



Reducing Pesticide Use in the Home Lawn and Garden

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Use an Integrated Pest Management Approach

Pesticide use affects the quality of human health, the environment, and nontarget organisms in the ecosystem. Therefore, any pesticide application warrants a careful assessment of the expected benefits and risks. Too often, however, homeowners use pesticides inappropriately or without careful consideration of alternatives. This fact sheet outlines general pest control tactics that can easily be implemented for home lawns and gardens, along with other information that home owners can use to make sound pest management decisions. The intent is to ensure that homeowners are aware of alternative control tactics and pesticide characteristics, and that pesticides are used properly and only when necessary.

According to the Environmental Protection Agency, 59 million pounds of active ingredient from conventional pesticides were applied in homes and gardens in the United States in 2012 and that is 6% of the total pesticide active ingredient used in the U.S. Applications of pesticides by professional applicators (e.g. commercial lawn services) are not included in the numbers outlined above and if included would likely raise these numbers significantly.

Integrated pest management (IPM) is a science-based decision-making process that uses information on pest biology, the environment, and available technology to manage pest problems in a manner that poses the least possible risk to nontarget organisms, human health, and the environment. Using an IPM approach in the home landscape will ensure that pesticides are used only when other management tactics have not controlled the pest problem at an acceptable level. It will also ensure that pesticides are used in a manner to minimize

associated risks. Determining whether or not the long-term health of the plant is threatened, whether the injury is acute and temporary or merely of minor cosmetic consequence, and other similar parameters should be used to determine an acceptable level of a pest problem.

Accurate identification of the pest problem is the first step in implementing IPM. Abiotic, or nonliving problems, are often mistakenly identified as pest problems; this frequently results in needless pesticide applications. Additionally, pesticide products are often used inappropriately when the pest problem is inaccurately identified. For example, a fungal disease is mistaken for insect damage and an insecticide is used for control. Accurate diagnosis may require contacting a local Virginia Cooperative Extension (VCE) office. (Offices are listed at www.ext.vt.edu/offices/index.html.) If needed, VCE can assist in submitting an appropriate sample for diagnosis or identification to the [Virginia Tech Plant Disease Clinic](http://spes.vt.edu/affiliated/plant-disease-clinic.html) (spes.vt.edu/affiliated/plant-disease-clinic.html) or the [Insect Identification Lab](https://www.ento.vt.edu/idlab.html) (<https://www.ento.vt.edu/idlab.html>). After the problem is diagnosed, information on the lifecycle of the pest, environmental conditions, and available control tactics should be used to make the best decision on how to manage the pest problem. Keep in mind that control of a pest will never be 100 percent. For each pest problem in the landscape, the grower will have to determine an acceptable level of control. Pesticides are certainly not the only means available to control pests. There are many tactics that homeowners can use to reduce the use of pesticides in the home landscape, the most fundamental of which are detailed on page 2.

Start with Plant Selection

Careful selection of ornamental plants is a critical first step in avoiding potential pest and abiotic problems in the lawn and garden. This will require identification of the cultural and environmental conditions required for each plant under consideration for the home landscape. For example, does the plant:

- prefer full sun, partial shade or full shade?
- require moist soil conditions or tolerate dry soil conditions?
- tolerate heavy clay soil or require loamy or sandy soil conditions?

It is also important to determine if the particular plant species under consideration is prone to disease, insect or mite problems. If the species is commonly afflicted with pest problems, find out if pest-resistant varieties are available and purchase these when possible. If resistant varieties of pest-prone species are not available, consider alternative plant species that are known to be relatively pest-free. (See Problem-free Trees for Virginia Landscapes, Virginia Cooperative Extension publication <http://pubs.ext.vt.edu/450/450-237/450-237.html>, and Problem-free Shrubs for Virginia Landscapes, Virginia Cooperative Extension publication <https://pubs.ext.vt.edu/450/450-236/450-236.html>)

It is critical that plants have adequate cold-hardiness (i.e. will be able to withstand the expected low temperatures) for the region in which they will be planted, so take careful note of the hardiness rating of potential purchases. (This information should be detailed on the tag.) A lower hardiness rating indicates a greater cold-hardiness than a higher hardiness rating. According to the USDA Plant Hardiness Zone Map, hardiness zones in Virginia range from zone 5a to 8a. Refer to the current [USDA Plant Hardiness Zone Map](https://planthardiness.ars.usda.gov/) (<https://planthardiness.ars.usda.gov/>) if you are unsure of your region's hardiness zone. Do not assume that because a vendor is selling a plant that it is hardy in your region – it may not be.

