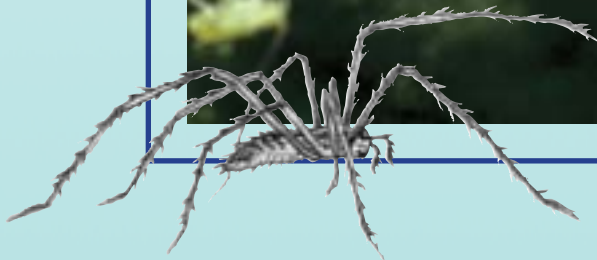


South Carolina Gardening & Recycling Organics Wisely



Natural Pest, Weed & Disease Control



Why Manage Your Garden Naturally?

Insects, spiders and other crawling or flying creatures are a vital part of healthy gardens. Most perform important jobs like pollinating flowers, recycling nutrients and eating pests. In fact, less than 1 percent of garden insects actually damage plants. Unfortunately, the pesticides often used to control pests and weeds are also toxic to beneficial garden life — and may harm people, pets, aquatic life and other wildlife as well.

Follow these basic steps to natural pest, weed and disease control

- ❶ Create a healthy garden to stop pest problems before they start. Healthy plants and soil not only resist pests and diseases, they also encourage beneficial garden life.
- ❷ Identify pests before you spray, stomp or squash. What you think is a pest may actually be a beneficial insect!
- ❸ Give nature a chance to work. Do not try to eliminate pests at the first sign of damage. Garden pests feed beneficial insect populations and allow them to grow.
- ❹ Use the least toxic pest controls available. You can often control pests by using traps or barriers, or by simply removing pests and infested plant parts. These methods do not harm beneficial garden life or the environment. If pesticides are the only way to control a problem, look for the least toxic ones and closely follow the application tips outlined later in this section (*and follow label instructions exactly*).



Start with Prevention

- **Try Integrated Pest Management**, an ecologically-based approach to managing pests with an emphasis on natural and cultural control processes and methods, including host plant resistance and biological control. Because the focus is on prevention, avoidance, monitoring and suppression of pests, chemical pesticides are used only where and when prevention measures fail to keep pests below damaging levels.
- **Build healthy soil to grow healthy plants.** Amend and mulch entire growing beds with compost, and fertilize moderately with natural organic or slow-release fertilizers to grow vigorous, pest-resistant plants. Determine the nutrient requirements of plants. Do a soil test and add lime and/or fertilize according to recommendations.
- **Plant right.** Place each plant in the sun and soil conditions it prefers. Select varieties that are known to grow well in your garden conditions and resist common pest and disease problems.
- **Give your plants some space.** Good air circulation can prevent or reduce many disease and pest problems. Space plants so they have plenty of room to grow, and remove some when they become too crowded. Group plants in the landscape according to water needs and sunlight requirements.
- **Water wisely.** Overwatering and underwatering are two of the most common causes of plant problems. Observe plants and check soil as deep as roots grow before and after watering to make sure plants get the water they need, but not too much. You can check the soil with a trowel, shovel or a soil-coring tool. Water early in the day or use soaker hoses to prevent diseases caused by wet leaves.
- **Clean up.** Remove weeds, wood boards and other yard debris that can harbor pests and disease. Fallen leaves and fruit from plants like apple trees and roses with persistent diseases such as scab, rust and mildew should be put in curbside yard waste collection containers — not in home compost piles, ravines, streams or lakes.
- **Diversify and rotate annual crops.** Grow a variety of plants to prevent problems from spreading, as well as to attract pest-eating insects and birds. Do not plant the same type of annual vegetables in the same spot each year; crop rotation prevents pests and diseases from building up in the soil.



Good bug:
Ladybird Beetle Larvae



Bad bug: Aphids

When is it a pest?

