
Pest and Disease Management

Insects are a fact of life in an outdoor vegetable or flower garden. They are needed for pollination of many plants; numerous fruits and vegetables couldn't develop without the friendly aid of busy bees (unless you want to hand pollinate rows of vegetables!). In fact, one third of the food we eat is the direct result of pollination by insects.

Some insects are called beneficials, because they eat harmful insects that are chewing on your plants. Even so-called harmful insects, however, are doing nature's work of breaking down plant tissue into reusable elements. Unfortunately, sometimes they start this work on their timetable, not ours!

Everybody's favorite beneficial is the lady beetle (sometimes called lady bug). An old folk superstition says that if you let the lady beetle fly off unharmed, you will have good luck. If you have them living in your garden, consuming pests, you are indeed lucky! Other beneficials are equally intriguing, especially to children. Look for the praying mantis with its folded legs in a "prayer" position as it holds its prey; dragonflies, often with bright, metallic colors flashing in the sun as they swoop and dart; and green lacewings, with their filigree-like wings. Don't be fooled by the lacewings' delicate appearance. One voracious lacewing can consume up to 60 aphids per hour! There are many other beneficial insects such as big-eyed bugs and tiny wasps. If you decide that you can tolerate a few insects, such as aphids, on your plants, you will be providing a reason for beneficials to come to your garden. Realize that indiscriminately spraying pesticides will kill these beneficials as well as the target pest.



Integrated Pest Management

We advocate integrated pest management (IPM). IPM is simply a formalized way to practice all of the alternatives for controlling insects, including the use of beneficial insects, traps, cultivation practices, and even doing nothing at all. An IPM program includes the following steps:

- Identify the pest
- Monitor the pest
- Decide how much damage is acceptable (for the plant's health and/or aesthetics)
- Consider all control options, including no control
- Keep accurate records
- Evaluate results and modify program as needed.

Identify the Pest

Your best defense against excessive plant damage is to monitor your garden and to know who is a “good bug” and a “bad bug.” Go out to the garden each morning and look at the plants. If there is no damage, you can enjoy the view! What if you see holes in your cauliflower leaves? Encourage the children to play “detective” to find the culprit. Put the “suspect” insect in a jar with holes in the lid. Use a small stick or wear gloves to move the insect unless you are sure it won't bite or sting. Put an intact piece of the leaf or plant part that the insect was feeding on into the jar, taking care to avoid introducing other insects. Does more damage occur?

Examine the insect and the plant it was eating carefully. You may need a magnifying glass. Insect identification often starts by determining what type of damage was inflicted on the plant. For example, insects with sucking mouth parts, such as whiteflies, aphids and leafhoppers, cause the leaves to turn yellow and will leave sticky honeydew secretions. Ragged edges and holes in the leaves show that chewing insects, such as caterpillars, beetles, leafcutter bees, thrips or grasshoppers, have been feeding on your plants. The *Master Gardener Entomology Manual*, written by Dave T. Langston and Roberta Gibson, is an excellent and inexpensive guide to help you identify insects commonly found in the Southwest.



Monitor the Pest

Keep a close eye on the plant(s) for the next day or two. Does the insect population increase dramatically? Do the plants look stressed? Have beneficials moved in?

Decide How Much Damage is Acceptable

Let the children decide what, if anything, needs to be done. A few holes may not matter, especially if you plan to harvest soon. After all, you'll be eating the cauliflower head, not the outer leaves. (Maybe the children would rather study the life cycles of caterpillars than eat cauliflower.) Perhaps you're planning an Open House and feel extensive insect damage would detract from the event. In that case, control might be justified. Alternatively, the children could use it as an opportunity to show off their knowledge of insects, pollination and life cycles. These are issues you and your young gardeners can discuss.

Control Options

Insects that chew leaves. The most significant garden pests with chewing mouth parts are tomato hornworms and cabbage loopers, which are large enough to be easily handpicked. Tomato hornworm larvae are bright green caterpillars about three inches long. They have white stripes on the body and a dark "horn" projecting from the rear. They are typically found on tomatoes, peppers and eggplant. Healthy plants can often sustain some feeding from tomato hornworms if their population isn't large.

