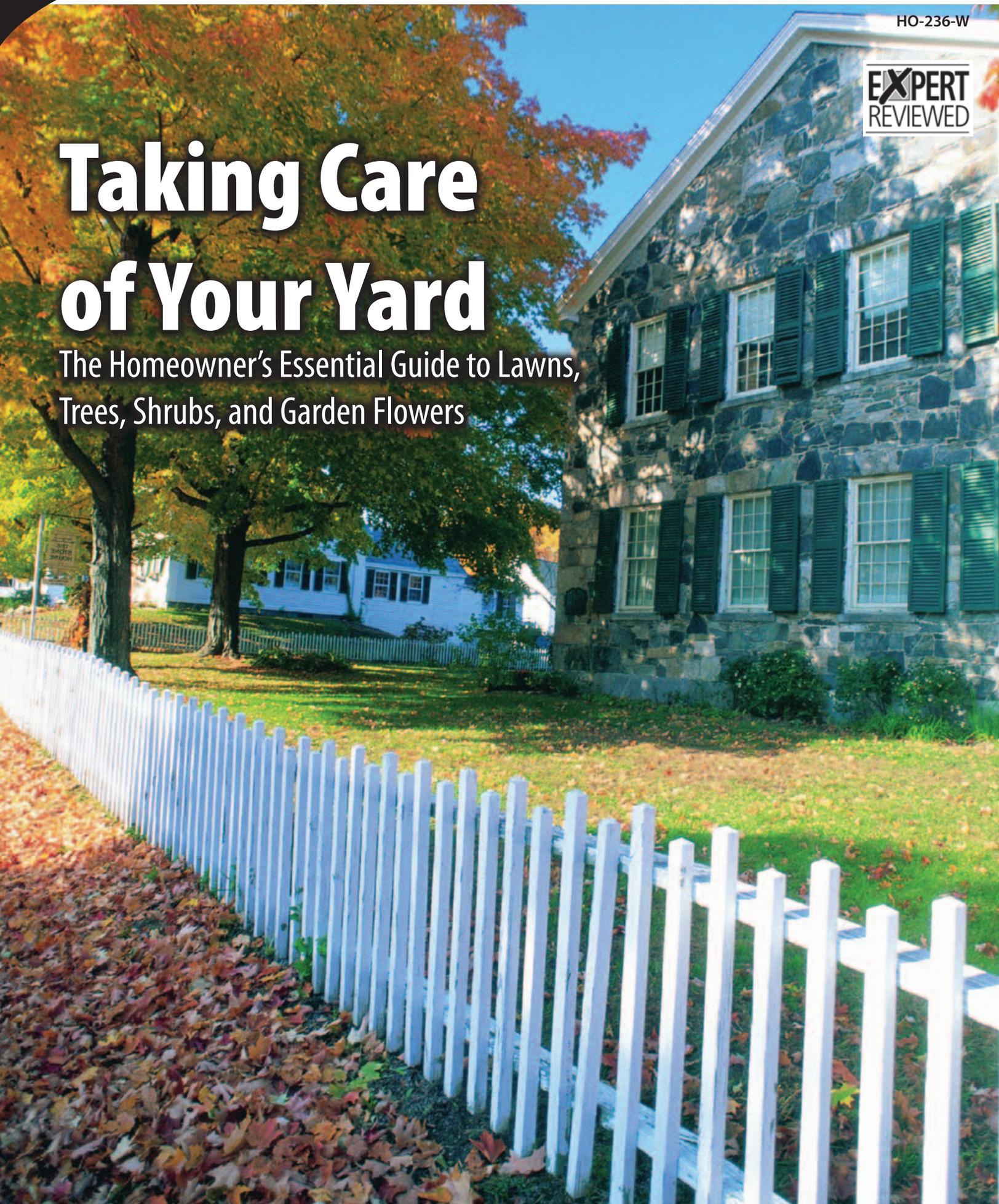




Taking Care of Your Yard

The Homeowner's Essential Guide to Lawns,
Trees, Shrubs, and Garden Flowers





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Purdue Extension Resources

Purdue Extension provides information and publications on vegetables, lawns, fruit, and trees, as well as nutrition, family finances, and many other topics.

You can order the Purdue Extension publications mentioned in this guide (many of them free) from the Education Store:

www.the-education-store.com
(888) EXT INFO (398-4636)

Indiana residents also can get these publications from their Purdue Extension county offices. Find your Purdue Extension office:

www.extension.purdue.edu
Click on the “County Offices” link
(888) EXT-INFO

If you live outside Indiana and want information specific to your state, contact your cooperative extension service — the back inside cover provides a selected list of state extension services.

Acknowledgements

The author wishes to thank Mike Dana, Purdue Horticulture and Landscape Architecture; Stacy Herr, Purdue Extension-Wayne County; Steve Mayer, Purdue Extension-Marion County; Zac Reicher, Purdue Agronomy; Douglas Richmond, Purdue Entomology; Daniel Ritter, Purdue Extension-Newton County; David Robson, University of Illinois Extension; Gail Ruhl and Tom Creswell, Purdue Plant and Pest Diagnostic Laboratory; Cliff Sadof, Purdue Entomology; and Amy Thompson, Purdue Extension-Monroe County for their review of this publication. A special thanks to Fred Whitford, Purdue Pesticide Programs, whose constructive comments greatly enhanced quality and readability.

Some of the information presented in this guide, especially pesticide recommendations, may be specific to Indiana. Readers outside Indiana should check with their own cooperative extension services for state-specific information.

Reference to products in this publication is not intended to be an endorsement to the exclusion of others that may be similar. Persons using such products assume responsibility for their use in accordance with current directions of the manufacturer.

Taking care of your yard — does this phrase bring to mind the glorious flowerbeds of summer or the tedium of mowing your lawn?

Do you anticipate with joy the first leaves of spring or think only of raking those leaves?

Have you been taking care of a yard for many years or did you just move into your first home?

No matter how you answer these questions, *Taking Care of Your Yard: The Homeowner's Essential Guide to Lawns, Trees, Shrubs, and Garden Flowers* will help you care for your yard and add beauty and value to your home.

Table of Contents

Ground Rules	2
Climate and Soil	4
Lawns	8
Trees and Shrubs	20
Garden Flowers	31
Wildlife	35
Additional Resources	36



Ground Rules

This guide covers the basics of yard care:

- Tasks you should do now if your plants are new
- Basic care for established plants
- Techniques for adding new plants to your yard
- Solutions to some common yard problems

Whether you're an experienced gardener or just starting out, whether previous owners planted your yard with a hundred trees or you have a new yard with little more than grass, whether you're new to your area or lived there all your life, this guide will help you care for the plants in your home landscape.

Different plants require different care, so there is a section for lawns, for trees and shrubs, and for flowering plants. Need to know about fertilizing your lawn? Find it in Care for Established Lawns on page 10. Bagworms in your evergreens? You'll find help in Solutions to Common Tree and Shrub Problems on page 27.

Expert Information

With an office in every county in Indiana, Purdue Extension staff can answer your lawn and garden questions, help you identify yard problems, and suggest ways to handle them.

You can also receive diagnoses of your plant problems by sending samples to the Purdue Plant and Pest Diagnostic Laboratory. For a small fee, the laboratory will analyze the problem and provide recommendations.

Information on fees and how to submit samples:

www.ppdl.purdue.edu
(888) EXT-INFO

Find your Purdue Extension office:

www.extension.purdue.edu
Click on the "County Offices" link
(888) EXT-INFO

If you live outside Indiana, please contact the extension service or diagnostic lab in your state first (see the back inside cover).



There are Purdue Extension educators in every Indiana county.

A Word About Pest Control

It's tempting to reach for a chemical solution to every yard problem, but don't!

Nonchemical methods are often easier, less expensive, and may be just as effective as chemical solutions. Chemicals might solve the problem for one year, but changing the way you care for your plant could keep the problem from occurring again and again.

This guide offers both chemical and nonchemical solutions to some of the most common plant problems. If you encounter a problem not covered in this guide, make sure you properly identify the problem before purchasing or using any controls. An accurate diagnosis will let you get the most up-do-date control recommendations.

If you decide that a pesticide (a substance that controls pests) is the best way to handle a plant problem, make sure to check the most recent recommendations from your state's cooperative extension service. The recommendations in their publications are updated regularly.

Use With Care

Pesticides are natural or man-made substances that kill living organisms. The names of the three most common pesticide types tell you what they do:

- Herbicides kill plants (like weeds)
- Insecticides kill insects and sometimes mites
- Fungicides prevent fungal spores from infecting plants

Pesticides are powerful substances that can harm you, your plants, and the environment if used incorrectly. The product label will tell you how to use the pesticide safely and should specifically state that it is intended for use against the pest and for use on the plants you will treat.

Always read the label and follow all instructions when using any pesticide.

Pesticide Names

Pesticide labels tell you both the common name of its active ingredients and its trade name (the manufacturer's brand name).

This is a lot like your experience at the pharmacy. The popular pain reliever's common name is acetaminophen and one of its many trade names is Tylenol®.

Pesticides are similar. The same active ingredient may be in several different products with many different trade names, which change frequently. For these reasons, this guide provides the common name of the active ingredients. The common name will be on the front of every pesticide container under active ingredients. Always check product labels to make sure you are getting the right active ingredients to control the pest.



Photo by Mary Welch-Kees

Some yard problems can be handled without pesticides. You may decide to pull weeds rather than apply herbicides.

Interested in Organic?

Some pest control methods, including many in this brochure, are considered organic.

But organic gardening is more than just pest control. Organic practices include soil improvement, plant selection, and plant care.

See Organic Gardening Resources on page 37.

Climate and Soil

As you drive across the Midwest you'll see plants growing in farm fields and forests, wetlands and prairies. Each of these plants is adapted to its climate and soil. They have found a place where they will grow well, where the winters aren't too cold, the winds are not too severe, and the soil provides the water and nutrients they need.

