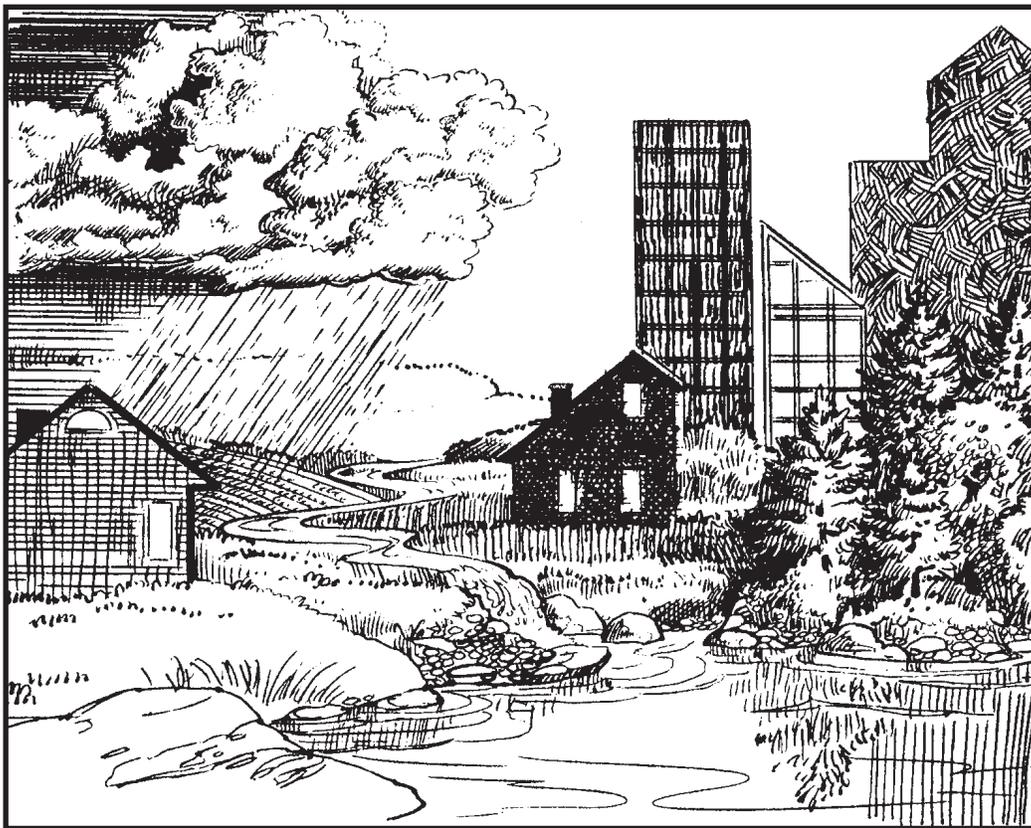




The Virginia Gardener Guide to Pest Management for Water Quality

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Understanding the Pesticide Label Will Help Reduce Environmental Problems

Research has shown that consumers find reading and understanding the label to be the most difficult aspect of applying pesticides. However, an understanding of the label information is essential before work begins. The label printed on or attached to a container of pesticide tells how to use it correctly and warns of any environmental or health safety measures to take. Read the label when you purchase a pesticide and again before mixing or applying it. If you are confused about any part of the label, consult your Extension agent or a representative of the company that makes the product. Many pesticides now list a toll-free number for consumers. The label includes specific information that you should be aware of and learn to understand.

The **brand name** is used on the front of the label to identify the company's product. **Type of formulation** identifies the way the pesticide in that container is formulated for application, such as wettable powder, dust, or ready-to-use. **Ingredient statement** lists the names and amounts of the active ingredients and the amount of inert ingredients. Comparing the cost per unit of active ingredient on different brands and formulations can save money, but don't buy more than you need just to reduce cost-per-unit; you may end up creating serious disposal problems. Pesticides have complex **chemical names** derived from their chemical composition; some also have a common name which makes them easier to identify. The same pesticide may be sold under several brand names, but either the common or chemical name will be on all of them. The **net contents** tell how much is in the container.

The law also requires the maker or distributor of a product to print the name and address of the company. A **registration number** shows that the product has been approved by the E.P.A. for the uses listed on the label, and an **establishment number** tells which factory made the chemical.

The label also includes several precautionary statements. A section with a title similar to **hazards to humans and domestic animals** tells ways in which the product may be poisonous to man and animals. It also describes any special steps necessary to avoid poisoning by highly toxic products; physicians are informed of proper treatment.

The **signal word and symbol** on the label tell how toxic a product is. Signal words to look for are **danger** along with the word **poison** and either the **skull and crossbones symbol** (highly toxic), the word **warning** (moderately toxic), or the word **caution** (slightly toxic).

If swallowing or inhaling the product or getting it in the eyes or on the skin would be harmful, the label contains **emergency first aid measures** and states types of exposure requiring medical attention. The pesticide label is the most important information you can take to the physician when someone has been poisoned. Without the label, it may be difficult for the physician to help.

The label tells how to avoid **damage to the environment**. Some examples are: "This product is highly toxic to bees exposed to direct treatment or residues on crops"; "Do not contaminate water when cleaning equipment or when disposing of wastes"; and "Do not apply where run-off is likely to occur."

Physical and chemical hazards are listed and include specific fire, explosion, and chemical hazards that the product may have.

The **directions for use** includes the pests the product controls; the crops, animals, or other items the product can be used on safely; how the product should be applied; how much to use; and where and when the product should be applied. This is often the most difficult part of the label to follow and, therefore, needs special attention.

Application to harvest specifies the amount of time that must pass from the time of application until it is safe to pick and use a food crop. Expressed as "days to harvest," this is the time required for the residue to drop to safe levels. It is often listed as a number in parentheses following the crop name. It is a mistake to assume that a residue can be washed off. The misuse statement reminds you that it is a violation of Federal law to use a product in a manner inconsistent with its labeling.

Storage and disposal directions must be followed for environmental and human safety.

Selecting Plants to Avoid Pest Problems

To protect water quality, you can reduce garden and landscape maintenance and the amount of pesticides you need by making wise choices of plant materials. Start by selecting plants that are suited to your area, including native plants. To maintain healthy plants with few pest problems, look for insect- and disease-resistant varieties.

At purchase time:

- Select plants that are sturdy and have well-developed root systems.
- Buy plants from a reputable grower who can assure you that they are disease- and insect-free, or grow your own from seed.
- Avoid accepting plants from friends if there is any chance they have insects or disease.

Native or naturalized plants usually are more tolerant of local environmental conditions and pests, ensuring better performance with less care. Beware—some native trees can also be problem trees, having either messy fruit (mulberry), troublesome root systems (willows), or high susceptibility to pests (black locust).