- **Pest** refers to an insect, animal, plant or micro-organism that causes problems in the garden.
- **Beneficials** are organisms in the air, on the ground or in the soil that do good things for your garden, like pollinating flowers, feeding on insect pests, or improving soil.
- **Some pests are also beneficials.** For example, yellow jackets are both predators of pests and painful to humans. When considering any controls, weigh a creature's damage against damage to the entire community of garden life.

Reduce the Need for Pesticides

Minimize the spraying of poisonous insecticides in your garden by letting certain types of plants and insect-eating animals control pests. Some plants, such as marigolds and onions, contain chemicals that repel pesky bugs. Toads, lady bugs, praying mantises and other insect-eating animals can also help control pest populations in your garden.

Experienced gardeners over the years have suggested plant combinations that work together in fending off insect pest problems. Actual research data on this phenomenon is not well established. These combinations should be taken as suggestions:

Good companions are:

- Beans with potatoes, cucumbers and carrots
- Beets with onions
- Cabbage with tomatoes, nasturtiums, thyme, mint, sage and rosemary
- Carrots with peas, leaf lettuce, thyme, leeks and chives
- Corn with soybeans, pole beans and vine-crop families
- Garlic around fruit trees and raspberry plants
- Leaf lettuce with radishes, carrots, chives and garlic
- Peas with turnips, carrots and chives
- Potatoes with beans and cabbage
- Tomatoes with dill, parsley and basil
- Vine crops with radishes, oregano and nasturtiums

(Source: www.penpages.psu.edu/penpages and "Backyard Bounty", by Jan Riggenschach)

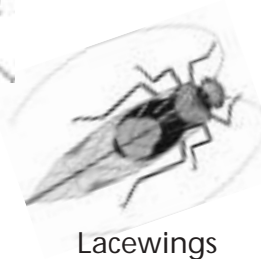
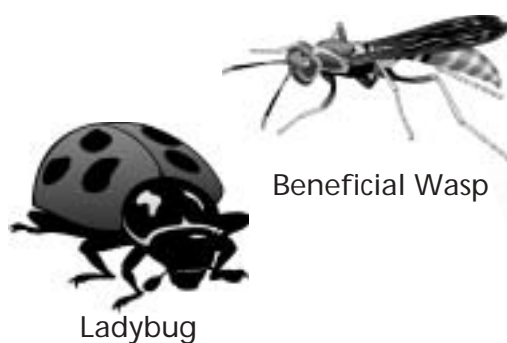
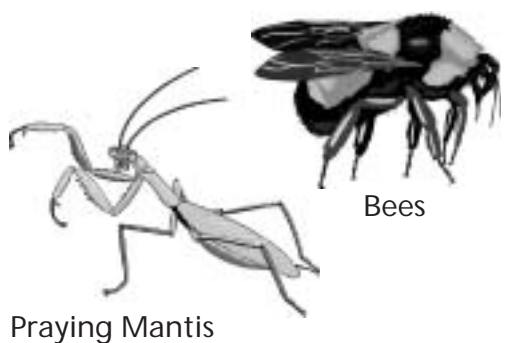


Biological Control: Beneficial insects can be purchased and released to control many home garden pests. However, if prey or habitat is not suitable, the released beneficial insects may venture off your property in a short time. The best approach is to encourage and conserve natural populations of beneficial insects. This can be done by avoiding or minimizing application of chemical insecticides, and planting flowering plants that attract beneficial insects to the garden. Beneficial insects fall into two groups — parasites and predators. Parasites live on or in the bodies of insects. Predators capture and devour insects. A number of biological agents are also available for pest control (for example, *Bacillus thuringiensis* (B.t.), milky spores, growth regulators).

Information adapted from "Integrated Pest Management," Master Gardener Fact Sheet by Norma Samuel, County Extension Agent - Horticulture, Sumter County and Dr. Goeff Zhender, Clemson Extension IPM Specialist (03/12/02) and the Seattle Natural Pest, Weed & Disease Control publication.