Understanding climate and soil will help you grow plants in your home's landscape. This section includes information about:

- Climate and your plants
- Soil and your plants

Climate and Your Plants

Many plants thrive in Indiana and around the Midwest, but plants from very warm, very cold, or very dry climates may struggle to survive. The Midwest's plentiful but irregular rainfall, and our four-season climate affect plant growth and survival.



Photo by Mary Welch-Keesey

Plant tags give you valuable information about a plant, including the hardiness zones in which it will grow.

Here are some weather-related issues to consider when selecting and caring for the plants in your landscape:

- **Know your hardiness zone.** The U.S. Department of Agriculture (USDA) has established plant hardiness zones based on a region's historical average minimum temperatures (see map). For example, zone 4 has average minimum winter temperatures of -20°F to -30°F. In zone 7, the range is 0°F to 10°F.

When you buy perennials, trees, and shrubs, the accompanying tag should list the USDA zones in which the plant will grow. Select plants that are hardy to your zone. For example, if you live in zone 5, make sure 5 is in the range listed on the tag. Plants listed as hardy in zones 3-6 or 5-7 will survive in zone 5 areas. Plants listed as hardy in zones 6-9 or 7-9 will find zone 5 areas too cold and are not likely to survive.

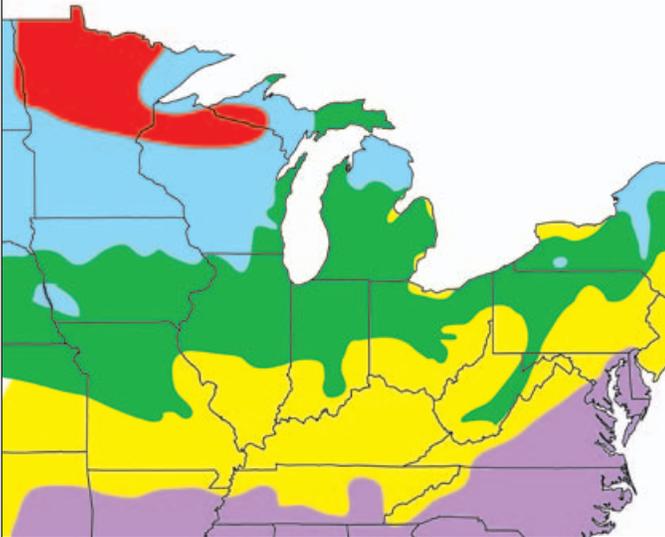
- **Know the direction of the prevailing wind.** Strong winter winds, often from the west or northwest, can dry out evergreen plants, especially ones with large leaves such as holly and rhododendron. These plants grow best when they are sheltered from the wind by the house or other structures.

- **Know the plant's water needs.** Although rainfall in the Midwest is often adequate, supplemental water may be needed during a dry summer or fall. This is especially true for newly-installed plants. During warm weather, plants need about 1 to 1.5 inches of water each week (total rain and irrigation), preferably supplied all at one time (see How Much Water?, page 15). After irrigating, check the depth of watering to make sure you have applied enough water to soak 8 to 12 inches into the soil.

In winter, evergreen plants can dry out after the ground freezes and they can no longer take up water. To keep this from happening, water evergreens in summer if it is dry. Continue to water them in autumn if rainfall is inadequate — even as late as November and December — until the ground freezes.

Midwest Hardiness Zones

- Zone 3 (-40°F to -30°F)
- Zone 4 (-30°F to -20°F)
- Zone 5 (-20°F to -10°F)
- Zone 6 (-10°F to 0°F)
- Zone 7 (0°F to 10°F)



For a detailed national map, see www.usna.usda.gov/Hardzone/index.html.

Climate Information

The Indiana State Climate Office at Purdue University offers many resources about Indiana climate and weather, including average temperatures, average freeze dates, and forecasts:

climate.org

The National Climatic Data Center provides a wealth of valuable climate information, including average frost and freeze dates for locations around the country. Visit the Web site below, click on the “Frost/Freeze Data 1971-2000 (CLIM20-01)” link, and select your state:

cdo.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl

Soil and Your Plants

The Midwest has some of the richest soil in the United States, supporting corn, soybean, tomato, pumpkin, and many other crops. Many landscape plants thrive in this soil as well.

You can learn about your soil by having it tested. The soil test results will provide you with the soil’s pH and nutrient levels, and provide fertilizer recommendations.

Solutions to Common Soil Problems

Just like the weather, Midwest soil can vary widely from site to site. Common soil-related problems you may encounter are:

- Poorly drained (waterlogged) soil
- High-clay (heavy) soil
- Sandy soil
- Soil pH

Recommendations for managing these problems are discussed on the following pages.

Soil and Your Plants

Testing your soil is one of the best things you can do for your plants. Purdue Extension provides a list of commercial soil testing labs at:

www.agry.purdue.edu/ext/soiltest.html

For soil testing labs in your state, contact your cooperative extension service (see the back inside cover).

Purdue Extension publication HO-71-W, *Collecting Soil Samples for Testing*, gives instructions for collecting and packaging the soil samples.

Find it at the Purdue Extension Education Store:

www.the-education-store.com

Poorly Drained (Waterlogged) Soil

We've all seen puddles of water form after a rainstorm. Sometimes the puddle is in a low-lying area where water naturally collects. Sometimes the soil simply can't absorb the water because it is compacted or dense.

If there is a puddle in your yard that lasts for several days, you may struggle to find plants that grow well there. There are several things you can do to improve the drainage of this area:

- If your yard has a low-lying area that collects water, you may be able to grade the soil surface so the water goes elsewhere. A landscaping professional may be able to help you with drainage issues. In Indiana, your local Soil and Water Conservation District (iaswcd.org) can help. Always check with city zoning and planning officials before making major drainage changes.
- You may be able to correct compacted soil and improve drainage by digging deeply to loosen the soil. If you know the compaction was caused by foot or vehicle traffic, do your best to prevent the problem from occurring again.
- Clay soil can be modified to improve drainage, see High-clay (Heavy) Soil below.

If, despite your efforts, the area remains waterlogged, you may choose to grow plants that can tolerate wet soil.

If you want to grow plants that need better drainage, consider building raised beds at least 8 inches high for your garden plants.



Photo by Mary Welch-Keeseey

Many plants, such as this pine tree, do not do well in poorly drained soils.

Raised Bed Gardening

You'll find more information on building a raised bed in Purdue Extension publication HO-200-W, *Container and Raised Bed Gardening*.

Find it at the Purdue Extension Education Store:

www.the-education-store.com

High-clay (Heavy) Soil

Soil high in clay is sticky to the touch when wet. It is easily molded when wet and very hard when dry — perfect for mud pies. Clay soil can drain slowly.

You can improve clay soil by adding organic matter such as compost, sphagnum peat moss, or aged manure and working it deeply into the soil.

You may see recommendations to add sand or gypsum to clay soil, but don't follow this advice. Neither sand nor gypsum improve clay soil. Adding small amounts of sand to clay soil may impede drainage rather than improve it. Always use organic matter to improve clay soil.



Clay soil is easy to mold when wet and often drains very slowly.

Sandy Soil

Sandy soil is gritty to the touch and the sand particles are visible to the naked eye. Sandy soil drains quickly so there is little water for plants.

If your soil is sandy, add organic matter. Organic matter acts like a sponge to hold water and slowly release it to plant roots.

As with poorly drained soil, it is possible to find plants that will thrive in sandy soil. Succulents, such as sedum, do well in sandy soil.



Sandy soil contains clearly visible particles and often drains very quickly.

Soil pH

Soil is acidic if it has a pH less than 7.0 and is alkaline if it has a pH more than 7.0.

Many plants native to the Midwest (as well as thyme, oregano, clematis, and others) grow well in alkaline soil. Some plants, such as pin oaks, rhododendrons, azaleas, and blueberries, require acidic soil and do not grow well when soil pH is high.

A soil test will tell you if your soil is acidic or alkaline and may give recommendations for correcting the problem.

Lime, which is ground limestone, is high in calcium and can be worked into soil to raise the pH of acidic soils. Elemental sulfur, when worked into the soil, can lower soil pH. Both products are available from most garden centers. Do not add lime or elemental sulfur to your soil unless your soil test recommends it.



Some plants, like azaleas, do not do well in alkaline soils. Have your soil tested to determine the pH.

Plant Selection

Purdue Extension offers several publications that can help you select plants for tough areas, such as sandy or wet soil in Indiana:

- *Landscape Plants for Shady Areas* (HO-222-W)
- *Landscape Plants for Areas with Full Sun* (HO-223-W)
- *Landscape Plants for Acid Soils* (HO-224-W)
- *Landscape Plants for Sandy Soils* (HO-225-W)
- *Landscape Plants for Moist to Slightly Moist Areas* (HO-226-W)
- *Landscape Plants for Wet Areas* (HO-227-W)

Find them at the Purdue Extension Education Store:

www.the-education-store.com

Find recommendations for other states by contacting your cooperative extension service (see the back inside cover).

Lawns

Most Midwest homes have at least a small lawn. If your home was just built, your lawn is new and will require extra care until it becomes established. If your home has an established lawn, routine maintenance will keep it looking great.

This section includes information on:

- Special care for new lawns
- Care for established lawns
- The ins and outs of fertilizing your lawn
- Solutions to common lawn problems



Photo by Mary Welch-Keese

Most homes in Indiana have at least a small lawn.

Special Care for New Lawns

If you purchased a new home, your lawn may be new and just starting to grow. Lawns can be started from seed or sod. Both techniques work well, but all new lawns need extra care for the first few weeks.