Check potential plant purchases for signs of stress or pest problems before purchasing. Do not purchase plants that are pest-infested or show evidence of significant stress. Be sure to check the root system and avoid purchasing plants whose roots are weak, soft, flaccid or sloughing (i.e. the outermost root tissue is shedding).

Table 1. Questions to consider before making a pesticide application.

- Has the problem been accurately identified? Many abiotic (nonliving) plant problems are mistakenly identified as insect, mite, or disease problems. Likewise, many insect problems may be mistaken for fungal or other problems and vice versa.
- Have you read the pesticide label? Is the pesticide labeled for use on the pest problem and will the application of the pesticide be in compliance with the pesticide label?
- Is use of a pesticide really warranted – does this pest pose a serious threat to plant health or is the problem merely a minor cosmetic problem?
- What are the expected risks and benefits of a pesticide application?
- How toxic is the pesticide and how long will the pesticide be active after application?
- What negative effects might result from an application of the pesticide to the environment, nontarget organisms and/or humans?
- Are low-risk pesticide alternatives available for control of the pest?
- At what time will an application of the pesticide be effective or most effective?
- Has the best pesticide application method been identified and has application equipment been calibrated?
- How can the application best be targeted to minimize product use?
- If this is one in a series of applications, are repeated applications of the pesticide resulting in reduced efficacy against the target species? If so, this could indicate that resistance to the pesticide is occurring.

Avoid Predisposing Plants to Pest Problems

Plants in poor health are weak and more susceptible to disease or insect and mite pests. They are also easily out-competed by weeds. Keep plants vigorous by providing them with adequate water and nutrients. The availability and uptake of soil nutrients is directly related to soil pH. Incorrect soil pH may result in either inadequate uptake of certain nutrients or toxic effects from excessive uptake of other nutrients. Have your soil tested to ensure proper soil pH and adequate soil nutrients. Your [local VCE office](https://ext.vt.edu/) (<https://ext.vt.edu/>) can provide you with information on how to submit a soil sample for testing. Fertilizer should only be applied at the appropriate time of year recommended for each plant or turfgrass species; this ensures plant health and reduces susceptibility to pests. Only the recommended rate of fertilizer should be used. Particularly avoid excess fertilization, which results in succulent, tender plant tissue that is prone to pest problems.

Avoid poor soil drainage situations since excessively wet soil conditions are detrimental to the root systems of most plants and favor development of many root rot pathogens. Adequate plant spacing in the garden and landscape is necessary to keep plants vigorous, so avoid crowding plants. Adequate spacing will also reduce moisture in the foliar canopy, which can reduce the incidence and severity of many foliar plant pathogens.

When seeding or transplanting annuals, follow the recommended planting dates for the particular species. Planting too early or too late results in poor germination and stress, both of which can predispose plants to disease and other pest problems. Many pest problems can be avoided by planting at the recommended time.

In vegetable gardens or annual beds it is beneficial to rotate crops from year to year. Rotating areas of the garden to crops in different plant families can prevent soil pest populations from building up to detrimental levels. For example, follow solanaceous crops (eggplant, pepper, potato, tomato) with an unrelated crop, such as a cucurbit (cucumber, gourd, melon, squash), crucifers (kale, cabbage, broccoli), or legume (bean, pea, peanut). If a pest problem has been identified in an area, rotating to an unrelated crop for several years may be necessary, depending on the pest.

Table 2. Avoiding pest problems in the home lawn.

- Your local VCE office can help identify the best turfgrass variety for your region and cultural conditions, in addition to giving you information on the proper planting and establishment of turf. Careful attention to VCE recommendations will go a long way toward a relatively trouble-free lawn.
- Applications of nitrogen and other nutrients may be necessary to avoid problems that can occur as a result of stressed and thinning turf, such as competition from weeds and other pest problems occurring in stressed turf.
 - a. Soil-test results will detail the proper fertilization regime and any recommended pH adjustments.
 - b. Do not apply more or less fertilizer or other soil amendments than recommended.
 - c. The timing of fertilizer application(s) will depend on the grass variety planted. Adhere to recommended fertilizer application dates for the particular turf variety to ensure turf vigor and avoid pest problems.
- Irrigation should be applied during dry periods.
 - a. Irrigate frequently enough that the grass does not suffer from symptoms that indicate drought stress, such as wilted, off-color, or brown blades.
 - b. Irrigate early in the day to promote drying of blades and decrease pest problems favored by prolonged moist conditions.