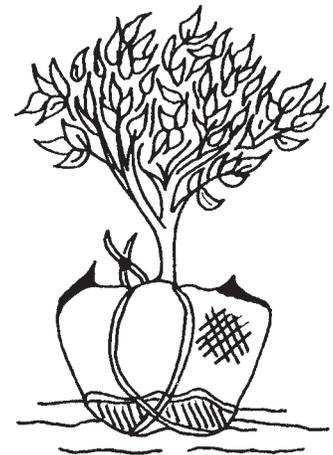
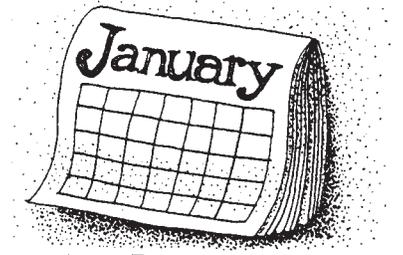
Fruit trees, including those grown for flowers, such as Kwanzan cherry, are often subject to diseases and Japanese beetle infestation. Management of fruit trees with pesticides requires a genuine commitment of time and resources; do not try to get into this halfway.

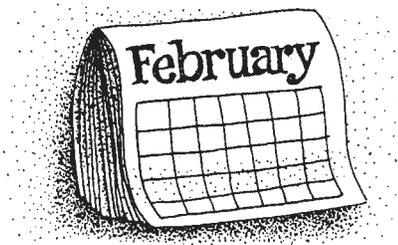
Disease-resistant varieties are plants that have been developed to resist a specific disease. A resistant variety is not resistant to all diseases, but only to those for which it has been developed. Disease resistance does not mean that the plant will not get the disease, but the disease will at least be less severe than for susceptible varieties.

Using disease-resistant varieties of vegetables not only makes gardening easier, but also reduces the expense and potential for pollution with pesticides. Although many non-toxic materials are used to control vegetable diseases, it is best to avoid all pesticide use if possible by selecting disease-resistant varieties. Seed catalogs and Virginia Cooperative Extension Publication 426-480, *Vegetables Recommended for Virginia*, indicate which varieties are resistant to various diseases. Watch for disease-resistant varieties when you order seed.

Insect-resistant plants are bred to resist or repel insects by physical or biochemical means. An insect-resistant plant can physically deter insects from extracting plant juices, for example, by the composition of its leaf hairs. Another instance of physical deterrence would be a stem structure that is incompatible with a particular insect's breeding habits (egg laying).

A plant possessing biochemical insect-resistant properties will contain plant sap or toxins that are unappealing to the insect, possibly causing the insect to become sick. The plant sap could also be nutritionally incomplete for the insect, leaving the insect unable to complete its life cycle.





New Developments in Biological Control

In the search for alternatives to traditional pesticides, much research has been focused on biological or naturally occurring controls, such as predators and parasites, to suppress pest populations. Research has brought recent advancements in such areas as insect-growth regulators (hormones), highly specific sexual attractants (pheromones), as well as a renewed interest in the study of allelopathy, the chemical reaction between plants.

Insect-growth regulators, under normal conditions, control the growth and development in insects from one stage to the next; however, excess amounts of these same materials are able to interfere with normal embryonic and larval development, alter metamorphosis, prevent molting, reduce reproductive ability, and inhibit chitin (exoskeleton) development. A major benefit of insect-growth regulators is that they usually are harmless to vertebrates and plants.

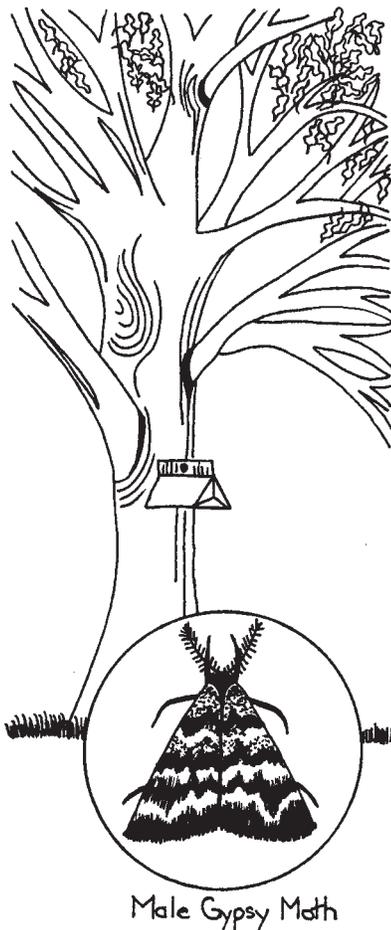
In another area of research, insect pheromones are being utilized to help control certain pests by disruption of mating. In this process enough pheromone is released into the environment so that a male is unable to successfully locate a pheromone odor trail emitted by a calling female. Artificial pheromones have been developed for a large number of insect pests and can be used in traps to monitor the presence of certain unwanted insects in an area, allowing for more effective use of insecticides. This technique has been used successfully for several fruit pests as well as the gypsy moth. Artificial pheromones are virtually non-toxic and pose no problem with their chemical breakdown in the environment.

In many plants there are natural growth regulators which can affect other nearby plants. Allelopathy, the natural chemical inhibition of the germination or growth of another plant, is a complex phenomenon. Scientists have been studying it since the 1880s, and now feel that it occurs frequently, though only severe interactions, such as those between tomatoes and black walnuts, are easily noticed. Competition for light or moisture can obscure milder occurrences of allelopathy.

Allelopathic chemicals transfer to other plants in several ways. In arid regions, volatilization of active compounds from leaf surfaces may occur, with the resulting aerosol condensing on other plants. This can be highly effective in inhibiting the development of competing plants. Several species of weed seedlings, including purslane, ragweed, and crabgrass, exude allelopathic compounds. These compounds diffuse through moist soil, to the detriment of vegetable seeds sown nearby.

Researchers are investigating the possibilities of breeding crops and ornamental plants that are allelopathic to common weeds. Already, we know that sunflowers suppress weeds and that some varieties of cucumbers and oats reduce weed growth.

Gardeners have long taken advantage of the allelopathic nature of barley, rye, sorghum, and wheat when they grow these cover crops to produce green manure. Research has shown that these crops produce chemicals toxic to many weeds, accounting for much of the observed weed reduction. These allelopathic chemicals are one reason gardeners should wait several weeks after incorporating cover crop stubble into the soil before sowing seed.



Attracting Bug-eaters

Not all birds and insects are unwanted pests in your yard and garden. Among them, voracious bug-eaters abound. Increasing these garden friends will reduce the need for pesticides and protect the quality of our water.