Newly Seeded Lawns

To care for a newly seeded lawn, follow these recommendations:

- **Water lightly but frequently.** You should water newly seeded lawns two to four times a day so the soil around the grass roots never dries. When the seedlings are 2 inches high, decrease the frequency but irrigate more deeply.
- **Mow as soon as the first leaves are 2 to 2.5 inches tall.** Most people wait too long to mow a new lawn, but you can almost never mow a new lawn too soon. Cut the grass to a height of 1.5 to 2 inches and continue to mow at this height each time the leaves reach 2 to 2.5 inches. After three or four mowings, increase the mowing height to 3 to 3.5 inches and mow as described in Care for Established Lawns, page 10.
- **Apply fertilizer after the grass begins to grow.** Four to six weeks after grass seeds germinate, apply 0.75 to 1.0 pound of actual nitrogen per 1,000 square feet. Apply again eight to ten weeks after germination (see The Ins and Outs of Fertilizing Your Lawn, page 11). You may use a starter high-phosphorus fertilizer or a high-nitrogen product commonly used for established lawns.

If the lawn was seeded in August, you may be able to fertilize in mid-September and again in mid-October. If the lawn was planted in September, your first fertilization may be in October. Always make one last high-nitrogen fertilizer application in late fall (November in Indiana), applying 1 to 1.25 pounds of actual nitrogen per 1,000 square feet.

- **Never apply herbicides to newly seeded lawns.** Herbicides can kill new grass. If weeds become a problem and you decide to use an herbicide, read the product label carefully to learn when it is safe to apply the herbicide to your new lawn.

Newly Sodded Lawns

If your lawn is newly-installed sod, follow these recommendations:

- **Water daily for the first two weeks.** Make sure to wet the entire root zone. After two weeks, test for root establishment by gently pulling up on the grass. If you feel resistance, the roots are beginning to grow into the soil beneath the sod. Once this occurs, reduce the frequency of watering, but irrigate more deeply.



Photo by Tim Thompson

Lawns can be established using strips of sod, which contain grass plants and soil.

- **Once grass reaches 4 inches, mow to 3 inches.** After that, mow regularly as described in Care for Established Lawns, page 10.
- **Wait at least four weeks before fertilizing.** After four weeks, fertilize on the schedule described in Care for Established Lawns, page 10.

Seed or Sod?

You can establish a new lawn using seed or sod.

Lawns are seeded by spreading the seed over the soil and lightly raking it in. To keep the soil moist, straw may be applied over the top. Some professionals mix seed with moist paper fiber that may make your lawn look green or blue. Grass from seed should show visible growth within two to three weeks if it is watered regularly.

Sod is grass that is already growing. It is harvested in strips containing both the grass plants and some of the soil. These strips are laid on top of loosened topsoil, providing an instant lawn.



Photo by Mary Welch Keese

Straw on top of a newly seeded lawn keeps it from drying out.

So, why choose one over the other?

Seed is less expensive but it takes longer for the grass to become established. Sod gives you an instant lawn but is more expensive.

There are other factors to consider. Late summer to early fall is the best time to seed a lawn. If you miss this window, then sod may be the better choice. Also, sod can immediately prevent soil loss if your yard is prone to erosion. If your house is new, you may find the builder sodded the front yard and seeded the back.

Care for Established Lawns

Give your established lawn the care it needs and it will reward you by smothering weeds and resisting diseases. Correct mowing is a big part of lawn care, but you need to fertilize and water correctly as well.



Mowing is a big part of lawn care. Mow frequently and pay attention to the height of the grass.

Here are the basics of caring for an established lawn:

- **Mow grass to 3 to 3.5 inches high.** You can adjust most lawnmowers to cut at this height. Grass cut to 3 to 3.5 inches tall is less prone to insect, disease, and weed problems.
- **Mow frequently and cut off no more than a third of the height.** Mow when the longest grass leaves are 4 to 4.5 inches tall. Kentucky bluegrass and fescue are common lawn grasses in the Midwest. They grow fastest in the cool weather of spring and fall. You may need to mow twice a week during these seasons, but less frequently during warm weather.
- **Leave the clippings on your lawn.** Don't bag your clippings during mowing or rake up the clippings. Leave them on the lawn to break down and return valuable nutrients to the soil. However, you should break up clumps of clippings by raking or mowing again so they don't shade the grass. Mowing frequently in the spring and only when grass is dry will prevent clumping.



Leave grass clippings on your lawn, but break up clumps of mown grass.

- **Fertilize in September and again in late fall.** If you fertilize at no other time, make sure to fertilize your lawn in September and late fall. Use a fertilizer high in nitrogen (the first number listed on fertilizer bag, see *The Numbers on the Bag*, page 11) such as 22-0-5. Fertilize again in mid- to late May to keep the lawn green and healthy throughout the summer.
- **Water deeply and infrequently as needed rather than on a set schedule.** When summer rainfall is plentiful, you may not need to water the lawn to maintain its color and density.

If rainfall is lacking, water the lawn after it first shows signs of water stress (it will turn bluish-gray or footprints will remain in the lawn). With each watering, apply enough water to wet the soil to a depth of 4 to 6 inches, usually 0.5 to 1 inch of water (see *How Much Water?*, page 15).
- **Consider letting the grass go dormant in a dry summer.** If the summer is dry, you may decide to save water and not irrigate your lawn. If you choose this option, the grass will go dormant and turn brown. Don't worry. The grass is not dead. It will revive when autumn brings cooler weather and rain.

You will still need to water the lawn just enough to keep the grass alive. Apply a half-inch of water every four weeks after the lawn turns brown in midsummer. Be sure to minimize or eliminate traffic on a dormant lawn to reduce possible damage.

Other Considerations

Some lawn grasses require special care. For example, if you live in southern Indiana, you may have a zoysiagrass lawn, which requires a special care schedule. For information, see Purdue Extension publication AY-6, *Zoysiagrass for Turfgrass Areas in Indiana*.

Lawn grass does not grow well in the shade. If the grass in a shady part of your yard is struggling, consider replacing it with shade-tolerant perennial or ground cover plants. For Indiana, suggestions are available in Purdue Extension publication HO-222-W, *Landscape Plants for Shady Areas*.

Download Purdue Extension publications from the Education Store:

www.the-education-store.com

Readers outside Indiana should contact their extension service for state-specific recommendations (see the inside back cover).

The Ins and Outs of Fertilizing Your Lawn

Regular, timely fertilizer applications will keep your lawn healthy. There are many types of lawn fertilizer. Do you know which fertilizer to buy? Read on to learn about different lawn fertilizers and how to use them.

The Numbers on the Bag

Every bag of fertilizer is labeled with three numbers. Those numbers represent the percentages (by weight) of three key nutrients: nitrogen-phosphorus-potassium.

For example, a fertilizer bag labeled 22-3-5 contains 22 percent nitrogen, 3 percent phosphorus, and 5 percent potassium. Plants need nitrogen for green, leafy growth. Plants need phosphorus and potassium for strong root and stem growth and for flowering.

Remember, the numbers refer to percentages, not to actual weights. A 10-pound bag of 10-30-15 fertilizer contains 10 percent nitrogen, not 10 pounds of nitrogen. To calculate the amount of actual nitrogen in the bag, multiply the percent nitrogen by the weight of the bag.



Photo by Mary Welch-Keesey

Every bag of fertilizer has three numbers, which represent the percentages (by weight) of three key nutrients: nitrogen-phosphorus-potassium.

For example, if you have a 10-pound bag of 10-30-15 fertilizer, multiply 10 percent (0.10) by 10 pounds (10). So, there is 1 pound of actual nitrogen in the 10-pound bag ($0.10 \times 10 = 1$).

That same bag contains 30 percent phosphorus ($0.30 \times 10 = 3$), or 3 pounds of actual phosphorus; and 15 percent potassium ($0.15 \times 10 = 1.5$), or 1.5 pounds of actual potassium.

In all, the 10-pound bag of 10-30-15 fertilizer contains 5.5 pounds of nutrients ($1+3+1.5$) and 4.5 pounds of filler which makes the fertilizer easier to handle.

Which Fertilizer Should I Use?

You'll find two general types of lawn fertilizer:

- **Starter fertilizers, which are high in phosphorus.** Use these products when seeding a new lawn and after the new grass has begun to grow. Do not use these fertilizers on established lawns. These fertilizers are especially beneficial if a test indicates your soil is low in phosphorus. A product with a 16-22-8 analysis is a good starter fertilizer (see *Special Care for New Lawns*, page 8).
- **High-nitrogen fertilizers for established lawns.** These fertilizers contain little if any phosphorus or potassium, and may have fertilizer analyses such as 46-0-0 or 23-3-5. Select a fertilizer that has as little phosphorus as possible unless a soil test indicates your soil is low in phosphorus.

Select the Right Form of Nitrogen

Nitrogen in lawn fertilizers comes in two forms: quick release and slow release.

Slow-release fertilizers usually affect lawns in three to ten weeks. Use slow-release nitrogen during the growing season to produce steady, constant growth.

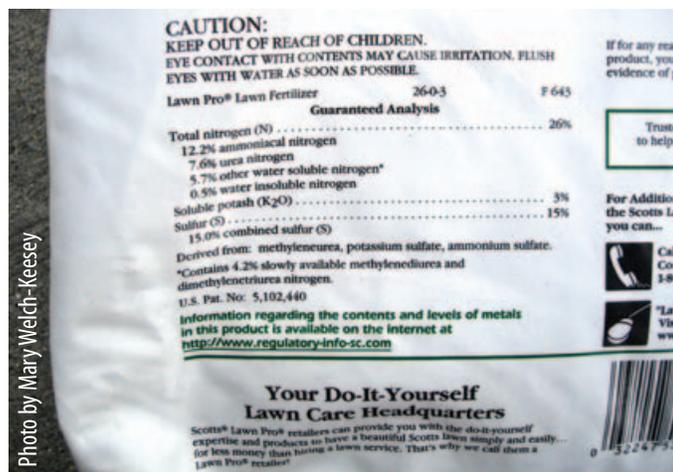
Quick-release nitrogen fertilizers affect lawns in about a week. Use quick-release nitrogen late in the season to stimulate root growth.

Fertilizer labels vary. Some list just the source of the nitrogen they contain. Others go further and clearly define the slow-release or quick-release forms they contain. See the Types of Nitrogen Fertilizer table below for common sources of quick-release and slow-release nitrogen.