TABLE 1: Plants and the Beneficial Insects They Attract

Plant	Beneficial Insects Attracted	Pest(s) Repelled
Anise (<i>Pimpinella anisum</i>)	Ladybugs, parasitic mini-wasps, tachinid flies	
Basket-of-Gold (<i>Aurinia saxatilis</i>)	Ladybugs, hoverflies	
Bee balm (<i>Monarda spp.</i>)	Bees, parasitic mini-wasps, beneficial flies	
Chives	---	Aphids
Coreopsis (<i>Coreopsis tinctoria</i>)	Spined soldier bugs, hoverflies, tachinid flies	
Cosmos (<i>Cosmos bipinnatus</i>)	Parasitic mini-wasps, hoverflies, tachinid flies, bees	
Dahlia	---	Nematodes
Dill (<i>Anethum graveolens</i>)	Lacewings, hoverflies, ladybugs, parasitic mini-wasps, tachinid flies	
Fennel (<i>Foeniculum vulgare</i>)	Lacewings, hoverflies, ladybugs, parasitic mini-wasps, tachinid flies	
Feverfew (<i>Tanacetum parthenium</i>)	Hoverflies	
Garlic	---	Aphids, borers, Japanese beetles, mites
Golden Marguerite (<i>Anthemis tinctoria</i>)	Lacewings, ladybugs, hoverflies, parasitic mini-wasps, tachinid flies	
Lovage (<i>Levisticum officinale</i>)	Beneficial wasps, ground beetles	
Marigolds	---	Nematodes, tomato hornworms, cucumber beetles
Painted daisy (<i>Chrysanthemum coccineum</i>)		Tachinid flies, parasitic mini-wasps
Pennyroyal	---	Ants
Rosemary	---	Slugs
Salvia	---	Nematodes
Sweet alyssum (<i>Lobularia maritima</i>)	Hoverflies	
Tansy (<i>Tanacetum vulgare</i>)	Ladybugs, predatory wasps, many other beneficials	Ants, cucumber beetles, squash bugs, cutworms, Japanese beetles
Yarrow (<i>Achillea spp.</i>)	Lacewings, hoverflies, ladybugs, parasitic mini-wasps	
Zinnia (<i>Zinnia elegans</i>)	Ladybugs, parasitic mini-wasps, bees	



Repellents

A variety of homemade and commercial preparations can be used to keep pests away from plants. Many gardeners claim repellents work, although some are not consistently effective in scientific trials.

A mixture of **raw eggs blended with water** produces a taste and odor that offend deer; some gardeners add garlic and hot pepper. Spraying this mix onto plant foliage can repel deer for several weeks, or until it is washed off by rain or sprinklers.

Garlic oil and extracts are used to repel a variety of insect pests, and also work as fungicides.

Meet the Beneficials!

Spraying any pesticide may kill more beneficials than pests. Think twice before you spray.



Ground beetles eat slug eggs and babies, plus other soil-dwelling pests.



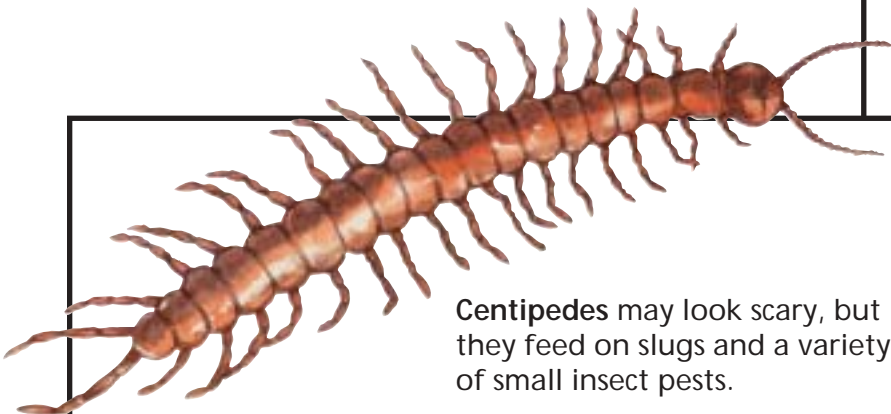
Lacewings and their alligator-like larvae eat aphids, scales, mites, caterpillars and other pests.