Good sanitation habits can go a long way toward preventing pest problems. Removing pest-infested plant debris reduces the chance for future infections. For example, raking and removing dead leaves in the fall reduces the chance for fungal disease outbreaks in the spring. This is because the overwintering fungal inoculum, which is harbored in infested leaves, is not present to initiate new infections in the spring. Likewise, pruning out diseased portions of branches back to healthy tissue can reduce further spread of the pathogen. Good sanitation habits include:

- removing pest-infested crop debris, such as fallen leaves, blossoms, and fruit

- removing annual bedding plants and crops from the garden at the end of the growing season
- removing weeds
- pruning dead or unthrifty branches back to white, healthy tissue (Disinfecting pruning tools with rubbing alcohol between cuts may help to prevent the spread of certain pests on pruning tools.)

Encourage Diversity

A diversity of plant species in the landscape can reduce the risk of pest problems, since most pests are specific to a single plant species or family and do not typically occur on a broad range of plant species. For example, planting only flowering dogwoods rather than a diversity of tree species in a landscape will make the development of high populations of dogwood pests more likely.

Table 3. Avoiding common cultural problems on woody shrubs and trees.

<p>When transplanting:</p> <ul style="list-style-type: none"> • Set woody shrubs and trees at the proper planting depth. The structural root nearest the soil line should be placed no deeper than 1 to 3 inches below the soil surface, measured 4 inches out from the trunk. (Structural roots are the large, woody roots that support the tree/shrub.) Note that structural roots are sometimes placed too deeply when potted or planted at the nursery. If this is the case, remove excess soil or potting medium so that plants can be set correctly in the landscape. • Avoid purchasing severely pot-bound container plants. If circling roots are evident when the container is removed, try to tease the circling roots out to encourage growth of roots out of the root ball into the surrounding soil. Carefully cut away circling roots at the top of the root ball that might eventually enlarge, girdle the stem and threaten the long-term health of the plant. 	<ul style="list-style-type: none"> • Water adequately during establishment. (If rainfall is below 1 inch per week, provide enough water to bring the total to 1 inch.) Keep in mind that newly planted trees and shrubs require frequent irrigation during dry periods since their root balls will dry out before the surrounding soil. Less frequent, deeper irrigation is recommended over more frequent, shallow irrigation, since this will encourage root systems to grow deeper into the soil profile. For newly planted container plants it is best to apply irrigation directly to the root ball to saturate the root ball during early establishment. • Mulch should be no more than 2 inches deep and should not contact the bark of woody plants. Deep mulch and mulch in contact with bark reduces aeration to the roots and makes plants vulnerable to colonization by wood decay organisms. Mulch plants in a shallow ring around trees and shrubs. • Avoid damage to roots, stems, and trunks both during and after planting. Wounds create entry points for wood decay organisms. Damage to woody plants often results from lawn mowers and trimming equipment.
<p>Pruning:</p> <p>Pruning at the wrong time of year can predispose woody plants to pest problems. Plant species vary in their recommended pruning times. Refer to the following VCE publications to ensure pruning tasks are performed at the correct time of year:</p> <p>A Guide to Successful Pruning, Deciduous Tree Pruning Calendar https://pubs.ext.vt.edu/430/430-460/430-460.html</p> <p>A Guide to Successful Pruning, Evergreen Tree Pruning Calendar http://pubs.ext.vt.edu/430/430-461/430-461.html</p> <p>A Guide to Successful Pruning, Shrub Pruning Calendar https://pubs.ext.vt.edu/430/430-462/430-462.html</p> <p>Practice proper pruning techniques to avoid creating wounds that can create entry points for wood decay organisms. Information on proper pruning techniques is available from your local VCE office.</p>	

Adding compost or other organic matter to soil encourages a diverse population of soil microorganisms. Some of these microorganisms may be predatory, inhibitory, or may simply out-compete soil-borne pests and reduce pest populations in the soil. Organic matter also improves soil aeration and fertility. Choose some plants that provide pollen and nectar to entice beneficial insects into the home landscape. Some of these beneficial insects may prey upon pests and, thus, reduce pest populations.