Organic lawn fertilizers are gaining popularity. Most of the nitrogen they contain is slow-release. Also, the amount of nitrogen these fertilizers contain is low (for example, 10 percent) compared to conventional lawn fertilizers (for example, 25 percent). This means you will need to use more organic fertilizer, by weight, than conventional fertilizer.

Types of Nitrogen Fertilizer

Quick-Release Nitrogen	Slow-Release Nitrogen
urea	sulfur coated urea (SCU)
ammonical nitrogen (NH ₄)	polymer coated urea
ammonium nitrate (NH ₄ NO ₃)	methylene ureas
	natural organics (for example, corn gluten)



Check fertilizer bags for the kinds of nitrogen they contain. Nitrogen comes in quick release and slow release forms.

Applying the Fertilizer — Established Lawns

Established lawns should be fertilized, at a minimum, in September and late fall (November in Indiana). Follow these steps so you purchase only the fertilizer you need and apply the correct amount to your lawn:

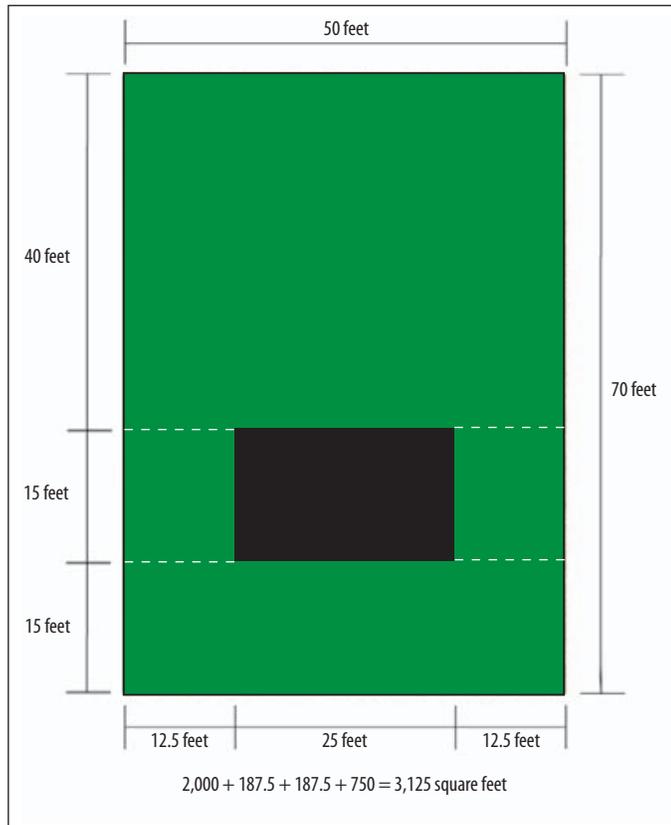
- 1. Determine the size of your lawn.** Fertilizer application rates are based on the area of your lawn in square feet. Remember, area is determined by multiplying the length of your yard by the width. To account for the space occupied by your home, or by irregular shapes in your lawn, you may have to divide sections of your lawn into smaller pieces, and then add the areas together to determine the total (see the example on page 13).
- 2. Select the right type of fertilizer.** Remember, there are slow-release and quick-release fertilizers that are more effective at different times of the season. See the Fertilizer Recommendations for Established Lawns table to determine the best fertilizer timings and rates for your lawn.

Fertilizer Recommendations for Established Lawns

Application Timing	Actual Nitrogen to Apply (pounds per 1,000 square feet)	Type of Nitrogen to Apply
September (autumn)	1.0	Mix of quick- and slow-release
Late fall (October-November)	1.0-1.25	Quick-release
May 15-June 1	1.0	As much slow-release as possible

- 3. Select a fertilizer with the proper nutrients.** Established lawns need a high-nitrogen fertilizer — 25-0-5 is a good choice. For more information about fertilizing newly seeded lawns, see Special Care for New Lawns, page 8.

An Example — Calculating the Amount of Fertilizer You Need



In this example, it's September and you want to fertilize your lawn. The Fertilizer Recommendations for Established Lawns table (page 12) advises you to apply a fertilizer that is a mix of quick-release and slow-release nitrogen. You choose one with a 25-0-5 analysis.

Now it's time to calculate — use the Fertilizer Worksheet (page 14) to calculate the amount of fertilizer your lawn needs.

Step 1. Determine the area of your lawn (in square feet).

Your house is on a 50-foot by 70-foot lot (see illustration above). Adding together the different areas, you determine your lawn is 3,125 square feet.

Step 2. Find the recommended nitrogen application rate.

Nitrogen application rates are provided in pounds per 1,000 square feet. Use the Fertilizer Recommendations for Established Lawns table (page 12). In September, you should apply 1 pound of actual nitrogen per 1,000 square feet.

Step 3. Divide the area of your lawn (Step 1) by 1,000 square feet.

$$3,125 \div 1,000 = 3.125.$$

Step 4. Determine how many pounds of actual nitrogen your lawn needs.

Multiply the recommended application rate from Step 2 (1 pound) by the number from Step 3 (3.125).

$1 \times 3.125 = 3.125$ pounds of actual nitrogen needed for your entire lawn.

Step 5. Determine how much actual nitrogen is in each pound of your fertilizer.

The first number on the fertilizer bag is the percentage of nitrogen it contains. So, if you have a bag of 25-0-5 fertilizer, it is 25 percent nitrogen. So each pound of fertilizer contains 0.25 pound of actual nitrogen.

Step 6. Determine the total amount of fertilizer your lawn needs.

Finally, determine how much fertilizer your entire lawn needs. Take the actual nitrogen your entire lawn needs (3.125 pounds, the number from Step 4) and divide it by the actual nitrogen in each pound of fertilizer (0.25 pound, the number from Step 5).

3.125 pounds of actual nitrogen required for entire lawn \div 0.25 pound of actual nitrogen per pound of fertilizer = 12.5 pounds of 25-0-5 fertilizer required for your entire lawn.

Once you've determined the amount of fertilizer to use, weigh it out and distribute it evenly with a hand-held or wheeled mechanical spreader. Your application will be more even if you apply half the fertilizer while walking in one direction, and then apply the second half while walking in a direction perpendicular to the first.

Make sure to water well after applying the fertilizer.

Fertilizer Worksheet

This worksheet will help you determine how much fertilizer you need to apply to your lawn.

Step 1.	Determine the area of your lawn (in square feet): Total area of lawn = _____ ft ²
Step 2.	Find the recommended nitrogen application rate. Use the Fertilizer Recommendations for Established Lawns table (page 12): _____ lbs. of nitrogen per 1,000 square feet
Step 3.	Divide the area of your lawn by 1,000 square feet. Step 1 ÷ 1,000 = _____
Step 4.	Determine how many pounds of actual nitrogen your lawn needs. Step 2 x Step 3 = _____ lbs. of actual nitrogen entire lawn needs
Step 5.	Determine how much actual nitrogen is in each pound of your fertilizer. Convert the first number on the fertilizer bag to a decimal (for example, 25 = 0.25): _____
Step 6.	Determine the total amount of fertilizer your lawn needs. Step 4 ÷ Step 5 = _____ lbs. of fertilizer needed for entire lawn

Online Fertilizer Calculator

Want to skip the math?

Check out the Purdue Turfgrass Program Turf Fertilizer Calculator:

www.agry.purdue.edu/turf/fertcalc/Fertilization%20calc.html

Solutions to Common Lawn Problems

Basic lawn care – mowing, fertilizing, and watering – is the basis of a great lawn. Even the best lawns have an occasional problem. The ones you'll encounter most frequently are:

- Weeds
- Thatch
- White grubs
- Moles

Each of these problems — and recommendations for managing them — is discussed on the following pages.

Weeds

Weeds struggle to survive in lawns with healthy, dense grass. A vigorous lawn is the best defense against weeds.

Weeds fall into two groups:

- **Grassy weeds**, which have long, slender leaves
- **Broadleaf weeds**, which have leaves that are more rounded or broad



Keep grass healthy and dense with proper care and you can reduce the number of weeds in your lawn.

Some weeds are annual. They grow from seed each year, produce more seed for the next, and then die. Other weeds are perennials. They produce new growth from their roots every year. Crabgrass is an annual grassy weed; nimblewill is a perennial grassy weed. Henbit and purslane are annual broadleaf weeds; dandelion, thistle, and ground ivy are perennial broadleaf weeds.

Different weed types require different control strategies, so the first step is to identify the weed. Not sure which weed you have? Your extension service may be able to help you identify them.

Annual Grassy Weeds

One of the most common annual grassy weeds is crabgrass. It grows from seed each spring, produces new seed over the summer, and dies with the first frost. The seeds produced in the summer will grow the following spring.

Proper mowing, fertilizing, and watering practices will produce a vigorous lawn, making it hard for crabgrass to grow.



Once crabgrass is large (after mid-July in Indiana), it is best to just tolerate it until it dies with the first frost.

If crabgrass has been a problem in your yard (or in your neighbor's yard), or if your lawn is new or thin, there are probably crabgrass seeds in your soil. To keep these seeds from growing you can use pre-emergent herbicides, often called "crabgrass preventers." These products may contain benefin, oxadiazon, trifluralin, pendimethalin, dithiopyr, prodiamine, or corn gluten, an organic herbicide. To be most effective, apply crabgrass preventers by the first week of April.

Crabgrass already growing in your yard in summer is more difficult to control. In early summer when the plants are small you can use herbicides containing MSMA, DMSA, dithiopyr, fenoxaprop, or quinclorac.

Apply these products carefully because they can harm your lawn if used incorrectly. Make sure you read and follow the label instructions on the herbicide container.

Once crabgrass is large (after mid-July in Indiana) it cannot be controlled effectively. It is best to just tolerate large crabgrass until it dies with the first frost. Mark your calendar so you remember to apply a pre-emergent herbicide by the first week of the following April.

Lawn Care Resources

Purdue's Turfgrass Program offers more information on lawn care in Indiana:

www.agry.purdue.edu/turf

Click on "Turf Tips" for timely updates.

Click on "Extension Publications" for information on lawn care, including weed, insect, and disease control.