Ladybird beetle larvae and adults feed on soft-bodied insects such as aphids, mealybugs, scale insects and spider mites, as well as insect eggs.



Hornets and yellow jackets are effective predators of many garden pests. However, controls may be necessary if they pose a threat to people or pets.



Centipedes may look scary, but they feed on slugs and a variety of small insect pests.

What to Do If a Pest Problem Develops



Washing Aphids from underside of leaf



Copper slug barrier



Protecting a crop with a floating row cover

Use Physical Controls First

Many pests can be kept away from plants with barriers or traps, or controlled by simply removing infested plant parts. These controls generally have no adverse impact on beneficial garden life, people or the environment.

Removal

Pests and diseased plant parts can be picked, washed or vacuumed off plants to control infestations. In fact, pulling weeds is a natural pest control!

Handpicking can be effective for large pests like cabbage loopers, tomato hornworms, slugs and snails.

Pruning out infestations of tent caterpillars is effective on a small scale. Control leaf miners on beets or chard by picking infected leaves. Put infestations in curbside yard waste collection containers—not in home compost piles, which do not get hot enough to destroy pests.

Washing aphids off plants with a strong spray of water from a hose can reduce damage. Repeated washings may be required, as this process does not kill the aphids.

Traps

It is possible to trap enough pests like moths and slugs to keep them under control. You can also use traps for monitoring pest numbers to determine when controls may be necessary. Two simple and effective pest traps include:

Cardboard or burlap wrapped around apple tree trunks in summer and fall will fool codling moth larvae into thinking that they have found a safe place to spin their cocoons as they crawl down the tree to pupate. Traps can be peeled away periodically to remove cocoons.

Slug traps drown slugs in beer or in a mixture of yeast and water. An old pie pan filled with beer can quickly and easily drown many slugs.

Barriers

It is often practical to physically keep pests away from plants. Barriers range from two-inch cardboard “collars” around plants for keeping cutworms away to eight-foot fences for excluding deer.

Floating row covers are lightweight fabrics that let light, air and water reach plants, while keeping pests away—they are useful for providing a barrier to pest and vegetables.

Mesh netting keeps birds away from berries and small fruit trees.

A band of sticky material around tree trunks stops ants from climbing trees and introducing disease-carrying aphids.

Use Least-Toxic Pesticides When Physical Controls Don't Work

The pesticides listed below have a low toxicity or break down quickly into safe by-products when exposed to sunlight or the soil. They are the least likely to have adverse effects. However, even these pesticides can be toxic to beneficial garden life, people, pets and other animals—especially fish. They should be used carefully and kept out of streams, and lakes.

Soaps, Oils and Minerals

● **Horticultural oils** smother mites, aphids and their eggs, scales, leaf miners, mealybugs and many other pests; they have little effect on most beneficial insects.

● **Horticultural soaps** dry out aphids, white flies, earwigs and other soft-bodied insects. They must be sprayed directly onto the pests to work, so repeated applications may be necessary. There are also soap-based fungicides and herbicides.

● **Sulfur** controls many fungal diseases such as scab, rust, leaf curl and powdery mildew without harming most animals and beneficials. For greater effectiveness, sulfur can be mixed with lime. Sulfur is also frequently combined with other materials to create more toxic fungicides.

● **Baking soda** (one teaspoon) mixed with dishwashing liquid (a few drops) and water (one quart) has been used by rose growers to prevent mildew. A commercial product is also available that contains potassium bicarbonate, which is similar to baking soda.

● **Iron phosphate slug baits** are less toxic than other slug baits and not as hazardous to dogs.

