

Early detection and treatment of pests means a healthier growing environment.

In your backyard

Pest management can be one of the greatest challenges to the home gardener. Yard pests include weeds, insects, diseases, and some species of wildlife. Weeds are plants that are growing out of place. Insect pests include an enormous number of species from tiny thrips, that are nearly invisible to the naked eye, to the large larvae of the tomato hornworm. Diseases are caused by fungi, bacteria, viruses, and other organisms, some of which are only now being classified. Poor plant nutrition and misuse of pesticides also can cause injury to plants. Slugs, mites, and many species of wildlife such as rabbits, deer, and crows can be extremely destructive.

Identify the problem

Careful identification of the problem is essential before control practices can be used. Some insect damage

Finding a pest problem and then treating for that problem - such as spot spraying - is cost effective and limits any damage to non-targeted species.

Backyard Conservation

is a cooperative project of:

**USDA Natural Resources
Conservation Service
National Association of
Conservation Districts
Wildlife Habitat Council**

may appear to be a disease, especially if no visible insects are present. Nutrient problems may also mimic diseases. Herbicide damage resulting from misapplication of chemicals also can be mistaken for other problems.

What to look for

Insects and mites
All insects have six legs, but other than that they are extremely variable. They include such organisms as beetles, flies, bees, ants, moths, and butterflies. Mites and spiders have eight legs- they are not insects. But for the purposes of this tip sheet, they will be considered as insects.



The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

One in a series of 10 tip sheets on backyard conservation

Insects damage plants in several ways. The most visible damage is chewed plant leaves and flowers. Many pests are visible and can be readily identified, including the Japanese beetle, Colorado potato beetle, and numerous species of caterpillars such as tent caterpillars and tomato hornworms. Other chewing insects, however, such as cutworms (which are caterpillars) come out at night to eat, and burrow into the soil during the day. These are much harder to identify but should be considered if young plants seem to disappear overnight or are found cut off at ground level.

Sucking insects are extremely common and can be very damaging. These insects insert their mouth parts into the plant tissues and suck out the plant juices. They also may carry diseases that they spread from plant to plant as they move about the yard. You may suspect that these insects are present if you notice misshapen plant leaves or flower petals. Often the younger leaves will appear curled or puckered. Flowers developing from the buds may only partially develop. Look on the underside of the leaves as that is where many species tend to gather. Common sucking insects include leafhoppers, aphids, mealy bugs, thrips and mites.

Other insects cause damage by boring into stems, fruits, and leaves. They may disrupt the plant's ability to transport water. They also create opportunities for disease organisms to attack the plants. You may suspect the presence of boring insects if you see small accumulations of sawdust-like material on plant stems or fruits. Common examples of boring insects include squash vine borers and corn borers.

Diseases

Plant disease identification is extremely difficult. In some cases,

only laboratory analysis can conclusively identify diseases. Disease organisms injure plants in several ways. Some attack leaf surfaces and limit the plant's ability to carry on photosynthesis. Other organisms produce substances that clog plant tissues that transport water and nutrients. Other disease organisms produce toxins that kill the plant or replace plant tissue with their own.

Symptoms associated with plant diseases may include the presence of mushroom-like growths on trunks of trees; leaves with a grayish mildewy appearance; spots on leaves, flowers, and fruits; sudden wilting or death of a plant or branch; sap exuding from branches or trunks of trees; and stunted growth.

Misapplication of pesticides and nutrients, air pollutants, and other environmental conditions such as flooding and freezing can also mimic some disease problems. Yellowing or reddening of leaves and stunted growth may indicate a nutritional problem. At first glance, blossom end rot of tomato, in which the bottom of the tomato turns black, might appear to be a disease caused by some pathogen. It is actually caused by the plant's inability to take up calcium quickly enough during periods of rapid growth. Prevent this problem with adequate moisture—adding more calcium is of no benefit! Leaf curling or misshapen growth may be a result of herbicide application.

Pest management practices

Preventing pests should be your first goal. But it's unlikely you will be able to avoid all pest problems, since some plant seeds and disease organisms lay dormant in the soil for years.