For recommendations specific to your state, contact your cooperative extension service (see the back inside cover).

How Much Water?

Watering recommendations for lawns and other plants are often given in inches.

But how do you know you've applied "an inch" of water?

A shallow flat can, such as a tuna or pet food can, will help you determine how much water has been applied. Before watering, set several empty cans around the lawn, then measure the water as it accumulates during irrigation. This will tell you how much water has been applied and help you determine areas where your sprinklers are supplying too much or too little water.

If you are irrigating a small area by hand, 1 inch of water is equivalent to two-thirds of a gallon applied to 1 square foot.



Automatic sprinkler systems are convenient, but movable sprinklers, and even watering cans, can be just as effective.

Watering recommendations may also tell you to wet the soil to a certain depth.

To determine how deeply irrigation water has penetrated, you can dig in the soil with a trowel and look. Wet soil will stay in a ball after you have squeezed it in your hand. A ball of dry soil will break apart.

You can also use a thin metal probe, such as a long-bladed screwdriver. Push the probe into the soil before watering. It will be hard to push it into dry soil. After watering, push the probe into the soil again. It should move easily into the damp soil but will stop when it reaches dry soil. The length of the probe that easily enters the soil tells you how far the irrigation water has penetrated.

Perennial Grassy Weeds

Perennial grassy weeds come back year after year. Currently, there are no products available to homeowners that will kill perennial grassy weeds such as nimblewill and quackgrass without also killing your lawn. Check with your extension office for any new products that might become available in the future.

Until new products are available, the only way to control perennial grassy weeds is to kill all the grass in the area with a nonselective herbicide (for example, a product that contains glyphosate), and then reseed the area. Multiple applications of the nonselective herbicide will be required. Make sure the herbicide does not also contain a pre-emergent, which would keep new grass seeds from growing.



Nimblewill is a common perennial grassy weed that turns brown as the weather cools, which makes it easy to spot in winter.

Annual Broadleaf Weeds

Annual broadleaf weeds grow from seed each year. You'll find them most frequently in new or thin lawns. Crabgrass preventers may keep some of these plants from growing, but once the weed is large, herbicides are often ineffective. It may be most efficient to pull these weeds by hand or to cut them back frequently so they do not flower and produce new seed.

Perennial Broadleaf Weeds

Perennial broadleaf weeds, such as dandelions, return year after year. There are several ways you can handle these weeds.

If you have just a few broadleaf weeds, you may decide to pull them out by hand.

If your weed problem is widespread, you may decide to use herbicides. Fall application of herbicides is most effective and less likely to damage your other plants.



Spotted spurge is a common annual broadleaf weed.

To treat your lawn for perennial broadleaf weeds, select a product that contains two or three of the following broadleaf herbicides, and apply in October: 2,4-D, MCPP (mecoprop), and dicamba. For more difficult to control weeds, such as ground ivy or thistle, use a product that contains triclopyr. If there are weeds in only a few isolated areas, spot treat just the weeds.



Dandelions are a common perennial broadleaf weed.

You can apply herbicides in the spring and summer, but they are much less effective than when applied in fall.

Be careful. Many ornamental plants you want in your home landscape are also broadleaf plants and can be harmed by these pesticides, especially if they are applied in spring. Always follow the instructions on herbicide packages carefully.

Thatch

Thatch is a tightly intermingled layer of dead and living grass shoots, stems, and roots that accumulate between the actively growing grass and the soil surface.

A thick layer of thatch can interfere with air and water movement and decrease the effectiveness of fertilizers and pesticides.

Thatch can be a problem in lawns that receive a high level of care and fertilizer. Correct lawn care (see Care of Established Lawns, page 10), including leaving grass clippings on the lawn, will help reduce thatch buildup. You may first notice thatch as a spongy feeling underfoot as you walk across the lawn. If you suspect thatch is becoming a problem in your lawn, dig out a small section of lawn and look for thatch in a layer between the soil and the green grass leaves.

If the thatch layer in your lawn is thin (less than a half-inch thick) you may be able to reduce it by aerifying. Aerification is the process of removing small columns of soil from your lawn to decrease soil compaction and increase air movement in the soil, subsequently reducing thatch.



Thatch occurs between the actively growing grass and the soil surface. The lines here indicate a thatch layer that's about 0.75 inch thick in spots.

When aerifying to reduce thatch, use an aerification machine that removes columns of soil 2 to 3 inches deep. Make 20 to 40 holes per square foot.

If you see thatch a half-inch thick or more, consider removing the thatch with equipment specifically designed for this purpose.

Thatch removal (dethatching) and aerification should be performed when grass is actively growing, in the cooler weather of April and September. Dethatching and aerification equipment is usually available for rent at reasonable rates at large garden centers and equipment rental firms.



Aerification removes small columns of soil from the lawn, which decreases compaction, increases air circulation, and reduces thatch.

Lawn Care Publications

Purdue Extension offers many publications on lawn care in Indiana — whether you want to install a new lawn or refurbish an old one.

- *Fertilizing Established Lawns* (AY-22)
- *Irrigation Practices for Homelawns* (AY-7)
- *Establishing Turfgrass Areas From Seed* (AY-3-W)
- *Establishing a Lawn from Sod* (AY-28)
- *Purchasing Quality Grass Seed for Your Lawn* (AY-25-W)
- *Seeding a Turf Area in the Spring* (AY-20)
- *Lawn Improvement Programs* (AY-13) — includes information on overseeding thin lawns
- *Should I Hire a Professional Lawn Care Service?* (AY-26)

Download these publications from the Education Store:

www.the-education-store.com

For recommendations specific to your state, contact your cooperative extension service (see the back inside cover).

White Grubs

Grubs are immature beetles that eat the roots of lawn grass and can, when severe, kill large areas of your lawn. Raccoons and skunks feed on these insects and may further damage your lawn by digging in search of grubs.

If you notice dead, brown grass in your lawn in August or September, or raccoon and skunk damage, there may be grubs in your lawn. Check for grubs by pulling up the dead area. Grubs are white, C-shaped, and easy to see.



White grubs are C-shaped and easy to see.

If you do find grubs, there are several factors to consider before using chemicals to kill them.

If you water and fertilize your lawn regularly (see *Care for Established Lawns*, page 10), a small amount of grub feeding will not cause permanent damage. A healthy lawn should recover without pesticide treatment even if you see as many as 10 to 15 grubs per square foot.

If your lawn receives less care, then treatment may be warranted if you find as few as 5 to 10 grubs per square foot.

Timing Is Critical

Insecticides only kill grubs when they are actively feeding, from about mid-July until about mid-October. Insecticide application must take this timing into account.

Insecticides applied after you realize there are grubs in the lawn are called “curative” treatments because they are applied to “cure” an existing problem. Insecticides containing the active ingredients trichlorfon or carbaryl can be used for curative treatments. These chemicals are usually applied in August and September, possibly as late as early October, after you have confirmed the presence of grubs.

You may find grubs in late fall or spring if you are working in your yard. These large, mature grubs are not damaging your lawn because they are not feeding. Do not apply curative treatments in late fall or in spring. These insecticides will not kill the large grubs because they are not feeding at those times.

If you have had problems with grubs in the past, you may decide that defense is the best strategy. “Preventative” treatments are applied in July to kill grubs when they are still very small and before they have caused much damage. Two different active ingredients may be found in products that prevent grub damage: halofenozide and imidacloprid. Ideally, both products should be applied in mid-July. Halofenozide is active for only a short time. Imidacloprid is longer lasting and can be applied earlier (May or June) or later (August and September). These treatments may not be as effective as a mid-July application.

Make sure you water the lawn after applying any of these insecticides. Use at least a quarter-inch of water to move the insecticide into the soil.

Treat Only When Necessary

Remember: not every lawn should be treated with insecticides to control grubs. Research has shown that 70 percent of all pesticides applied to control grubs were unnecessary because no grubs were present.

If you had grub problems last year, a preventative treatment may be appropriate since the same area is often reinfested with grubs year after year.

If you did not have grubs last year, there is no reason to believe you will have a grub problem this year. Wait until you confirm the presence of grubs before you purchase and use insecticides to control them. Finding grubs in your garden beds in spring does not imply you will have a grub problem later in summer and usually does not require grub treatment.

Moles

Moles dig underground tunnels through lawns to look for earthworms, insects, and other food. This tunneling can damage both lawns and gardens.

You will hear about many strategies to control moles. Some of these (like trapping) work, while others (like bubble gum) do not.

Trapping is an established and reliable method of mole control, but even this method may offer only a temporary solution. Once the original moles are eliminated, new moles may move into the same area.



Photo by Mary Welch-Keesey

This mole trap, when set, can effectively control moles.

If you don't want to use traps, the newly available mole toxicants containing bromethalin may be an alternative. These worm-shaped baits are placed in the mole tunnel and eaten by the mole, which soon dies. As with traps, correct placement is critical for success. Check your local garden center for these products and make sure you follow the safety and placement instructions on the label carefully.

Unfortunately, many home remedies for mole control *do not work*, including:

- Placing bubble gum, razor blades, or human hair in the tunnels
- Using insecticides to kill grubs
- Planting a "mole plant" (*Euphorbia latharis*)
- Using ultrasonic devices

Mole Control

More information on mole control, including information on commercial mole trappers, is available from the Purdue Wildlife Conflicts Information Hotline:

www.wildlifehotline.info



Mole tunneling can damage lawns and gardens.

Trees and Shrubs

Trees and shrubs add beauty and structure to the home landscape. They provide shade, create privacy, and add value to your property. Care for your trees and shrubs properly and you will enjoy them for many years to come.



Photo by Mary Welch-Keesey

Care for trees and shrubs properly and you will enjoy them for many years

This section includes information on:

- Special care for newly planted trees and shrubs
- Care for established trees and shrubs
- Selecting and planting new trees and shrubs
- Solutions to common problems

Special Care for Newly Planted Trees and Shrubs

Newly planted trees and shrubs require extra care. The following recommendations will help keep your new trees and shrubs healthy and vigorous.