Botanicals

These plant-derived insecticides degrade quickly in the sun or soil. However, most are initially toxic to people, animals, fish and beneficial garden life. Use cautiously and follow label directions closely, just as when applying synthetic pesticides.

● **Neem oil** kills and disrupts feeding and mating of many insects, including some beneficials. Also an effective fungicide, neem oil is the botanical that is least toxic to people, animals, birds and fish.

● **Pyrethrum, ryania and sabadilla** kill many tough pests, but are also toxic to beneficial insects, people, fish and other animals. These pesticides should only be used as a last resort.

Biocontrols

● ***Bacillus thuringiensis* (Bt)** is a common, commercially available bacterium that poisons caterpillar pests, including cutworms, armyworms, tent caterpillars, cabbage loopers and corn earworms. Bt is not toxic to people, animals, fish or insects—although it can kill caterpillars of non-pest butterflies and moths.

● **Predatory nematodes** kill a wide variety of pests, including cutworms, armyworms, root maggots, crane fly larvae, root weevil larvae and other soil-dwelling pests. Proper soil temperature and moisture are required for nematodes to be effective.

● ***Beauveria bassiana*** is a commercially available fungus that destroys an extensive range of pest insects.

● **Beneficial insects** like ladybugs and lacewings can be purchased and released. A healthy and diverse garden will usually have lots of them around already.

● **Compost teas** use compost organisms to help control leaf and root diseases. They are sometimes effective, and they won't harm any beneficial organisms. Call the Home and Garden Information Center Hotline at 1-888-656-9988.



Use Synthetic Pesticides Only As a Last Resort

When physical and least-toxic controls fail to control a pest, other pesticides may be used as a final resort. But first, consider your pest problem. Is it the result of poor plant placement? Is it likely to recur after pesticide treatment? Keep in mind that scientists have found pesticides — including commonly used insecticides - in local streams, some at high enough levels to harm fish and what they eat.

- Don't use services that spray insecticides or herbicides on a prescheduled plan. Preventive sprays can disrupt natural controls, and may do more harm than good. Fungicides are an exception because they only work when applied prior to the appearance of the problem — use the least toxic fungicides only on plants which have been infected in previous years.
- Look for the least toxic pesticide. Ask nursery staff for help identifying the least toxic pesticides for your pest problem. Refer to <http://hgic.clemson.edu> for publications on pesticide use and safety. Avoid products with warnings like "highly toxic," "causes permanent eye damage," or "may be fatal if swallowed." Choose "ready-to-use" products which are safer to use, instead of more toxic concentrates which require mixing.
- Don't use broad-spectrum insecticides like diazinon, chlorpyrifos (Dursban), malathion and carbaryl. These are likely to kill more of the pests' natural enemies than the pests themselves." adding the apostrophe after pests and add the word themselves. Pest populations may soar and become more of a problem than before they were sprayed.
- Avoid "weed and feed" and other pesticides that are broadcast over the entire yard. Instead, spot apply the least toxic product only where you have a pest or weed.
- Buy only as much as you need. Unused pesticides are dangerous to store or dispose of, and expensive for local governments to dispose of.
- Read and follow label directions carefully. Only use pesticides on the plants and pests listed on the label, and apply exactly according to label directions. Be sure to wear specified protective clothing and equipment, and keep children and pets off application areas for the time specified on the label.
- Apply only when and where pests are present. Timing is critical with all pest controls. Most pesticides should not be used as a preventive measure, except for fungicidal tree sprays.
- Dispose of empty pesticide containers properly. Empty containers should be disposed of in your garbage. Dispose of unused pesticides at household hazardous waste disposal sites. (Note: Charleston County, (843) 720-7111; Horry County, (843) 347-1651; York County, (803) 628-3195 have permanent disposal options available).



What About Weeds?