Avoid broad-spectrum pesticides that harm nontarget (e.g. beneficial) organisms. If a pesticide application is deemed necessary, try to find a pesticide product that will target only the pest. Using a pesticide that harms beneficial organisms can make pest problems worse. For example, spider mites are a common problem on many plants during hot, dry summers. Carbaryl insecticides, such as Sevin, may appear to offer an easy solution to a spider mite problem. However, along with spider mites, other mite species are present that do not harm the plant but actually prey upon the spider mites that are injuring the plant. An application of a carbaryl insecticide will harm the predaceous beneficial mites, as well as the spider mite pests. This can cause the pest problem to worsen. If it is necessary to use of a pesticide that is likely to harm nontarget organisms, spot treatment on the plant may be an option that can minimize harm to beneficial organisms.

The Pesticide Label and High- and Low-Risk Pesticides

Pesticides vary in their impact on the environment and on nontarget organisms. Environmental factors, such as soil type, proximity to water, and temperature, influence the effect of pesticides on the ecosystem, as do the toxicity and persistence of the pesticide itself. A pesticide's persistence or length of activity after a pesticide application is a characteristic that directly affects its ability to move through groundwater and potentially harm organisms inhabiting streams.

Pesticides are designated as high- or low-risk. A pesticide is considered low-risk if it reduces the potential for negative effects on one of the following: 1) human health 2) nontarget organisms or 3) the environment. A low-risk designation can also occur if the pesticide will expand the use of IPM strategies or increase the effectiveness of IPM practices or their availability. Current trends in research and development have been toward lower risk pesticides, due in part

to the 1996 Food Quality Protection Act, which significantly raised the safety bar for pesticides currently registered and those facing registration.

Biorational pesticides, sometimes called bio-pesticides, are a type of low-risk pesticide that pose little or no risk to the environment and nontarget organisms compared to conventional pesticides. Biorational products are typically used in small quantities and degrade rapidly, leaving little residue. Examples of biorational pesticides are growth regulators, enzymes, hormones, oils, soaps, pheromones, and minerals. Biological controls, which are living organisms used to control pests, are also biorational pesticides. Biological control agents may be predators, which kill pests; parasites, which infest and rob nutrients from pests and weaken or kill the pest; toxin-producing microbes; or pathogens, which cause disease in the pest. Certain viruses, nematodes, fungi, bacteria, insects, mites, and other living organisms may be used as biological control agents. Biological controls are used to control many pests, such as fungi, weeds, nematodes, and insects. They are typically specific to certain pests and not useful for controlling a broad range of pests.

Homeowners should be aware of the toxic attributes of pesticides and make an effort to minimize any negative effects on the ecosystem and human health when using pesticides. The pesticide label includes precautions, information on potential environmental risks associated with the use of the pesticide and other important product characteristics. For help locating and understanding pesticide labels, see the Environmental Protection Agency's Pesticide Labels webpage at www.epa.gov/pesticides/label/.

Pesticide Resistance

There is a potential for pesticide resistance associated with the use of certain pesticides. Pesticide resistance is related to the genetics of the pest and occurs when a pesticide product no longer has a negative effect on a pest. Many low-risk pesticides are prone to the development of pesticide resistance because they target a single mechanism in the pest, which can be overcome by a single mutation in the genes of the pest.

Pesticide resistance occurs by several different mechanisms, depending on the characteristics of the pesticide product and the pest. A simplistic example of how the application of pesticide could result in the development of resistance is a homeowner who applies consecutive applications of a fungicide that disrupts a single mechanism in the fungal pest. Some individual fungi within the fungal population may possess a

Table 4. Read the product label.