When attracting and maintaining populations of beneficial birds and insects, it's important to minimize use of pesticides. Provide appropriate conditions of food, shelter, nesting material, and water to encourage insect-eating birds. In rural areas, chickens, guineas, and other domestic fowl can be allowed to eat grubs and insects in the garden.

- Plant bushes and trees which bear edible fruits. Provide seed in feeders throughout the year. Add a birdbath to your garden.
- Install birdhouses designed for beneficial species. Consult your local Extension office for publications on attracting birds to your garden and for birdhouse plans.
- Use alternative ground covers instead of lawn grasses, and don't rake the area clean. The leaves which will build up under the ground cover plants provide an excellent hunting ground for birds that feed on worms and insects. Don't rake the area under shrubs clean for the same reason.
- Vary vegetation heights to accommodate birds with different feeding and nesting level preferences.
- Drive stakes in and around your garden, leaving 3 to 5 feet above ground level, to serve as perches for flying insect predators like phoebes.

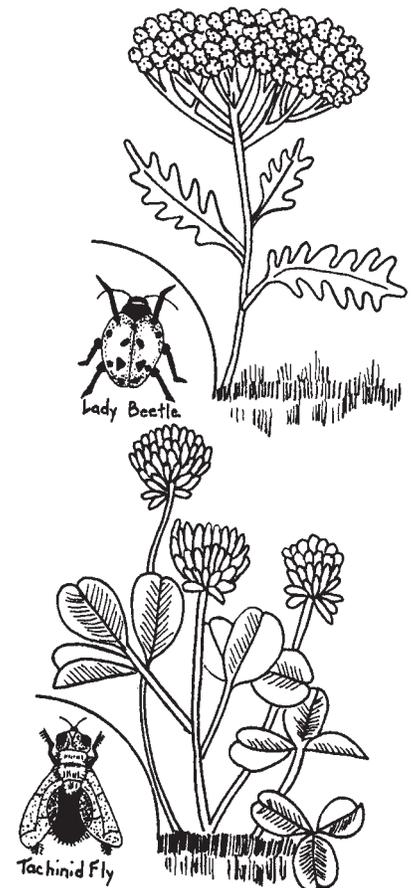
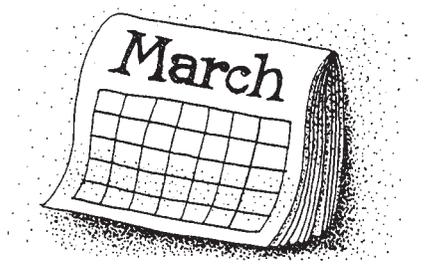
Beneficial Insects for Your Garden

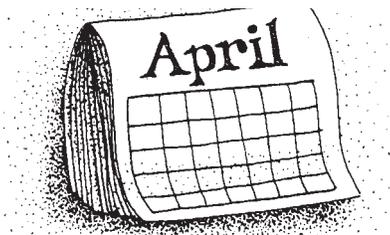
By sustaining a population of beneficial insects, you achieve a natural pest maintenance program in your garden. Tiny parasitic wasps are aggressive beyond their size when it comes to pursuing aphids and caterpillars. Lacewing larvae and ladybug larvae and adults make inroads on aphid populations. Ground beetles prey on a variety of ground-dwelling pests.

These various beneficial insects consume large numbers of pest insects, but their diets are not limited to other insects. In fact, many of the beneficial species have periods in their life cycles during which they survive only on nectar and pollen. Therefore, a little planning for insects can pay off. Planting a variety of insectary plants will ensure an adequate supply of nutrients to keep beneficial insects going strong. Insectary plants also include those which provide shelter for beneficial insects, another critical requirement.

Additional Bug-eaters

Many people object to spiders in their garden, but in fact, they are one more asset in the control of pests in the garden. Toads and frogs should be encouraged, and bats can be better than an arsenal of pesticides. Install a bat house to control mosquitoes and other night flying insects. Six to eight bats will consume 10,000 flying insects each night. If you have a pond for water plants, maintain a collection of goldfish or frogs to devour mosquito larvae.





Impact of the Environment on Pesticides

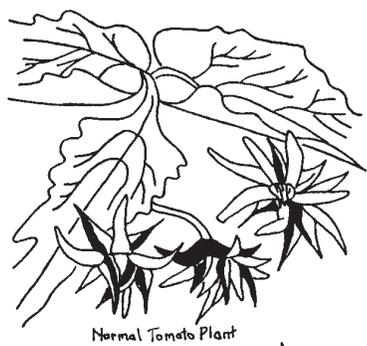
Before you apply pesticides, be aware that weather conditions and time of day influence application and effectiveness of the spray. Applications under optimum conditions will result in greater control with a minimum amount of chemical. Application under adverse conditions may require higher rates or multiple treatments, increasing the chemical load in the environment and adding to water pollution.

Wind

Wind can cause spray droplets to drift to adjacent, nontreatment areas. For herbicides, spray drift can result in uneven weed control, with the potential for injury to nontarget plants. For the homeowner, risk of injury to nontarget plants from spray drift is greatest for the post-emergence turf broadleaf herbicides, such as 2,4-D, and for the non-selective herbicide glyphosate. Avoid herbicide applications under windy conditions. Often early morning and late afternoon hours have the least amount of wind. Spray drift from pesticides intended only for ornamentals could contaminate food crops. Avoid drift into streams and ponds. Pesticide run-off into these areas could be damaging not only to fish, wildlife, and water plants, but to the surrounding environment, as it pollutes the water.

Rainfall

Rain within a few hours of application may reduce the effectiveness of insecticides and post-emergence herbicides, especially ones that are slowly absorbed, such as glyphosate. Rain after application is generally beneficial for pre-emergent herbicides. Excessive rain can cause leaching of some insecticides and pesticides, with the potential for movement into groundwater. This risk is greater in sandy soils than clay soils. Excessive rain can also cause surface run-off, moving soil particles from treated areas. Pesticides may be bound to soil particles and thus carried to ponds, streams, or rivers. Avoid pesticide application when there is a potential for heavy showers that may cause run-off or deep leaching. If it does rain within 24 hours after you have applied a pesticide, do not re-apply. Monitor the plant for several days or weeks, depending on the pest, to see if the pesticide will be effective. If it's a food crop, you could be consuming food with a much greater pesticide residue than normal if a second application is made. Read the pesticide label to determine if a second application can be made once the first application has failed to control the pest. Check the weather report before spraying so you're not faced with this situation.