A “weed” is simply a plant in the wrong place. Some weeds compete with desirable plants, but many are merely aesthetic concerns. For instance, white clover is often considered a weed in lawns, yet it stays green when dry conditions turn lawns brown, and its roots support bacteria that transform nitrogen from the air into plant fertilizer. So clover feeds your lawn every time you mow!

- **Accept a few weeds in your lawn.** Target the problem weeds, and leave the others. Many people who see a lawn with 10-20 percent weed cover consider it healthy and good looking.
- **Prevention: don't give weeds a chance.** Weeds thrive in bare soil and neglected garden areas. Plant spreading ground cover to outcompete weeds, or smother them with weed barriers and lots of mulch.
- **Physical control: be a control freak with problem weeds.** A single weed flower can produce thousands of seeds. To prevent future infestations, remove weeds before they go to seed. Cultivating with a hoe works well on young or shallow-rooted weeds in garden beds or paths. Long-handled pincer-type weed pullers work great for weeds with taproots like dandelion and thistle, especially in lawns when soil is moist.



The almost lost art of hand weeding



Using a weed puller

● **Least toxic controls: corn, soap or vinegar?** Herbicides with low toxicity to beneficial garden life, people and wildlife include corn gluten (a milling by-product which is used as animal feed), herbicidal soaps, and vinegar (acetic acid). Corn gluten prevents the growth of weed seedlings, but actually fertilizes established plants. It is sold under several brand names. Corn gluten's effect is short-lived, so applications must be timed to coincide with seed germination. Herbicidal soaps and vinegar both damage leaf cells and dry out plants. Tough weeds resist these herbicides or resprout from roots. Some concentrated vinegar products can cause permanent damage if accidentally splashed into the eyes. Ready-to-use dilutions are safer.

● **The last resort: spot apply synthetic herbicides.** When extreme weed problems call for treatment with synthetic chemical herbicides, carefully apply them (only as directed on the label) directly onto weed leaves. Do not use "weed and feed" or pre-emergent products, because when it is time to weed, it is not time to feed. Therefore, a product is being used unnecessarily which spreads toxic herbicides all over lawns or gardens and is likely to run off into streams. If you are applying an herbicide on a regular basis, there is probably a landscape design or soil problem that needs to be addressed.



Spot apply the least toxic herbicide



Spreading mulch to prevent weeds

Natural Pest Control Resources

Contact your local Clemson Extension Office listed in your telephone book or on their Web site (<http://clemson.edu/extension>) to ask a question or to request pest control information. Community groups, garden clubs and landscape professionals also can request a presentation to learn more about natural pest management methods. You can also visit <http://hgic.clemson.edu>, to see pest management publications online.

Books For Gardeners

- *Month by Month, Gardening in the Carolinas* by Robert Polomski, offers expert advice on what should be done in the garden and the correct time to do it.
- *Southern Living Garden Problem Solvers*, Steve Bender, editor, has photos and descriptions of many common insect and disease problems in the southeast.

Clemson County Cooperative Extension Resources and Services

- Master Gardener Clinics. Master Gardener volunteers are available to answer questions and diagnose problems over the phone or at clinics held regularly throughout South Carolina. For phone help and clinic locations, call your local Clemson County Extension office, 8 a.m. to 4:30 p.m.
- View Cooperative Extension publications on horticulture and pest management online at <http://hgic.clemson.edu>.
- Watch "*Making it Grow*" and "*From the Ground Up*" on South Carolina ETV, a common sense approach to gardening.
- Publications. For a small charge order many bulletins on growing plants and managing pests at your local Clemson Extension office. Landscape professionals and home owners can purchase the *Pest Management Handbook* from a local Clemson Extension Office.

Pesticide Disposal and Emergencies

- Poison Control. In case of pesticide poisoning, call (800) 222-1222, or just call 911.
- Household Hazardous Materials. For information and locations, call the Recycling hot line at 1-800-768-7348 or 1-888-656-9988, the Clemson Home & Garden hot line.



Photographs by Joanne Jewell & Carl Woestwin