Cabbage looper larvae are also green caterpillars but are smaller than hornworms. Cabbage loopers are about one to one-and-a-half-inches long with pale stripes running the length of their back. They "loop" as they crawl, forming a little arch with their bodies. They like to feed on members of the *Cruciferae* or cabbage family, including cabbage, broccoli, cauliflower, kale, and others.

Insects that suck nutrients out of leaves. Most insects with sucking mouth parts can be controlled with a strong spray from your hose, so try that first. Why indiscriminately spray insecticides? You'll reduce the beneficial insects, waste money and put potentially harmful chemicals into the soil. (If you determine there



is a need for insecticides, be sure to check your school district's policy before spraying.)

Aphids are tiny insects (1/16- to 1/8-inch long) that generally thrive in cooler weather. They are usually green or gray/black, depending upon the species and the plants they prefer to eat. Check annual flowers, beans, and the members of the cabbage family such as broccoli, bok choy, cabbage, and kale. Aphids often cluster on new growth or buds and may cause yellowing, wilting, or a sticky residue called honeydew.

Whiteflies are another tiny insect (less than 1/16-inch), but they are active in warmer weather, particularly late summer and early fall. The immature form of the whitefly looks like a scale and is attached to the underside of the plant's leaves, where it is sucking sap.

For particularly bad infestations of aphids or whiteflies, you might try a soapy water spray (see recipe below). Test a few leaves or one plant before spraying the whole crop. Be sure to spray the underside of the leaves, where many sucking insects, such as whiteflies, reside. Spray in the early morning or early evening so that any soap residual won't burn the plants during the hotter parts of the day.

Another method of whitefly monitoring and control is to put "sticky" traps in the garden. You can purchase them from nurseries or make your own with yellow cardboard smeared on both sides with petroleum jelly. Evidently whiteflies are attracted to the color yellow. They fly to it, get stuck and can't do any more damage to your plants.

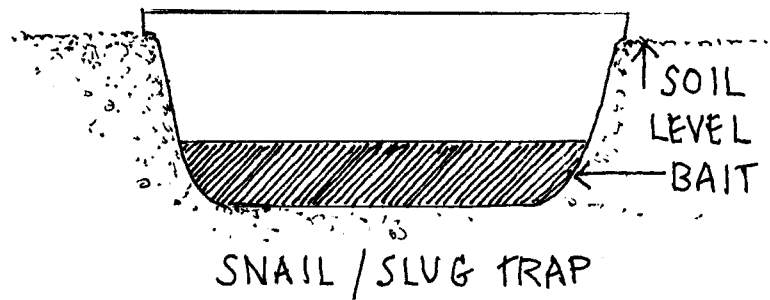
Soapy Water Spray Recipe

Use one teaspoon to two tablespoons of liquid detergent soap per gallon of water. Use regular detergent, not the extra concentrated types. Do not use dish soaps that contain lemon. The citric acid may burn plants. Start with the smaller amount of soap and increase if the insects aren't responding. Spray as often as needed. Keep records of when and how much was sprayed.

Leafhoppers are about 1/8-inch long with strong jumping legs that allow them to move easily from plant to plant. Some leafhoppers spread a virus called “curly top” to tomatoes. There is no cure for curly top once it strikes. Floating row cover, a gauzy lightweight fabric that appears to “float” above the plants, can act as an insect barrier and provide shade. This control method has been used successfully to limit the aptly-named leafhoppers. They don’t care for shade and should move on to find a brighter spot.

Slugs and snails. Little containers of any sugar, yeast and water mixture sunk below soil level will lure and drown slugs and snails. Barriers of diatomaceous earth or sawdust also keep them away.

Ants. An Arizona entomologist found that the most common pests around school grounds are ants, probably because of all the crumbs scattered around the play areas. If you have ants, citrus rind that has been finely ground into a slurry in a blender or cream of wheat in its dry state poured at the mouth of an ant hill should do the trick. Ground citrus only works during warm or hot weather; it must be used *immediately* after grinding to be effective. Note that many gardeners believe that ants help to improve the condition of the soil and don’t mind sharing space with them, as long as they aren’t the stinging kind. Contrary to common belief, with a few rare exceptions, the ants do not harm plants. They are more interested in feeding on the plant pests.