Normal Tomato Plant



Tomato Plant with Herbicide Injury

Temperature

Most pesticides are more effective when applied under warm conditions (greater than 50° F). Applications at lower temperatures may result in poor pest control. Although many pesticides are relatively nonvolatile, pesticide breakdown or degradation by microorganisms in the soil is generally greatest under warm, moist conditions. However, some herbicides, such as ester formulations of 2,4-D, may move as a gas under high temperatures. Avoid applications of volatile herbicides during excessively high temperatures. Read the pesticide label for temperature warnings.

Relative Humidity

Pre-emergent herbicides and other pesticides are generally not affected by the humidity level present at application. Post-emergent herbicides generally work best under high temperature and high relative humidity. Applications to plants under drought stress conditions of high temperature, low relative humidity, and low soil moisture may result in poor control. Other forms of pesticides can be significantly influenced by relative humidity. Read the pesticide label for relative humidity warnings.

Selecting the Right Package: Pesticide Formulations and Quantity

The formulation describes the physical state of a pesticide and determines how it will be applied. The chemical in the pesticide formulation that actually kills the pest(s) is termed the active ingredient. Inert ingredients are added to make the product easy and safe to mix or apply.

Formulations that require mixing and special equipment are concentrates that require mixing with water to form a dilute spray which is applied to the plants. They are less expensive if a large area is to be treated. But due to their concentrated form and mixing requirements, they require more handling and escalate the risk of spray drift. If left unused, they may also increase environmental risk due to storage and disposal problems. These formulations include:

Emulsifiable concentrates (EC or E): active ingredient mixed with an oil base

Flowables (F or L): active ingredients in a liquid

Wettable powders (WP or W): active ingredient attached to a fine powder that requires continuous agitation to remain mixed with water

Soluble powders (SP): active ingredient in powder form that dissolves in water

Formulations that are ready to use (proper dilution) as they are purchased include:

Solutions (S): in spray bottles

Aerosols (A): for a fine spray or mist

Dusts (D): active ingredients attached to a fine inert powder, used dry

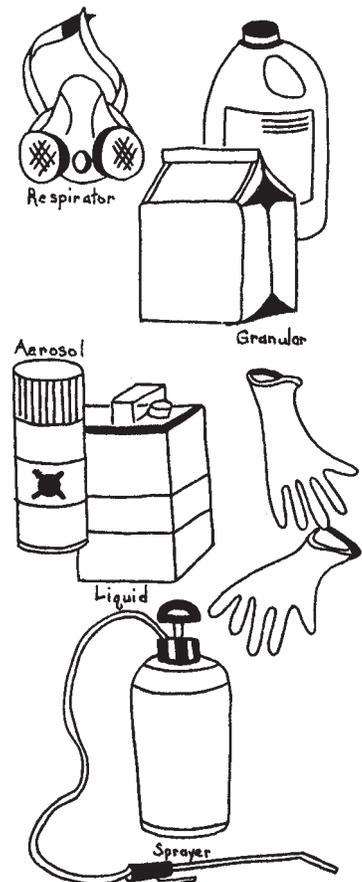
Granules (G): active ingredient attached to coarse particles of inert material

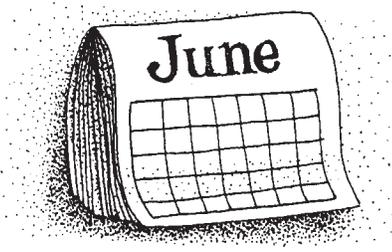
Baits (B): active ingredient attached to an edible substance attractive to pests

Use pesticides that are packaged specifically for home garden and landscape. These products are packaged in small quantities, i.e., pints, quarts, ounces, or pounds; are seldom highly toxic; and are usually in low concentrations. The label rate is given in spoonfuls per gallon or pounds per 1000 square feet.

Products packaged for the commercial grower may be less expensive per unit of active ingredient, but homeowners should not attempt to use them. They are generally more toxic than those for home use, require special protective clothing and equipment for application, are more concentrated, and come in larger containers than the homeowner could expect to use or safely store. They are more difficult to mix since rates are usually based on a per-acre application.

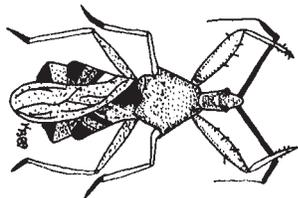
Try to buy only the amount of pesticide you can use in one season. If you do buy more than you can use in a season, store chemicals in a cool (60 to 70° F), dry, secure location. The location should be fireproofed; well ventilated; well lighted for use, dark when not being used; away from feed, seed, and fertilizers; and maintained at a temperature between 32 and 90° F. Store herbicides separately. All pesticides should be stored away from sinks or floor drains that allow access to the water system because accidental breakage of a bottle containing pesticides can seriously affect water quality. These chemicals should be locked up and out of reach of children, pets, and unauthorized persons to avoid possible poisoning!





Beneficial Insects

Naturally occurring predators and parasites are found in gardens, orchards, and fields. Learn to properly identify these species as the benefits of your environment. Avoid using pesticides around them. They are as susceptible to insecticides as pests.



Assassin bug

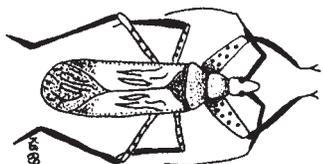
Assassin bug *Reduviidae* - The assassin bug feeds mainly on aphids, caterpillars, Colorado potato beetles, Japanese beetles, leafhoppers, and Mexican bean beetles.

Damsel bug *Nabidae* - The damsel bug feeds on aphids, leafhoppers, mites, and caterpillars.

Big-eyed bugs *Lygaeidae* - Big-eyed bugs feed on aphids, caterpillar eggs and larvae, immature bugs, leafhoppers, and spider mites.

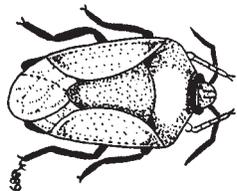
Predacious stink bug *Pentatomidae* - Predacious stink bugs feed on Colorado potato beetles and various caterpillar larvae.

Syrphid fly larvae *Syrphidae* - Fly larvae of this species feed on aphids and mealybugs.



Damsel bug

Some naturally occurring beneficial insects can also be ordered from insectaries. A variety of insects are available to help control the insect pests in your garden. This method, known as augmentation or colonization of natural enemy populations, depends on knowing the pest's life cycle to permit well-timed releases of natural enemies. The more of a generalist the natural enemy is in its feeding or host acceptance behavior (such as lady beetles), the less knowledge is required for successful establishment. However, keep in mind that while beneficial insects will enhance the control of the pests, they are not a quick fix to eradicate a pest. Predators and parasitoids that are available from insectaries include:



Predacious stink bug

Lady beetles *Hippodamia convergens* - The lady beetle feeds mainly on aphids and other soft-bodied insects, such as mealybugs and spider mites.