The pesticide label is a legal document and using a pesticide in any manner other than those specified on the label is a federal offense. Homeowners are urged to read the pesticide label before using any pesticide product. Labels typically include the following:

- What pest problems the product may be used to control.
- If the product is a restricted or unrestricted pesticide – restricted pesticides may only be used by certified pesticide applicators or by those under their direct supervision.
- The amount of pesticide product to use and application method(s), frequency of application, and other related information.
- Information on how to use and store the pesticide effectively and safely.
- Precautionary information relating to phytotoxicity, mixing products, and pesticide resistance.
- Information on what type of protection is required when applying the pesticide (e.g. protective clothing).
- The required safety interval between pesticide application and harvest.
- First-aid instructions.

genetic variation that allows them to escape harm from the single-site fungicide. Consecutive applications of the fungicide select for the fungi that can tolerate or resist the fungicide. As these fungi continue to reproduce, a larger and larger percentage of the fungal population is resistant to the fungicide and the pest problem worsens. Pesticide products at risk for development of pesticide resistant will have specific instructions on the product label to avoid resistance development.

Evaluate Pest Problems and Control Options

When evaluating potential pest problems in the home garden and landscape, keep an open mind – pests are not the only cause of plant problems. Abiotic, or nonliving

Table 5. Avoiding the development of pesticide resistance.

Many pesticides at risk of causing resistance include information on how to avoid this serious problem on the product label. Some general practices homeowners can use to reduce the risk of the development of pesticide resistance include:

- Avoid reliance on pesticides to control pest problems and instead use an IPM approach to prevent and control pest problems.
- Limit pesticide applications and avoid repeated or sequential use of a product that is at risk for causing pesticide resistance to develop.
- Check the product label carefully for information on pesticide resistance.
- Use the application rate specified on the product label. Do not increase or decrease the rate.
- Time pesticide applications to coincide with times when the target pest is most vulnerable to the pesticide.
- Monitor the results of pesticide applications carefully. If a pesticide product appears to be losing its efficacy, contact the product manufacturer or your local VCE agent.

factors, are also common causes of plant decline and death. Commonly encountered abiotic problems that may be mistaken for pest problems include chemical injury from herbicide drift, nutrient problems, and an assortment of environmental stress factors and cultural problems. When confronted with declining plants, determine what abiotic factors, such as drought, poor soil conditions, mechanical injury, poor planting or chemical injury, might be involved.

If you are considering a pesticide application in the home landscape, remember that pesticides should be the last line of defense and pesticides should be used only when alternative approaches cannot reduce the problem to an acceptable level. Be aware that there are no true “all purpose” pesticides. (A single fungicide will not control all fungi, a single herbicide will not control all weeds and a single insecticide or miticide will not control all insects and mites.) Your [local VCE office](https://ext.vt.edu/offices.html) (<https://ext.vt.edu/offices.html>) can assist you in accurately diagnosing the problem and determining control options, including the proper pesticide to be used.

Integrated Pest Management in the Home Garden and Landscape Video Series

For more information on IPM in the home lawn and garden view the IPM training video series at <https://spes.vt.edu/affiliated/plant-disease-clinic/common-diseases-management.html>. Links to individual videos in the series are also provided below:

- [Introduction to Integrated Pest Management](https://video.vt.edu/media/I-Introduction%20to%20Integrated%20Pest%20Management/1_df7fu17q) (https://video.vt.edu/media/I-Introduction%20to%20Integrated%20Pest%20Management/1_df7fu17q)
- [Pesticides--A Primer on Toxicity and Exposure Risk](https://video.vt.edu/media/II-Pesticides--A%20Primer%20on%20Toxicity%20and%20Exposure%20Risk/1_bycnruk5) (https://video.vt.edu/media/II-Pesticides--A%20Primer%20on%20Toxicity%20and%20Exposure%20Risk/1_bycnruk5)
- [Pesticides in Practice](https://video.vt.edu/media/III-Pesticides%20in%20Practice/1_6mxy7b0) (https://video.vt.edu/media/III-Pesticides%20in%20Practice/1_6mxy7b0)
- [The Plant Disease Triangle](https://video.vt.edu/media/IV--The%20Plant%20Disease%20Triangle/1_z1vu0r7s) (https://video.vt.edu/media/IV--The%20Plant%20Disease%20Triangle/1_z1vu0r7s)
- [IPM Tactics](https://video.vt.edu/media/V--IPM%20Tactics/1_cvr04a98) (https://video.vt.edu/media/V--IPM%20Tactics/1_cvr04a98)

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