Diseases need three elements to become established: the disease

organism, a susceptible species, and the proper environmental conditions. Some disease organisms can live in the soil for years; other organisms are carried in infected plant material that falls to the ground. Some disease organisms are carried by insects. Good sanitation will help limit some problems. Planting resistant varieties of plants prevents many diseases. Rotating annual crops in a garden also prevents some diseases.

You will likely have the most opportunity to alter the environment in favor of the plant and not the disease. Healthy, vigorous lawn and garden plants have a higher resistance to pests. Plants that have adequate, but not excessive, nutrients are better able to resist attacks from both diseases and insects. Excessive rates of nitrogen often result in extremely succulent vegetative growth and can make plants more susceptible to insect and disease problems, as well as decrease their winter hardiness. Proper watering and spacing of plants limits the spread of some diseases. Some disease species require free standing water in which to spread, while other species just need high humidity. Proper spacing provides good aeration around plants. Trickle irrigation where water is applied to the soil and not the plant leaves may be helpful.

Barriers may be effective to exclude some pests. Mulching is effective against weeds. Fences can limit damage from rabbits. Row covers may prevent insect damage on young vegetable plants. Netting can be applied to small fruit trees and berries to limit damage from birds.

Integrated Pest Management (IPM)

It is difficult, if not impossible, to prevent all pest problems every year. If your best prevention efforts have not been entirely successful, you may need to use some control methods. Integrated Pest Management (IPM) relies on several techniques to keep pests at acceptable population levels without excessive use of chemical controls. The basic principles of IPM include monitoring (scouting), determining tolerable injury levels (thresholds), and applying appropriate strategies and tactics. Unlike other methods of pest control where pesticides are applied on a rigid schedule, IPM applies only those controls that are needed, when they are needed, to control pests that will cause more than a tolerable level of damage to the plant.

Monitoring is essential for a successful IPM program. Check your plants regularly. Look for signs of damage from insects and diseases as well as indications of adequate fertility and moisture. Early identification of potential problems is essential.

There are thousands of insects in the garden, many of which are harmless or even beneficial. Proper identification is needed before control strategies can be adopted. It is important to recognize the different stages of insect development for several reasons. The caterpillar eating your plants may be the larvae of the butterfly you were trying to attract. The small larvae with six spots on its back is probably the young of the ladybug, a very beneficial insect. Some control practices are most effective on young insects. Different stages may also be more damaging than others.

It is not necessary to kill every insect, weed, or disease organism to have a healthy yard. This is where

the concept of thresholds comes in. The economic threshold is the point where the damage caused by the pest exceeds the cost of control. In a home garden, this can be difficult to determine. What you are growing and how you intend to use it will determine how much damage you are willing to tolerate. Remember that larger plants, especially those close to harvest, can tolerate more damage than a tiny seedling. A few flea beetles on a radish seedling may warrant control whereas numerous Japanese beetles eating the leaves of beans close to harvest may not.

If the threshold level for control has been exceeded, you may need to employ control strategies. Strategies can be discussed with the Cooperative Extension Service, garden centers, or nurseries.

Control strategies

Mechanical/physical controls

Insects—

Many insects can be removed by hand. This method is preferable if a few, large insects are causing the problem. Simply remove the insect from the plant and drop it into a container of soapy water or vegetable oil. Caution: some insects have spines or excrete oily substances that can cause injury to humans. Use caution when handling unfamiliar insects. Wear gloves or remove insects with tweezers.

Many insects can be removed from plants by spraying water from a hose or sprayer. Small vacuums can be used to suck up insects. Traps can be used effectively for some insects. These come in a variety of styles depending on the insect to be caught. Many traps rely on the use of pheromones—naturally occurring chemicals produced by the insects and used to attract the opposite sex during mating. They are extremely specific for each species and, there-

fore, will not harm beneficial species. One caution with traps is that they may actually draw more insects into your yard. You should not place them directly in the garden. Other traps are more generic and will attract numerous species. These include such things as yellow and blue sticky cards. Different insects are attracted to different colors. Sticky cards can also be used effectively to monitor insect pests.

Weeds—

Hoing, pulling, and mulching are the most effective physical control methods for weeds. Weeding is most important while plants are small. Well established plants can often tolerate competition from weeds.