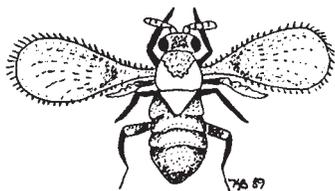
Green lacewings *Chrysopa carnea* - Lacewing larvae, known as aphid lions, feed on insect eggs, aphids, spider mites, thrips, leafhopper nymphs, and small caterpillar larvae. Adult lacewings are not predacious.



Green lacewings

Predatory mites *Phytoseiulus persimilis* and several other species - Feed on many mite pests, including the two-spotted spider mite.

Trichogramma wasps *Trichogrammatidae* - This tiny wasp attacks eggs of more than 200 pest species, including cutworms, corn borers, corn earworms, armyworms, codling moths, and cabbage moths. Release time is critical for their effectiveness since they only attack pest eggs.

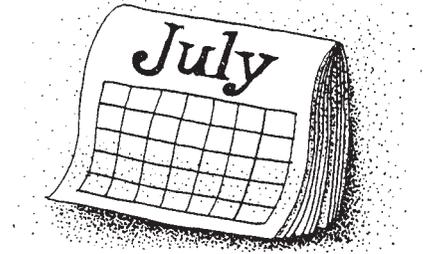


Trichogramma wasps

Encarsia formosa *Encyrtidae* - The greenhouse whitefly is parasitized by this wasp in third and fourth larval instars when Encarsia lay their eggs inside the whitefly scale.

Cultural Practices to Minimize Pests in the Vegetable Garden

Start by selecting varieties that are insect and disease resistant and locally adapted. Plant warm-weather crops after the soil has warmed to avoid problems with seed and root rots. Avoid planting the same kind of crop in the same place each year. Use related crops in one site once every three or four years. Thin young plants to proper spacing. Overcrowding causes weak growth and subsequent insect and disease problems.



Water in the morning so that plants have time to dry before the cool evening. Drip irrigation prevents the foliage from getting wet. For plants susceptible to fungus infections, leave extra space between plants to allow good air flow and orient rows so that prevailing winds will help foliage dry quickly after a rain or watering. To prevent spreading diseases, stay out of the garden when the plants are wet with rain or dew.

Stake plants or plant them in wire cages to prevent the fruit from touching the soil and rotting. Caging helps reduce sunscald often seen in staked tomatoes; since caged plants do not require as much pruning, a heavier foliage cover can act as a sunscreen. Boards or a light, open mulch, such as straw, placed beneath melons will prevent rotting. Use a mulch to reduce soil splash, which brings soil-borne diseases into contact with lower leaves.

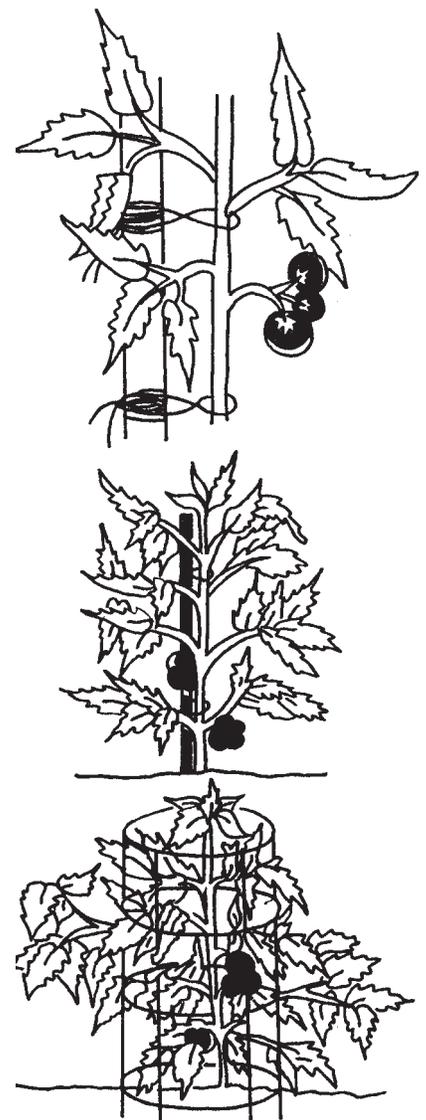
Mulch to keep down weeds and grass, which often harbor pests and compete for nutrients and water. Use your dried grass clippings as a mulch. Drying the clippings from your lawn keeps them from packing down, fermenting, and smelling. If your lawn contains grasses that spread from runners (Bermuda grass, centipede, etc.), spread layers of newspaper or cardboard before mulching to reduce rerooting. Do not use clippings from lawns treated with herbicides.

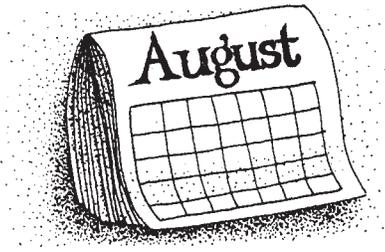
Do not use tobacco products, such as cigarettes or cigars, when working in the garden. Tomato, pepper, and eggplant are susceptible to a mosaic virus disease common in tobacco.

Remove infected leaves from diseased plants as soon as you observe them. Dispose of severely diseased plants before they contaminate others. Clean up crop refuse as soon as harvesting is finished. Old sacks, baskets, decaying vegetables, and other debris, which may harbor insects and diseases, should be kept out of the garden.

Avoid injury to plants. Cuts, bruises, cracks, and insect damage are often the site for infection by disease-causing organisms. In cases where fruits are difficult to remove, such as cucumbers, watermelons, and peppers, cut them off instead of pulling them from the plant. If you cultivate your garden, avoid cutting into the plant roots.

The most effective and most important of all practices to minimize garden pests is to observe what is going on in the garden. Many serious disease or insect problems can be halted or slowed down early by the gardener who knows what to look for. Regular visits to the garden for the purpose of trouble-shooting will reduce the need for pesticides and improve the quality of our water.





Pest and Plant Life Cycles: How They Influence Control Measures

Scout your home landscape for insect and plant pests. Learn to distinguish the good guys from the bad. Before you apply control measures, be sure you properly identify the pest. Educate yourself about the pest, its life cycle, and feeding habits. Time your pesticide application to the most effective periods in the pest's life cycle or population development.

Timing of Control for Common Garden Insects

Scale - On outside ornamentals, use pesticides when scales are at the crawler stage during the growing season or use dormant oil in winter.

Whitefly - Whiteflies are susceptible to most control measures in the adult and nymph stage. Thoroughly coat the undersides of the leaves with a recommended insecticide where the whitefly eggs and nymphs are usually most prevalent. Since whiteflies produce many broods each year, repeat according to the pesticide label as eggs hatch (in 4 to 12 days) since most pesticides don't harm eggs.