Water Regularly

Newly planted trees and shrubs must be watered regularly for the first year after planting. Regular watering is often the difference between a plant that thrives and one that dies.

New trees and shrubs should receive 1 to 1.5 inches of water (total rain and irrigation) every seven to ten days in the summer and fall (for more about measuring water, see *How Much Water?* page 15). Water the plants when there isn't enough rain, but do not water every day in small amounts. Instead, soak the soil deeply, and then allow it to dry somewhat before the next watering. You can check to see if it is drying by pulling aside any mulch and digging into the soil.

Regular watering is especially important if the trees or shrubs are planted in fall when rainfall may be limited. Continue irrigation until the plant is dormant (loses its leaves) or, for evergreens, until the ground freezes.

Wait to Fertilize

Newly planted trees and shrubs do not need to be fertilized. Delay fertilization until the year after planting.

Use Stakes Carefully

It may take one to two years for a newly planted tree's roots to grow into the surrounding soil and stabilize it. During this time, large trees (more than 6 feet tall) may be staked to keep them from tipping.

If your trees have been staked, check the straps frequently to make sure they are secure and not cutting into the tree bark. Remove the support after one growing season for a 1-inch diameter tree, or after two seasons for a 2-inch diameter tree.

Staking Trees

Purdue Extension publication FNR-FAQ-6, *Should Newly Planted Trees Be Staked and Tied?*, explains when you should stake trees and provides instructions for doing it correctly.

Download it from the Education Store:

www.the-education-store.com

Check Your New Trees and Shrubs

If you move into a home with newly installed trees and shrubs, take a few minutes to inspect each plant. If there is mulch around the new plants, make sure it is not piled up against the trunk (see *Mulch*, page 22). If it is, move the mulch so it is 2 to 6 inches away from the trunk.

Also check for and remove any tags or twine, especially around the base of the tree. As the tree grows, any remaining tags or twine will strangle and kill the trunk or branch. Write down the information on the tag so you know which trees and shrubs are planted in your yard. This information will help you diagnose any insect or disease problems that might occur.



Inspect your trees and remove any twine or tags to prevent them from strangling and killing the trunk or a branch. This tree will not grow well unless the twine is removed.

Care for Established Trees and Shrubs

Once established, trees and shrubs require less maintenance than many other plants — just think how often you'll be mowing that established lawn. Regular inspection and care, even if it only takes a few minutes each month, will ensure these plants are healthy, long-lived additions to your landscape. Following these recommendations will keep your trees and shrubs looking great.

Watering and Fertilizing

Shrubs and small trees should receive about 1 to 1.5 inches of water (total rain and irrigation) every seven to 10 days during warm weather, preferably in one

application (see *How Much Water?*, page 15). Although some large, established trees and shrubs can survive several weeks without water, they will benefit from irrigation if they haven't received 2 inches of rain within two weeks.

Don't water every day. If you think it is time to water, pull aside any mulch and check the soil. If the top few inches of soil are dry, you need to water. In autumn, make sure to continue watering evergreens (if rainfall is inadequate) until the ground freezes, even into November and December.

Trees and shrubs may need fertilizing once or twice each year, primarily with nitrogen. However, trees growing in a well-fertilized lawn may not need additional fertilizer. If needed, the best times to fertilize trees and shrubs are in the early fall as the plant begins to go dormant (September to early October in Indiana), and in spring when the buds swell (late March-April in Indiana).

Tree roots grow wide, but only a few feet deep. The roots of established trees typically extend well past the tips of the branches, so make sure water and fertilizer reach all of the roots. Apply water and fertilizer not only to the soil under the tree but also to the soil beyond the spread of the branches.

Fertilizing Your Trees and Shrubs

Have your soil tested to determine the best fertilizer to use on your trees and shrubs.

If test results show that soil phosphorus and potassium levels are high, use a high nitrogen fertilizer such as 21-0-0, 33-0-0, or 45-0-0 (see *The Numbers on the Bag*, page 11). If phosphorus and potassium are at low or medium levels, use a fertilizer containing all three nutrients such as 10-10-10, 20-10-5, etc.

Apply 2 to 4 pounds of actual nitrogen per 1,000 square feet each year. Make sure you apply the fertilizer not only to the soil under the tree but also to the soil beyond the spread of the branches. To calculate your fertilizer needs, see *The Ins and Outs of Fertilizing Your Lawn*, page 11.

Trees and shrubs growing in well-fertilized lawns may not need additional fertilizer applications. Needle evergreens (such as pines) need less fertilizer than trees that lose their leaves each year.

Mulch

Adding mulch around trees keeps soil cool and moist, prevents weed growth, and protects the trunk from lawnmower and weed trimmer injuries. Equipment injuries can damage the trunk and shorten a tree's life.

Apply mulch by spreading a layer 2 to 3 inches thick on the soil around the trunk. Never let the mulch mound up against the trunk. This practice may injure the plant by keeping the bark continually moist. Always keep mulch a few inches away from the trunks of all trees and shrubs.



Photo by Mary Welch-Keesey

Never form a "mulch volcano" around your tree. Instead, keep mulch a few inches from the trunk and only 2-3 inches deep.

You can make the mulch ring around the tree 1 foot wide or 10 feet wide, depending on your landscape situation. Most homeowners find a ring extending about three feet from the trunk is both practical and aesthetically pleasing.

Remember, the most popular mulches (such as bark nuggets, wood chips, and compost) will break down and disappear over time. Check the mulch yearly and reapply when it becomes too shallow.



Mulch, correctly applied, helps hold soil moisture and keeps lawnmowers and weed trimmers away from the trunk.

Pruning

Not every tree or shrub needs pruning every year. You should, however, regularly remove:

- Dead branches
- Broken branches
- Branches that rub against other branches

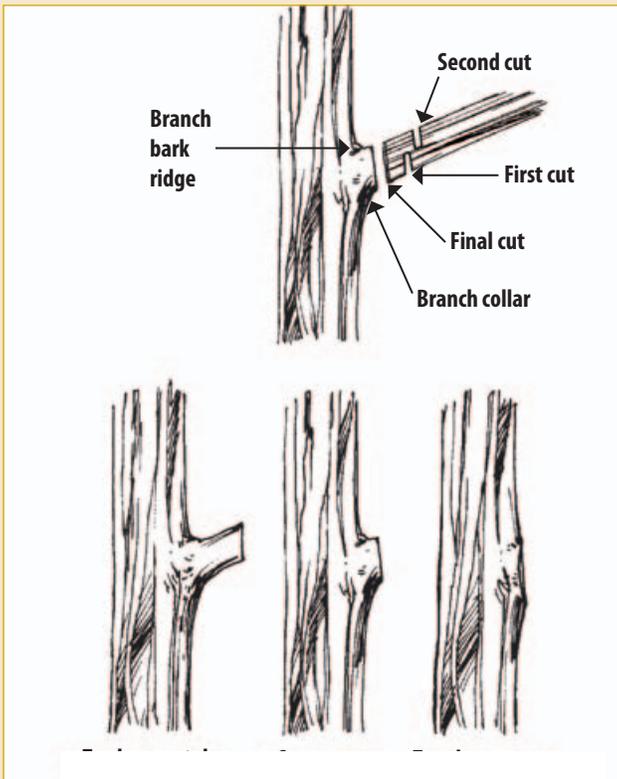
When you prune, always keep the natural shape of the plant by cutting back individual branches rather than shearing them all to the same height (except, of course, formal hedges). To ensure spring flowers, do not prune trees or shrubs that flower before June 30 until immediately after they flower. Trees grown only for shade and trees or shrubs that flower after June 30 are usually pruned while they are dormant — in late winter or early spring. (see the When to Prune Flowering Trees and Shrubs table on page 23).

Large trees are difficult and dangerous to prune and even small branches can be quite heavy. If the branch is more than 3 inches in diameter, or if it's high in the tree, consider hiring a professional arborist.



Broken branches can be removed at any time of the year.

Prune Carefully



If you want to prune a branch more than 3 inches in diameter, hiring a professional arborist is a better option than doing it yourself.

For smaller branches, make three cuts as shown here. The first two cuts remove the weight of the branch. The third removes the stub. Be careful! Make sure you don't cut too close to the trunk or leave too long a stub.

Pruning and Trimming Trees and Shrubs

Purdue Extension offers several publications that answer questions about pruning and trimming trees and shrubs:

- *Pruning Ornamental Trees and Shrubs* (HO-4-W)
- *Trees Need a Proper Start — Prune Them Right* (FNR-FAQ-19-W)
- *Hedges* (HO-27-W)
- *Why Hire an Arborist?* (FNR-FAQ-13-W)
- *Storms and Trees* (FNR-FAQ-12-W)
- *What's Wrong with Topping Trees?* (FNR-FAQ-14-W)

Download these publications from the Education Store:
www.the-education-store.com

For recommendations specific to your state, contact your cooperative extension service (see the back inside cover).

When to Prune Flowering Trees and Shrubs

Here are some common trees and shrubs and the ideal times for pruning them.

Prune in Late Winter or Early Spring Before Flowering	Prune in Early Summer After Flowering
beautyberry	beautybush
butterfly bush	big-leaf hydrangea
coralberry	oakleaf hydrangea
goldenrain tree	Carolina allspice
mimosa/silk tree	Cornelian cherry dogwood
panicle hydrangea	cotoneaster
smooth hydrangea	crabapple
rose of Sharon	deutzia
sumac	flowering cherry, plum, and pear
	flowering dogwood
	forsythia
	fringetree
	hawthorn
	Kousa dogwood
	lilac
	magnolia
	mock orange
	privet
	redbud
	rhododendron and azalea
	serviceberry
	smoketree
	spicebush
	spirea – white-flowering
	viburnum
	weigela

Plants are listed here by their common names. More information on pruning, including detailed plant lists with scientific as well as common names, can be found in Purdue Extension publication HO-4-W, *Pruning Ornamental Trees and Shrubs*.