Diseases—

Removal of diseased material limits the spread of some diseases. Clean up litter dropped from diseased plants. Prune diseased branches on trees and shrubs. When pruning diseased trees and shrubs, disinfect your pruners between cuts with a solution of chlorine bleach to avoid spreading the disease from plant to plant. Control insects known to spread plant diseases.

Other pests—

Fences, netting, and tree trunk guards can be extremely successful in limiting damage from small mammals and birds. Numerous traps are also available to catch or kill some animals. Caution: In many states it is illegal to move wildlife, including squirrels. Traps may also catch animals other than the ones targeted. Check local regulations before trapping.

Diatomaceous earth, a powder-like dust made of tiny marine organisms called diatoms, can be used to reduce damage from soft-bodied insects and slugs. Spread this material on the soil—it is sharp and cuts or

irritates these soft organisms. It is harmless to other organisms. Shallow dishes of beer can be used to trap slugs.

Biological controls

Biological controls are nature's way of regulating populations. Biological controls rely on predators and parasites to keep organisms under control. Many of our present pest problems result from the loss of predator species.

Other biological controls include birds and bats that eat insects. A single bat can eat up to 600 mosquitoes

an hour. Many bird species eat insect pests on trees and in the garden. *Bacillus thuringiensis* (Bt) is a bacteria that specifically attacks larvae of some insect pests including white grubs in the lawn and Japanese beetles. This bacteria is harmless to desirable species.

Chemical controls

When using biological controls, be very careful with pesticides. Most common pesticides are broad spectrum in that they kill a wide variety of organisms. Spray applications of insecticides are likely to kill numerous beneficial insects as well as the pests. Herbicides applied to weed species may drift in the wind or vaporize in the heat of the day and injure non-targeted plants. Runoff of pesticides can pollute water. Many pesticides are toxic to humans as well as pets and small animals that may enter your yard.

Some common, non-toxic household substances are as effective as many more toxic compounds. A few drops of dishwashing detergent mixed with water and sprayed on plants is extremely effective in controlling many soft-bodied insects such as aphids and whiteflies. Crushed garlic mixed with water may control certain insects. A baking soda solution has been shown to help control some fungal diseases on roses.

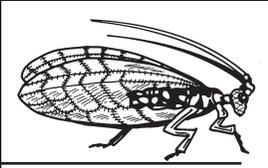
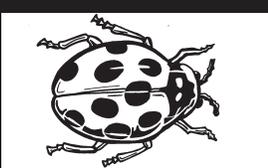
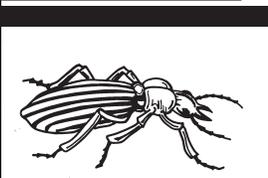
When using pesticides, follow label directions carefully. Altering the rate of application or increasing the frequency of application can injure desirable plant and animal species.

Spot applications of the pesticide to the targeted pest can reduce the amount used and help reduce the risk of injury to non-targeted species. Do not apply on windy days. Read the label for information on other environmental conditions such as temperature and rain that may influence the pesticide's effectiveness. Be aware that many so-called "organic" pesticides may be just as toxic as the synthetic or chemical products.

On the farm

Proper pest management on the farm involves a variety of practices, such as rotating crops to reduce disease and insect problems, and establishing tall grass hedges to provide habitat for beneficial insects. Many farmers now monitor their fields regularly—a practice called scouting—to keep track of insect and weed populations. Only when populations reach a level where an unacceptable amount of damage is likely are direct control measures initiated. When pesticides are necessary, farmers fill and clean tanks away from water sources, mix only necessary amounts, and apply only to land where problems exist.

Many farmers are using IPM techniques for effective and economic control of pests. Based on monitoring of specific pests, farmers apply only those pesticides needed for adequate control.

Some beneficial insects	
Lacewing	
Ladybug	
Praying mantis	
Ground beetle	
Trichogramma wasp	

Beneficial Insect	Controls
Green lacewings	aphids, mealy bugs, thrips, spider mites
Ladybugs	aphids, Colorado potato beetle
Praying mantis	almost any insect
Ground beetles	caterpillars that attack trees and shrubs
Parasitic nematodes	grubs, beetles, cutworms, army worms
Trichogramma wasp	corn borer, cabbage looper, other worms
Seedhead weevils	weeds