Bagworm - Pesticides can be used in the first two weeks of June when the worm is small enough to be controlled (one-fourth inch or less, before it forms a bag). Pick off bagworms in fall, winter, and spring, and destroy.

Leafminer - Employ pest control measures on the immature pest after eggs hatch but before the leafminer starts to burrow into the leaves. It is difficult to control leafminers once they're in the leaf, since they are resistant to systemics. Once the insect emerges from the leaf as an adult (small fly, moth, or beetle), it can be controlled before it lays eggs.



Cucumber beetle - Appearing in early summer, these beetles spread bacterial wilt and squash mosaic disease, which can damage and possibly kill plants. One of these beetles should be enough warning to take the precaution of controlling this pest at once.



Timing of Herbicide Applications for Weed Control in Lawns

Crabgrass - Apply a recommended pre-emergent crabgrass herbicide in early spring prior to crabgrass germination. Use the flowering of forsythia as a guide for proper time to treat. For certain crabgrass preventers, a second application later in the year may be needed for season-long control.

Annual bluegrass - Apply a recommended pre-emergent herbicide in late August prior to annual bluegrass (*Poa annua*) germination.

Dandelion, plantain, buttercup, chickweed, henbit - Apply a recommended turf post-emergent broadleaf herbicide in October or November. Apply to actively growing weeds under good soil moisture conditions. Risk of injury to deciduous trees and shrubs is less at this time than during periods of active growth (April to June).

Vigorous Plants Are Less Susceptible to Pests

Follow general maintenance and cultural steps to keep your trees and shrubs healthy and prevent pest problems. This may reduce or eliminate the need for spraying, as healthy plants are less susceptible to insects and diseases.

Pruning

Pruning maintains plant health by eliminating dead, dying, or diseased wood. Any dying branch or stub can be the entry point or build-up chamber for insects or fungi that spread to other parts of the plant. When removing wood infected with a disease, such as a fungal canker or fire blight, make the cut in healthy wood beyond the point of infection. Sterilize blades with alcohol after pruning to prevent spread of disease. Clean and oil pruning tools regularly. Keep cutting edges sharp.

The development of a sound framework of branches will help prevent upper branches from shading out lower branches on the plant. It will prevent wounds from rubbing branches and will reduce potential for branch splitting due to ice or wind. Broad-leaved evergreen shrubs usually will benefit from an occasional thinning of foliage. This thinning will allow penetration of light and air throughout the shrub, resulting in even growth of the foliage.

Fertilizing

Fertilizers add elements essential for healthy growth. To ensure tree vigor, fertilize as required and maintain the optimum pH for the tree or shrub. Keep soils free of compaction so roots can get water and essential elements. A well-fertilized lawn provides adequate fertilizer for the trees it surrounds or borders. On mature trees and shrubs, maintain the existing growth without stimulating new growth by feeding every two to four years. Broadcast the desired fertilizer on the soil or turf surface under the trees and shrubs, and water it in. Spread the fertilizer, starting at the stem or trunk and extending an average of twice the radius of the crown, out beyond the drip line. Use 1 to 6 pounds of actual nitrogen (N) per 1000 square feet (10 to 60 pounds of 10-10-10) of root zone area for trees that have shown a need for fertilization. The best time to fertilize is in the fall when the leaves start to drop and plants are dormant, but before soil temperature drops below 45° F.

Watering

Watering correctly is vital for developing and maintaining a healthy landscape planting. Lack of water can cause a plant to wilt and ultimately die. Excessive water blocks the uptake of nutrients by roots and ultimately kills the roots. As a rule, plants are capable of withstanding moderate drought more easily than excessive water. For this reason, it is important to allow the soil to become fairly dry between waterings, then water thoroughly so soil is moist 6 to 8 inches deep.

Winterizing Trees and Shrubs

It is often necessary to give a little extra attention to plants in the fall to help them overwinter and start spring in peak condition. Avoid late-summer pruning or fertilizing that will stimulate new growth that cannot harden-off before frost. If autumn rains have been insufficient, give plants a deep soaking to supply water to the entire root system before the ground freezes. Mulch to reduce soil erosion and water loss. Remove snow that is collecting on branches by sweeping upward with a broom to lift snow. When the branches are frozen and brittle, avoid disturbing them until a warmer day.





Fall Cleanup Cuts Down on Next Year's Pests

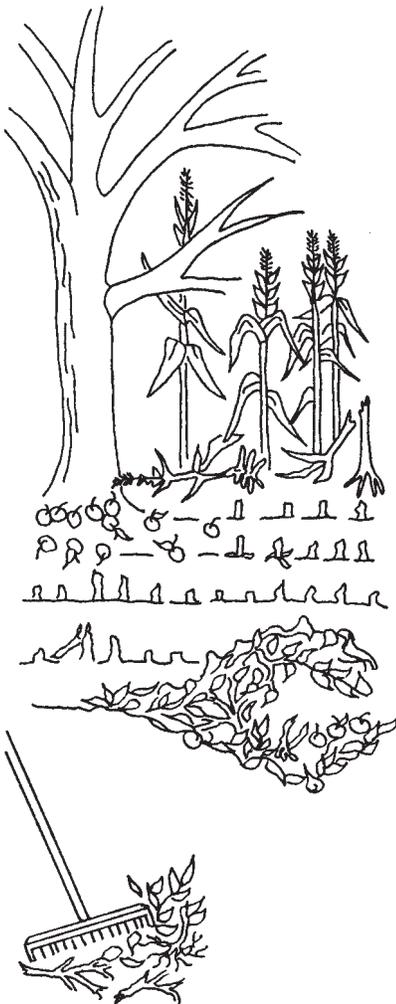
By the end of October, most Virginia gardeners are wrapping up the garden season. With a little extra care now, gardening can be easier and more rewarding in future seasons. Yard and garden cleanup at this time is important to prevent pest problems in the coming year, which means less pesticide use and cleaner water.

Preparing the Vegetable Garden for Winter

Remove all crop debris from the garden. Dead plants provide winter hiding places for insects and diseases, which can cause problems the following spring. Either till debris into the garden or put it on the compost heap. Plant material that is diseased should be disposed of or properly composted so that the temperature in the pile is high enough to kill disease organisms.

Fall plowing or tilling can benefit the garden in several ways. Besides mixing in organic matter to improve soil structure and fertility, it can also disrupt the life cycle of many insect pests, exposing larvae and pupae to winter cold. If a soil test indicates the need to apply lime or sulfur to alter soil pH, apply them to the garden before fall tilling. By spring, they will have corrected the pH problem. Plant a cover crop in the fall to reduce winter and spring weeds and to control soil erosion.

