there are natural enemies of disease pests. Biological weed control is generally aimed at non-native introduced weeds.



Wasp parasitizing an aphid

Ladybugs, lacewings and certain mites are common predators of insects. Some tiny wasps and some fly species are parasites of insects. Many beneficial parasites are host specific and do not control a wide range of pests. Parasites and predators are often very effective at keeping insect pests at low levels. For example, aphids, scales, and mites rarely build to damaging levels in pine or spruce forests because their populations are controlled by predators and parasites. Insects are also affected by a variety of bacterial, fungal, and viral diseases that affect only insects.

Biological control organisms are very sensitive to pesticides. Pesticide applications to control a pest may have the unwanted side effect of wiping out part of the natural predator and parasite population along with the pest. This, in turn, may cause a population explosion of a different pest in the void left by the predators and parasites.

Pesticides

Pesticides are a very important tool in IPM when large pest populations threaten high-value trees. Knowledge of the pest's life cycle, selection of an appropriate pesticide, proper timing of the application, and use of the right application equipment will improve coverage and effectiveness. The ability to recognize beneficial biocontrol organisms, combined with cultural and mechanical controls, may allow you to reduce, delay, or eliminate pesticide treatment of a minor pest problem.

Evaluation

Evaluate the results of management strategies. It is very important to determine how effective your management and control tactics are. This information will determine whether any follow-up treatment is needed and will improve your management strategies for next year. Return to the area after applying a treatment and compare posttreatment pest activity to pretreatment. This is where a pest management logbook will become invaluable. Include your observations about where pests first showed up, what kinds of natural enemies you observed, where and when specific treatments were applied, and what the results were. Sound IPM practices pay off both economically and environmentally.

CHAPTER 1

Review Questions

Chapter 1: Principles of Pest Management

Write the answers to the following questions and then check your answers with those in the back of the manual.

1. Why is a good pest control decision usually a compromise?

2. Which of the following is NOT a component of scouting trees?
   A. Record observations.
   B. Examine a representative sample of trees from the site.
   C. Search for a single pest at each inspection.
   D. Examine each tree from top to bottom and from outer edges to center.

3. What is the first thing you should do when you detect the presence of a pest?
   A. Select a control tactic.
   B. Identify the organism.
   C. Determine the threshold level for control.
   D. Notify the Department of Agriculture.

4. How would you go about identifying an insect pest found on a tree?

5. What is the threshold level?

6. Describe a situation in which you would not recommend a control procedure for a severe pest infestation.

7. Name an unwanted side effect when pesticides are used to control a pest population.

8. What IPM practice manipulates the environment to make it more favorable for plants and less favorable for pests?
   A. Biological management
   B. Mechanical management
   C. Pesticide use
   D. Cultural management

9. A net is an example of what type of IPM practice?
   A. Biological management
   B. Mechanical management
   C. Pesticide use
   D. Cultural management

10. What IPM practice depends on natural enemies of pests?

    A. Biological management
    B. Mechanical management
    C. Pesticide use
    D. Cultural management

11. Pesticides are an important tool in the practice of IPM.

    A. True
    B. False

12. Biological control organisms are not affected by pesticides.

    A. True
    B. False

13. The effectiveness of a pesticide application is related to:

    A. Choosing the right pesticide
    B. Proper timing
    C. Good coverage
    D. All of the above

14. Why is it important to evaluate the results of IPM management strategies?

15. Another term for evaluating pest management strategies is:

    A. Biocontrol
    B. Site-specific
    C. Diagnosis
    D. Record keeping

16. After pest management tactics are applied:

    A. Don't return to the site until pests are a problem again.
    B. Don't return to the site until the biocontrol organisms are active.
    C. Return to the site and harvest the crop.
    D. Return to the site and evaluate the degree of pest control.

17. What type of information should be recorded when evaluating the effectiveness of an IPM program?

18. Sound IPM practices have both economic and environmental benefits.

    A. True
    B. False