Find a Professional Arborist

Certified arborists are specialists who are trained and equipped to deliver care for individual trees. The International Society of Arboriculture maintains a list of tree care services:

www.treesaregood.org
 (217) 355-9411

For Indiana residents a list is available from the Indiana Arborist Association:

www.indiana-arborist.org

Click on the "Finding a certified arborist" link

Don't Top Your Trees

“Topping” trees — the practice of cutting off large branches to drastically reduce tree height — is very damaging. Don't do it and don't let anyone do it to your trees. Topping severely damages a tree's health and increases the likelihood that branches will break off in a storm. If you must reduce a tree's height, consult a professional arborist who can suggest more appropriate, less harmful techniques.

Trees and shrubs will continue to grow up and out until they reach the height and width normal for their species. If you have a plant that outgrows its space no matter how often you prune, it may be the wrong plant for that space. Consider replacing it with a plant that has a natural height and width appropriate for the location.



Match plants to your soil and growing conditions. Some trees and shrubs, like this azalea, do not grow well in alkaline soils.



Photo by Mary Welch-Keeseey

This tree has been topped. The new branches growing from the stubs are very weak and could break off in a storm.

Adding New Trees and Shrubs

It is gratifying to watch a small sapling grow into a healthy tree. To ensure success, you'll need to select one that is adapted to your climate and soil, and then plant it correctly and water it regularly.

Select the Right Plant

Not all plants grow well in all locations. Do a little research before you select a new tree or shrub to ensure it will do well in the sun and soil conditions in your yard. Also, make sure you select a plant that will grow in the USDA hardiness zone where you live (see *Climate and Your Plants*, page 4). Purdue Extension publications, reference books, garden center professionals, and plant tags can provide valuable information.

Soil pH also is a consideration. Many trees and shrubs will grow in soils with a pH greater than 7.0, but a few popular landscape plants will struggle if soil pH is too high. If your soil has a pH greater than 7.0, avoid azalea, rhododendron, pin oak, red maple, and river birch. Select hollies carefully — some don't grow well in alkaline soils. If the pH of your soil is more than 7.5, then also avoid sugar maple, serviceberry, sweetgum, Sargent cherry, and bald cypress.

When you research plants, you also should note the plant's mature size. Make sure you match the plant to the location so it will have plenty of space to grow to its natural mature height and width.

Not Sure of Your Soil's pH?

A soil test can determine your soil's pH, as well as provide valuable information on nutrients.

You can find a list of commercial soil testing labs at:

www.agry.purdue.edu/ext/soiltest.html

For soil testing labs in your state, contact your cooperative extension service (see the back inside cover).

Purdue Extension publication HO-71-W, *Collecting Soil Samples for Testing*, gives instructions for collecting and packaging the soil samples.

Find it at the Purdue Extension Education Store:

www.the-education-store.com

Where You Plant is Important

Once you've selected a tree or shrub that will grow in your yard, there are several things you should consider before digging a hole.

Stay Away from Overhead Utility Lines

Take special care if you are planting near overhead utility lines. Select plants that, when mature, will not touch the wires (see table below).

Remember, some utility lines — like those that connect directly to your home — are only 12 feet high, so plan accordingly. Avoid planting trees directly below utility lines and maintain a distance of at least 10 feet from them.



This tree was planted too close to the utility line. The utility company pruned it to keep falling branches from breaking the line.

Planting Under Utility Lines

Height of Fully Grown Tree	Distance from Utility Line
Up to 20 feet	OK to plant within 20 feet of line
Between 20 and 40 feet	Plant at least 20 feet away from line
More than 40 feet	Plant at least 50 feet away from line

Purdue Horticulture and Landscape Architecture maintains a list of trees and shrubs generally less than 20 feet tall when mature, visit www.hort.purdue.edu/ext/trees_utilities.html.

Stay Away from Underground Utility Lines

Many utilities run underground. Local utility companies will mark the underground utility locations for free. Dig your planting holes away from the marked lines.

Stay Away from Septic Fields

Do not plant trees and shrubs over septic absorption fields or close enough that their roots can reach the field. This means you should plant trees 20 to 50 feet away from septic fields and plant shrubs at least 10 feet away.

Call Before You Dig

Protect yourself and your property.

Call 811 before you dig.

The call is free and the location of the underground utility lines on your property will be marked in 48 to 72 hours.

Don't make risky assumptions. Damaging a utility line can knock out service for you or your neighbors. More information available at:

www.call811.com



**Know what's below.
Call before you dig.**

Planting Over Septic Systems

Purdue Extension publication HENV-15-W, *Landscaping Over Septic Systems with Native Plants*, provides information about plants that can be grown over septic absorption fields.

Download it from the Education Store:

www.the-education-store.com

For recommendations specific to your state, contact your cooperative extension service (see the back inside cover).

Tree Selection

Want to know which trees and shrubs will thrive in your landscape?

In Indiana, Purdue Extension offers several publications that can help you select plants:

- *Landscape Plants for Shady Areas* (HO-222-W)
- *Landscape Plants for Areas with Full Sun* (HO-223-W)
- *Landscape Plants for Acid Soils* (HO-224-W)
- *Landscape Plants for Sandy Soils* (HO-225-W)
- *Landscape Plants for Moist to Slightly Moist Areas* (HO-226-W)
- *Landscape Plants for Wet Areas* (HO-227-W)

Find them at the Purdue Extension Education Store:

www.the-education-store.com

Find recommendations for other states by contacting your cooperative extension service (see the back inside cover).

Also, most libraries have reference books that can help you select trees and shrubs. A visit to a park or arboretum will let you see the mature, established form of your chosen plant.

Plant Carefully

Most trees and shrubs will do well if planted early in spring, just before or as new growth starts. Some can also be successfully planted in fall. For detailed information, see Purdue Extension publication HO-100-W, *Planting and Transplanting Landscape Trees and Shrubs*.

To determine the right size for the planting hole, you'll need to measure your new tree's soil and roots (called the root ball). Measure the height of the root ball from the bottom of the root ball to the root flare, the place where the trunk gradually widens and starts to become roots. If necessary, remove some of the soil at the top of the root ball and find the root flare. Dig your hole only as deep as the distance from the bottom of the root ball to the root flare.

The width of the planting hole should be two to three times as wide as the root ball.

After digging, place the root ball in the hole and make sure the root flare is level with the soil surface. Don't

forget to remove the root ball from any container it came in, and if it is covered with burlap, cut back and remove the top half of the fabric. Also be sure to cut and remove any twine or wire from the root ball. Then inspect the roots and remove any roots that are circling the outside of the root ball. Adjust the tree or shrub so it is standing straight, and then add back soil until the hole is filled. Use the soil you removed from the planting hole. Do not add fertilizer, organic matter, or sand to the soil you put around the root ball.



The slight widening at the base of the tree trunk is the root flare.

Newly planted trees and shrubs must be watered if they are to survive. Water thoroughly after planting, then water as needed to make sure the plant receives 1 to 1.5 inches of water (total rain and irrigation) every seven to ten days (see *How Much Water?*, page 15). You may need to irrigate frequently the first few weeks after planting, but this still does not mean you should irrigate every day. Instead, soak the soil thoroughly, and then allow it to dry somewhat before the next watering.



After placing the tree in the planting hole, remove all twine and wire from the root ball and cut back and remove at least the top half of the burlap.

Planting Trees

Purdue Extension offers publications on planting trees and shrubs in Indiana:

- *Planting & Transplanting Landscape Trees and Shrubs* (HO-100-W)
- *Trees Need a Proper Start — Plant Them Right!* (FNR-FAQ-18-W)

Find them at the Purdue Extension Education Store:

www.the-education-store.com

Find recommendations for other states by contacting your cooperative extension service (see the back inside cover).

Solutions to Common Tree and Shrub Problems

Trees and shrubs may have occasional problems. The ones you'll encounter most frequently are:

- Leaf scorch and winter burn
- Chlorosis
- Japanese beetles
- Bagworms

Each of these problems — and recommendations for managing them — is described on the following pages.

Leaf Scorch and Winter Burn

If a plant receives too little water; if its water-conducting system is injured; or if it experiences excessive water loss in hot, windy weather, the leaves can turn brown or black. When the browning occurs uniformly along leaf edges and between the major veins, it is called leaf scorch.

In most cases, no disease or insect is directly causing the damage. Rather, leaf scorch is simply a case of a tree or shrub growing in an environment that is less than optimal. Leaf scorch is most often seen on plants growing in dry conditions; in sunny, hot environments; or on windy sites. Newly planted trees and shrubs also may exhibit scorch.

Leaf scorch usually does not kill plants but it will make the leaves look bad. Over time, leaf scorch may weaken the plant. Once the leaves turn brown there is nothing you can do to turn them green again.



Uniform browning on the edges of leaves is called scorch. It usually indicates the plant needs to be watered more frequently or placed in a shadier site.

If only a few leaves have browned, you may be able to prevent scorch on the remaining green leaves by watering the plant more frequently. This still does not mean you should water every day! Rather, you should increase the frequency — for example, the plant should receive 1 to 1.5 inches of water (total rain and irrigation) every five to eight days instead of every seven to ten days. Make sure to wet the soil deeply each time you water.

Houses on Wooded Lots

Wooded lots are beautiful. Unfortunately, construction can severely damage trees and tree roots.

If your house is new and surrounded by trees, monitor the trees' health. It may be several years before damaged trees begin to decline (for example, you may first see the upper branches begin to die). If you suspect your trees are injured, have them inspected by a certified arborist to make sure they are not a hazard to you or your house.

Wooded lots are shady so lawn grass may not grow well. Try planting low-growing perennials or groundcovers if your grass does not thrive.

Purdue Extension offers publications that can help you select plants for shaded areas in Indiana:

- *Groundcovers for the Landscape* (HO-105-W)
- *Landscape Plants for Shady Areas* (HO-222-W)

Download these publications from the Education Store:

www.the-education-store.com

For recommendations specific to your state, contact your cooperative extension service (see the back inside cover).