Do not apply fertilizer to the garden in the fall. Winter rains will leach most fall-applied nutrients from the soil, wasting your time and money. The nutrients that are washed away can cause problems where they are not needed, polluting groundwater or causing algal blooms in ponds, streams, and rivers where they end up. Wait until planting time to apply fertilizer.



Sanitation in Fruit Crops

Adopt good orchard sanitation practices. The destruction of harboring places for insects and diseases plays a large part in the control program. Conditions that encourage mice should also be eliminated. Mice live in the grass around the trees, so it is difficult to be rid of them without trapping or baiting. Practices to include in an orchard sanitation program:

- Collect and dispose of debris.
- Remove and destroy all dropped fruit.
- Rake and dispose of apple and cherry leaves.
- Scrape loose bark from trunks, crotches, and main limbs of apple trees.
- Prune and destroy all dead or diseased limbs, branches, and twigs.

Canes of bramble fruits are biennial in nature; the crowns are perennial. Each year, new shoots grow from buds at the crown, mature, and set fruit the next year. After fruiting, the old canes die, while new shoots are developing from the crowns.

Old fruiting canes may be removed any time after harvest. They should be cut close to the base of the plant, removed from the plot, and destroyed. Some growers, as a sanitation practice, do this immediately after harvest. Most, however, wait until the dormant pruning in late winter.

Using Proven Biological Controls

Take advantage of the biological control already at work in your garden by encouraging natural predators, such as ladybugs, lacewings, ground beetles, syrphid fly larvae, and others. Study the food and habitat preferences of these helpers. Provide these conditions where possible. Learn to recognize the eggs and larvae of beneficial insects, and avoid harming them. Spiders, toads, and dragonflies are beneficial and should not be a source of fright to the gardener.



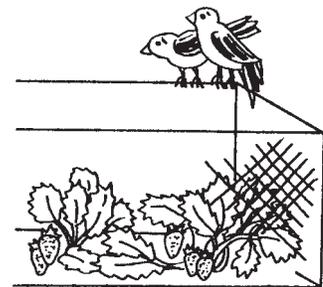
Traps

Use various insect traps to reduce insect population levels. Uprturned flower pots, boards, etc., will trap earwigs and sowbugs; collect them every morning and feed to pet frogs, toads, turtles, and fish, or destroy with boiling water. Slugs can be caught in shallow pans filled with beer. Sink the pan into the soil, setting the rim of the pan at ground level. Indoors or outdoors, whiteflies can be caught with sticky yellow traps made with boards painted yellow and lightly coated with oil or grease. Commercial sticky traps are also available through some catalogs. Although several Japanese beetle traps on the market are effective in attracting beetles, use of these traps has not been shown to be effective in preventing Japanese beetle injury to garden plants since the traps attract beetles from a wide area.

Botanical Insecticides and Soaps

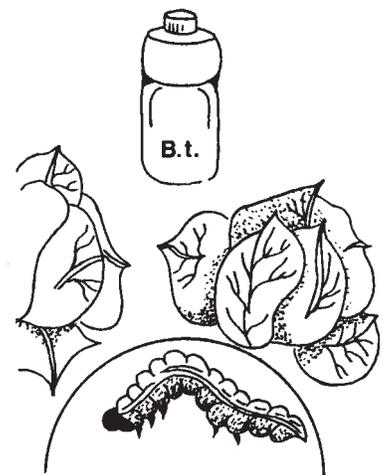
Botanical insecticides are favored by some because they break down rapidly, but remember, they are toxic and can be dangerous. In addition to the botanical insecticides, some biological products can help in the battle against insects. *Bacillus thuringiensis* is an effective product commonly used against moth larvae. B.t., as it is known, is a bacteria that produces a toxin quite lethal to caterpillars, but nontoxic to beneficial insects and mammals. B.t. is most effective on young larvae.

Commercial insecticidal soap, a special formulation of fatty acids, has been proven effective against aphids, leafhoppers, mealybugs, mites, pear psylla, thrips, and whiteflies. Homemade soap sprays also work to some extent: use 3 tablespoons of soap flakes (not detergent) per gallon of water, and spray on plants until dripping. These homemade materials can cause leaf damage to many plants, so some experimentation is advised.



Blocks

Various materials can be used to physically block or repel insects and keep them from damaging the plants. Place wood ash, cardboard tubes, or orange juice cans around seedlings to keep cutworms away from plant stems. Use paper bags over ears of corn to keep birds and insects out, but do not cover until pollination is complete. Net-covered cages and row covers over young seedlings will help prevent insect, bird, and rabbit damage.





Dispelling Pesticide Myths to Protect Water Quality

MYTH *When it comes to garden chemicals, if a little bit is good, a lot is better.*

This myth is not only false, but dangerous. Doubling or tripling the dose of any chemical can have disastrous results. Weed killers used in this manner can injure plants you never intended to harm, not to mention leaving long-lived residues in soil. Over-use of insecticides may kill beneficial bugs, harm plants, and render vegetables unfit for consumption. Doubling the recommended rate of any pesticide increases the chances of poisoning people by inhalation, absorption through the skin, or ingestion.

MYTH *Nonselective herbicides control only herbaceous plants.*

Nonselective herbicides are just that – nonselective. They will also injure or kill your ornamental woody plants if sprayed along a border or at the edge of the planting. Do not apply nonselective, pre-emergent herbicides meant for long-term weed control within the root zone of desired plants. Use weed and feed formulations with caution. The herbicide portion cannot distinguish between trees, shrubs, and dandelions. Feeder roots of trees can extend to well beyond the drip line, so over-applying “weed-and-feed” within these areas could endanger a favorite specimen. This also applies for shallow-rooted shrubs, such as azaleas, which could absorb the herbicide portion.

MYTH *Small amounts of leftover pesticides, when diluted with water, can be safely disposed of down the drain or sewer trap.*

It is not only unsafe, it is illegal to dispose of any pesticide, however diluted, down the drain. You could create an environmental hazard in your home by carrying unused pesticide indoors. In septic systems, pesticides contamination can kill the beneficial bacteria in a sewage field, rendering it inoperable. Read the pesticide label to determine how to properly dispose of a pesticide, or contact your local Extension agent for help.

