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Methods of Integrated Pest Management

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To practice IPM in the landscape, choose plants that are well suited to the site. Plant them properly and keep the plants healthy by carefully watering, fertilizing, and pruning them. Watch out for problems on your plants as they arise. If a pest or disease causes unacceptable damage despite preventative efforts, choose an effective management method that will have the least amount of impact on other living creatures and the environment.

Steps to Make an IPM Control Decision

Confirm That There is a Pest Problem: Look for pests and diseases and the evidence or signs they leave. Look for symptoms the plant exhibits as a result of pest activity. Examine your plants often. Identify your plants to be sure that the twisted leaves, unusual coloration, or strange-looking structures you see are not a normal part of the plant. Try to rule out site-related problems by making sure that the soil type, drainage conditions, fertility level, and other environmental conditions are favourable for the plant.

Identify the Problem: Effective pest management depends on the accurate identification of the pest. Insects and mites often are associated with specific plants, and they follow certain development and behaviour patterns as the season progresses. Use reference books from the library or garden canter to identify pests. If you can't find an accurate description there, consult someone in your local extension office. Learn about the insect's life cycle, behavior, and natural enemies.

Plant diseases may be caused by pathogens including fungi, nematodes, bacteria, or viruses. Each pathogen is capable of infecting only certain plants. Infection occurs under particular environmental conditions, with symptoms of the disease appearing later. To identify plant diseases accurately, compare visible signs and symptoms of the disease with descriptions in reference books. Some diseases are more difficult to identify, and you may need a laboratory analysis or the help of an expert. These services are available through landscape professionals or your local extension office.

Determine if a Control Measure is Needed: Determine if the damage is severe enough to justify a management tactic. Is the damage actually affecting the health of the plant? If not, does it make the plant look bad enough to detract from the appearance of your landscape? You may become alarmed if you notice that caterpillars are making holes in leaves, but if the damage is slight or occurs late in the season, you probably won't need to control the caterpillars.

Are the pest's natural enemies present? In most cases, they will be. If so, an application of a nonselective insecticide could kill them, allowing the pest population to rebound uninhibited by predators and parasites, which may have been providing significant control.

Choose a Method: If a control is needed, consider physical or biorational methods first. If they are unavailable or impractical, you may need to carefully use a conventional chemical control.

- **Physical methods:** Pests can be removed from plants physically. For example, some aphids and mites can be knocked off by spraying the plant with water. Bagworm larvae can be picked off an infested plant. You can use traps to catch certain pests, and barriers to protect plants from insect attack or disease infection. One effective method for controlling gypsy moth larvae on small numbers of trees is to put a band of folded burlap around the tree trunk to provide an artificial resting site for the caterpillars, and then destroy the caterpillars that gather there. Applying an anti-transparent spray to lilac leaves in summer to prevent infection by the spores of powdery mildew is another example of a protective barrier. In some cases, the best solution may be physically removing the plant and replacing it with one that will not be affected by the pest or disease. Thinning crowded plants to improve air circulation can reduce many disease problems.
- **Biorational methods:** Biorational methods can be divided into two groups. The first group includes living organisms that can kill the pest. The second group includes naturally occurring biochemicals that are harmful to the pest yet often are harmless to other living organisms. Insect pests frequently have natural enemies that are beneficial to the landscape. These beneficial insects often exist in the landscape naturally, but they also can be introduced. "Beneficials" may be predators or parasites. One common example of a beneficial predator is the lady beetle. Both the larvae and adult lady beetles eat aphids and other soft-bodied insects. Other predators include lacewings, spined soldier bugs, flower flies, and spiders. Parasites live on and often kill another organism, called the host. Some parasitic wasps use caterpillars, whiteflies, aphids, and soft scales as hosts. An example of a method that uses a naturally occurring biochemical is the bacterium *Bacillus thuringiensis* (Bt). Bt contains a protein that is poisonous to specific insects, yet harmless to other organisms. Bt can be sprayed on plants. When the sensitive insect pest feeds on the sprayed leaves, it will ingest the protein and be killed.

Chemicals: Conventional chemicals are used only as a last resort in an IPM program, but sometimes are the most effective means of control. To have the greatest effect, these materials need to be applied on a specific part of the plant when the pest is most vulnerable. Always apply chemical controls according to label directions.

In many cases, environmentally safe pesticides such as horticultural oil or insecticidal soap are effective choices. Again, applications must be timed carefully to have the greatest effect on the pest insect population. Because they have no residual activity after they have dried, soaps and oils are usually the option that is the least disruptive to populations of beneficial organisms.

The label of every pesticide formulation displays a signal word that relates to the pesticide's level of toxicity. These words, from least toxic to most toxic are: "caution," "warning," and "danger." Use these words as guidelines to help you choose the least hazardous material among the effective alternatives. For most landscape pests, you need to consider pesticides in only the first two categories. Some pesticide formulations can be applied only by applicators with special training and who are certified by the state's department of agriculture.

A pesticide may be applied only to plants that are listed on the label. Refer to the *Woody Ornamental Insect, Mite, and Disease Management Guid*e, published by Penn State Extension, or to another current reference for a list of materials that are registered for use on plants in your state. Read the label to be sure that you have chosen a product that is effective against the pest you have identified, and choose your timing based on professional recommendations.

Follow these procedures for your safety and success

- Mix pesticides according to label instructions. Do not use more or less concentrate in the mixture than the label recommends. Mix only as much material as you need for the application.
- Wear protective clothing as specified on the label.
- Label a set of mixing and measuring tools that are used *only* for insecticides and fungicides, and store them with the products. Use a separate set of measuring tools and spray equipment for herbicides.
- Keep pets and people away from the area where you store, mix, and apply pesticides. Stay away from a treated area for as long as the label directs.
- Do not spray on a windy day or when air temperatures will be above 85°F before the spray solution dries.
- Clean equipment and mixing tools as soon as you finish spraying.
- After spraying, change your protective clothing and bathe. Wash the clothes you were wearing separately from your regular laundry.
- Keep records of where and when you sprayed, what pesticide you used, and how much you used. Give the treatment time to work, then evaluate and record your results.