Your very best defense against pest and disease is to grow strong, healthy plants. Vigorously growing plants will resist attack by insects and disease. Water correctly to prevent disease and keep your soil as well conditioned as possible. Unhealthy plants are more susceptible to pests and disease. Insects actually seek out stressed plants. Plant selection, soil improvement, proper watering and fertilizing have all been explained in earlier chapters. If you follow those guidelines, you should reduce the likelihood that your plants will be attacked by pests and disease. Other pointers for keeping pests at bay include:

- ☞ Look for cycles in pest populations and time your planting to avoid their peaks. For example, delay planting fall crops until the summer peak of the whitefly population has decreased. (Whiteflies don't reproduce as rapidly when the temperature starts to cool.)
- ☞ Get rid of overly abundant crops of weeds, which provide a food and shelter source for pests.
- ☞ Keep your garden free of sick or damaged plants, which invite pests. Remove plant debris and put it in your compost pile.



Keep Accurate Records

Keep a log of all insects the children find. For example,

- When was the insect found?
- How many were there?
- What plant was the insect on?
- What kind of damage did the plant have?
- How quickly did the damage progress?
- What does the insect look like?
- How many legs does it have?
- What color is it?
- How big is it?
- Does it have wings?
- What, if any, control method was used?
- How much was applied and when?
- Did it work?



Evaluate Results and Modify Program as Needed

If the children have been keeping careful records, it will be relatively easy to determine what worked and what didn't. If for several days you tried a spray of water to get rid of aphids but their numbers increased, you may want to start with a low dose of soapy water. If that doesn't work, you might increase the amount of soap. Maybe the children have counted an increase in the number of beneficials and will wait to see if they achieve the desired result. Keeping records makes this step fun and rewarding.

Plant Disease

Plant diseases are sometimes flagged by discoloring, wilting, rotting and/or curling. Many of the same cultural practices discussed above to prevent insect damage apply to preventing plant diseases. Soil improvement, proper watering practices, correct fertilizer application and choosing appropriate plant varieties for our climate all influence the health of your plants. If you have been following the information provided and still see these or other symptoms, consult the diagnostic chart in Appendix G. Crop rotation is another cultural practice that helps prevent plant problems.



Class Activity

Start an Insect Collection

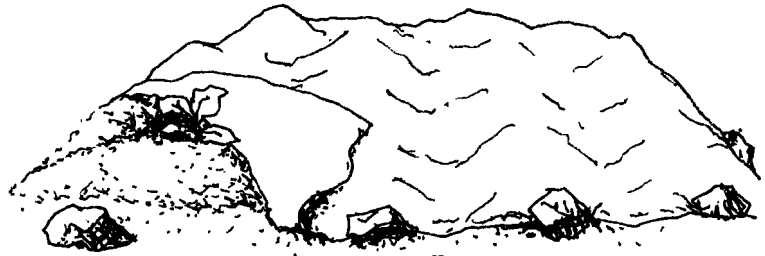
Hard-bodied insects such as beetles, grasshoppers and plant bugs can be killed by placing them in a freezer for at least 48 hours. Entomologists typically pin up insect specimens using special insect pins, but the students may also glue the insects onto small cardboard triangles (points) and then mount the points onto straight pins. Either clear nail polish or Elmer's® glue may be used. For soft-bodied insects such as aphids, caterpillars and spiders, the specimen should be kept in a vial or jar with about 70–75% alcohol mixed with water. Many insect guides contain basic information about making an insect collection. Insects should be labelled with the collection date and location.



Crop Rotation

Crop rotation simply means not planting the same crops, or family of crops, in the same place year after year. Waiting two to three years before planting the same family is a good rule of thumb. An example of a family of crops would be the *Cruciferae* or cabbage family, including cabbage, broccoli, brussel sprouts, cauliflower, kale, radishes, turnips, rutabagas, bok choy and others.

Crop rotation is beneficial to the soil in two ways. First, alternating plants that feed heavily from the soil and thus deplete many of its nutrients (e.g., corn, tomatoes, squash, lettuce) with light feeders (e.g., turnips, carrots) or with legumes (e.g., peas, beans, alfalfa) that actually “fix” nitrogen in the soil, helps promote soil fertility. Secondly, by not planting the same crop, disease and insects that are plant- or family-specific don’t have an opportunity to build up in the soil over time.



FLOATING ROW COVER