MYTH *When you discover a problem with your plants, your first course of action should be to apply a pesticide as soon as possible.*

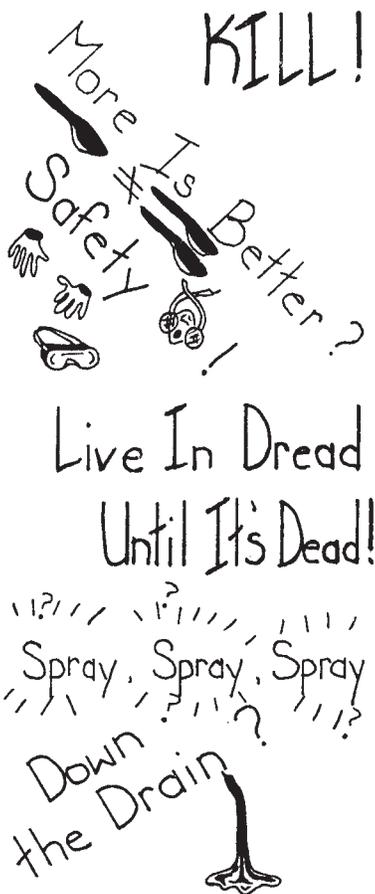
The first cardinal rule of keeping your plants healthy is proper identification of the cause of your problem. Very often the problem is environmental or cultural. The pests you see may be secondary and may disappear if the problem is solved. Use a pesticide only as a last resort.

MYTH *Pesticides should be applied weekly to control insects and diseases on food crops.*

Spray only if a problem exists that warrants a pesticide application. Do not overspray. Prevention of disease in certain plants requires timely applications for control.

MYTH *This herbicide worked well in my lawn so it should work well in my garden.*

Most herbicides are selective, meaning they kill certain plants and do not affect others. Most of the turf post-emergent broadleaf herbicides will injure or kill most vegetable crops. Only apply pesticides to sites listed on the label.



Properly Identifying Pest Problems

Diagnosing the problem and treating the problem are not the same. Some plant problems are “treated” without a proper diagnosis and, more than likely, the problem never gets solved. Here are some guidelines to follow before you reach for something from your garden cabinet that does not solve the problem or could end up being a threat to your plants’ health and the quality of our water.

DIAGNOSING PLANT PROBLEMS

Symptoms	Possible Causes	Possible Cures	Symptoms	Possible Causes	Possible Cures	
Dying young	Fertilizer burn	Mix fertilizer thoroughly with soil. Water heavily to leach excess salts from soil.	Spots, darkened areas on leaves and stems, molds	Disease	Identify disease. Use recommended control measures to reduce damage. Consider disease-resistant varieties for next crop.	
	Disease (Damping off)	Avoid over-watering. Do not plant seed when soil is excessively moist. Select well-drained garden sites.		Fertilizer burn	Wash off plants if fertilizer comes in contact with leaves.	
Stunted plants (pale to yellow)	Low soil fertility	Add 2 to 3 lbs. of a complete fertilizer for 100 sq. ft.	Failure to set fruit	Pesticide burn	Use recommended rates of pesticides. Do not apply pesticides to plant species on which they are not registered for use.	
	Poor soil drainage	Add organic matter and improve drainage.		High temperatures	Fruit set will improve as weather cools.	
	Shallow or compacted soil	Plow deeper. Add organic matter.		Low temperatures	Protect from freezing.	
Stunted plants (purplish color)	Insects or diseases	Identify the insect or disease, and use currently recommended control measures.	Poor pollination	Insects	Identify insect, and use controls.	
		Lack of phosphorus		Wait for warm weather; protect from frost. Add phosphorus (P) fertilizer.		Bee activity may be reduced in cloudy weather.
Wilting plants	Low temperatures	Protect plants with covers.	Fruit rots	Disease	Protect the foliage and fruits with recommended fungicides. Stake vines to avoid contact with the soil.	
	Dry soil	Apply water if possible.		Abnormal leaves and growth	Virus disease	Remove infected plants to prevent spreading. Identify the disease. Control insects that spread the disease. Consider resistant varieties for next crop.
	Excess water in soil	Dig ditches to drain surface water away.		Herbicide injury		Use of herbicides near the garden can result in misshapen leaves and fruit. Destroy affected plants and fruit.
Disease caused by fungus, bacteria, or nematodes	Use resistant varieties if possible or recommended control measures. Consider soil fumigation before planting.	Neighbors' kids	Share melons in exchange for garden work.			
Weak, spindly plants	Too much shade	Move garden to sunny location.	Vanishing watermelons			
	Too much water	Make ditches.				
	Plants too thick	Thin plants.				
Holes in leaves	Too much nitrogen	Avoid excess nitrogen fertilizer.				
	Insects	Identify the insect, and use recommended control measures.				

Conversions for Liquid Formulations

- 3 teaspoons = 1 tablespoon
- 2 tablespoons = 1 fluid ounce = 29.6 milliliters
- 8 fluid ounces = 1 cup
- 2 cups = 1 pint
- 2 pints = 1 quart = 946.2 milliliters
- 1 gallon of water = 8.34 pounds
- 1-1/3 fluid ounces per gallon = a 1% solution
- 1% solution = 10,000 parts per million
- 1 part per million = 1 milligram per liter

Conversions for Dry Formulations

- 1.29 ounces by weight per gallon = a 1% solution
- 1 ounce = 28.35 grams

16 ounces = 1 pound = 453.6 grams

Terms which describe how to use pesticides on a plant:

- Band - apply a strip in the ground along each row
- Broadcast - scatter uniform to an entire, specific area
- Dip - immerse plant in a pesticide
- Directed - aim at a specific portion of a plant
- Drench - saturate the soil with a pesticide
- Foliar - apply to the leaves of plants
- In-furrow - apply in furrow in which plant is growing
- Sidedress - apply along the side of a crop row
- Spot treatment - apply to a small section or area of a crop

PEST MANAGEMENT AND YOUR RESPONSIBILITY TO THE ENVIRONMENT

Learn to manage pests wisely in your landscape:

- Start by selecting plants that are suited to your area, including native plants.
- By sustaining a population of beneficial insects, you achieve a natural pest maintenance program in your garden.
- Before you apply pesticides, be aware that weather conditions and time of day influence application and effectiveness of the spray.
- When purchasing pesticides, buy only the amount you can use in one season.
- Learn to identify the cause of a pest problem before you decide what control method to use.
- For plants susceptible to fungus infections, leave extra space between plants to allow good air flow; orient rows so that prevailing winds will help foliage dry quickly after a rain or watering.
- Maintain optimum growing conditions for your trees and shrubs by allowing the soil to become fairly dry between waterings, then watering thoroughly so soil is moistened 6 to 8 inches deep.
- Use proven biological controls, such as covered cages and row covers over young seedlings, to help prevent insect, bird, and rabbit damage.
- Using these and other methods from this calendar will provide:
 - Increased awareness of your own environment
 - Reduced use of pesticides
 - Increased plant vigor
 - Increased water quality



Play an active role in implementing these practices and you will become an expert of your own environs and steward of clean water. For more information, contact your local Extension office for slide and video programs and publications available on pest management.

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