The leaves of this evergreen turned brown in spring. This may be winter burn; dehydration caused by strong, drying winds; dry soil; or de-icing salts. Similar symptoms may also be caused by excessive soil moisture, root rot, or the death of new growth stimulated by late summer pruning.

Leaf scorch is not permanent. Next spring, the tree will produce new green leaves. If one of your plants exhibits leaf scorch every year, you may not be watering enough or the plant may not be well adapted to that location. If it's not suited to the location, the only solution is to replace the tree with one more suited to the soil and moisture conditions.

Any kind of evergreen tree or shrub can experience excessive drying in winter (sometimes called winter burn). Evergreen plants exposed to drying winter winds or full sun are prone to winter burn, especially when the ground is frozen or dry.

During the winter, evergreen leaves experiencing winter burn may turn brown or discolor and will not turn green again. When growth begins in the spring, new branches may grow, but then turn brown and die.

To prevent winter burn, water evergreen trees and shrubs during the summer if the weather is dry, and continue to water until the ground freezes. When planting evergreens, choose sites that are protected from winter winds.

Chlorosis

Leaves that are light green or yellow rather than a healthy dark green may have a condition called chlorosis (yellowing). Compacted soils, poor drainage, and root damage can cause chlorosis. However, one of the most common causes of chlorosis is alkaline (high pH) soils that prevent plants from taking up two important nutrients: iron and manganese.

If leaves are abnormally yellow and you suspect chlorosis, have your soil tested and specifically request a test for iron and manganese. If iron and manganese levels are sufficient, a high soil pH (7.0 or above) may be causing the problem (a soil test will also tell you the pH of your soil).

Many trees will grow in soils with a pH greater than 7.0, even 7.5, without developing chlorosis. A few popular landscape plants — pin oaks, red maples, river birch, and bald cypress — are especially prone to this problem. They will get chlorosis every year if planted in high pH soils.



The yellow between the veins on this leaf indicate chlorosis.

The best way to avoid problems with chlorosis is to select trees and shrubs adapted to the pH of your soil. If existing plants already have chlorosis, you can try to lower the pH of the soil or, in some cases, provide supplemental iron. Unfortunately, these solutions are often only temporary and treatment may be needed every year.

Treating Chlorosis

For more information on treating chlorosis in existing plants, see Purdue Extension publication BP-27-W, *Iron Chlorosis of Trees and Shrubs*.

Download it free from the Education Store:

www.the-education-store.com

Find recommendations for other states by contacting your cooperative extension service (see the back inside cover).

Japanese Beetles

Adult Japanese beetles are a problem in many parts of the Midwest. They are active in June, July, and August. These metallic green insects are voracious eaters, feeding on the flowers and leaves of hundreds of different plants. Certain plants (such as roses, hollyhocks, lindens, and grapes) will attract Japanese beetles almost every year.

There are several things you can do — and should avoid doing — to reduce Japanese beetle damage:

- **Choose less susceptible plants.** See *Plants Relatively Free of Feeding by Adult Japanese Beetles*, page 30.
- **Pick off and destroy the first beetles to arrive and the leaves or flowers they damage.** You may find fewer beetles attack your plants later in the season if you are proactive when they first arrive.



Photo by Steve Mayer

Japanese beetles often eat all but a leaf's veins, which gives leaves a lace-like appearance.

- **Physically remove the beetles from your plants every few days.** For example, you might place a bucket of soapy water under the infested plant, and then shake the plant so the beetles fall into the water. This works well on cool mornings when the beetles are sluggish.

An additional measure for small, high-value plants is to exclude the beetles by placing a fine mesh netting over the plant. Netting all your plants is impractical.

- **Apply a repellent to keep Japanese beetles away from your plants.** Products containing neem and products with the active ingredient azadirachtin will repel Japanese beetles. However, if you have lots of Japanese beetles, you may still see damage to your plants. Apply these repellents regularly before plants are severely damaged and when the adult beetles are active, but no more than once a week.
- **Apply insecticide when the damage becomes aesthetically unacceptable.** Beetles will not kill established, healthy trees and shrubs, but leaves and flowers eaten by Japanese beetles are unattractive. If you feel treatment is warranted, insecticides containing acephate, carbaryl, imidacloprid, cyfluthrin, deltamethrin, and permethrin are effective. These insecticides will kill feeding beetles, but will not repel them.

Be careful. These insecticides also kill bees, which are important pollinators of many plants. Do not spray insecticide on flowers that are attractive to bees. Remember to always read and follow the insecticide label.
- **Do not use Japanese beetle traps.** Yes, you may kill a lot of beetles, but you also attract many more to your yard. You will see more Japanese beetle damage on your plants with a trap than without one.

Help for Insects and Diseases

Information about diseases and insects that attack trees, shrubs, vines, and flowers, is available from your extension service (see the back inside cover).

In Indiana, find information from Purdue Extension about:

Insect pests:

extension.entm.purdue.edu

Plant diseases:

www.ag.purdue.edu/btny/Extension/Pages/extpubs.aspx

Plants Relatively Free of Feeding by Adult Japanese Beetles

conifers	red maple
boxwood	shagbark hickory
flowering dogwood	Kousa dogwood
holly	tuliptree
sweetgum	magnolias
white oak	scarlet oak
black oak	common lilac
some crabapples	

Plants are listed here by their common names. The publications below provide more information, including scientific names.



There are some plants Japanese beetles don't find attractive, including this Kousa dogwood.

Purdue Extension has more information about controlling Japanese beetles:

- *Japanese Beetles in the Urban Landscape* (E-75-W)
- *Crabapples Resistant to Apple Scab and Japanese Beetle in Indiana* (ID-217-W)

Download them free from the Education Store:

www.the-education-store.com

Find recommendations for other states by contacting your cooperative extension service (see the back inside cover).

Bagworms

They may look like miniature pinecones, but bagworms are really caterpillars wrapped up in protective clothing.

These caterpillars build a bag out of leaves and then carry it around as they eat and grow. They are most often seen on needle evergreens, but can be found on many different trees, and even on the sides of buildings. Severe infestations can completely defoliate and kill an evergreen.

Bagworm caterpillars are active from June through late summer. Removing the bags by hand and destroying them is an easy control method. It is also the *only* control method from fall through spring when the bags are large and insecticide resistant.

The caterpillars are most susceptible to insecticides when they are active in summer and the bags are small.

If you find active bagworms on your trees and choose to use an insecticide, spray the foliage thoroughly in June with a product containing *Bacillus thuringiensis kurstaki* (*Btk*) or spinosad. Check two weeks later and, if there are still active bagworms, repeat the insecticide treatment. Spinosad products can be used even on larger bagworms as long as they have not stopped feeding (feeding usually continues into August).



Bagworms can be controlled by picking off the bags. Some insecticides will also control this pest.

Emerald Ash Borer

Emerald ash borer is a serious pest of ash trees. If you have ash trees in your yard, you need to learn more about this pest. Because of this pest, ash trees are no longer recommended for planting in much of the Midwest.

Find everything you need to know, including how to determine if your tree is an ash, at:

www.emeraldashborer.info

Garden Flowers

A landscape in full bloom is a wondrous sight. Annuals and perennials can be combined to surround your home with color and add year-round interest.

This section includes information on:

- Selecting your flowers
- Preparing and planting your flower garden
- Caring for your flowers
- Growing flowers in containers
- Solutions to common flower problems



Photo by Mary Welch-Keesey

Flowering perennials, like this wild indigo (*Baptisia australis*), are wonderful additions to the landscape.

Selecting Your Flowers

Annuals last for only one summer and must be replanted each year. You can change the look of your garden each year simply by changing the annuals you grow. Most annuals also bloom all summer, an added advantage.

Perennials, including bulbs such as daffodils and crocus, will live and bloom for many years. Perennials often bloom for only a few weeks and always at a specific time of year (for example, tulips usually flower in April). It can be fascinating to grow perennials since the garden is continuously colorful but continually changing through the year.

An incredible variety of annuals and perennials is available at garden centers and by mail order. When selecting flowering plants for your yard, consider:

- Their preference for sun or shade
- Their preference for soil moisture
- The final size of the plant

If you are buying perennials, also make sure they are suited to your USDA hardiness zone (see *Climate and Your Plants*, page 4). Don't assume. Always check the tag or other references to confirm plant hardiness.

Preparing and Planting Your Flower Garden

Before planting your annuals and perennials, loosen the soil by digging or tilling, and then mix in organic matter such as compost, sphagnum peat, or aged manure. Once the soil is loose, it is easy to dig a planting hole for each new plant.

Make the planting hole twice as wide as the plant's root ball. The depth of the hole should equal the height of the root ball. Remove the plant from its container, set the root ball in the hole, and gently firm the soil around it. Water well immediately after planting. New plants may need extra water for the first few weeks after planting.

Most annuals and perennials do well when planted in spring, but be careful! Many annuals are sensitive to cold and should be planted only after the danger of frost has passed, usually two weeks after the average last frost date (see *Climate Information*, page 5).

Plant hardy bulbs (for example, daffodils, tulips, crocus, hyacinth) in fall after the weather has cooled (October-November). Plant them deep enough so the bottom of the bulb is at a depth that is three times the height of the bulb. Place the bottom of the bulb (the part with the hairy roots) down, not up.

Caring for Your Flowers

Many flowering plants thrive if they receive about 1 to 1.5 inches of water a week (total rain and irrigation) while they are growing (see *How Much Water?*, page 15). Water deeply and infrequently rather than daily. Pay attention to the plants — some need more water than this, some less.

Fertilize perennials in the spring as they begin to grow. Test your soil to determine the best fertilizer to use. If you don't have results from a soil test, use a fertilizer that contains nitrogen, phosphorus, and potassium (such as 10-8-6, 12-12-12, etc. — see *The Numbers on the Bag*, page 11). Apply 2 teaspoons of fertilizer per square foot (2 to 3 pounds of fertilizer by weight for 100 square feet or 1 pound of actual nitrogen for 1,000 square feet).



Many flowering plants need 1 to 1.5 inches of water a week (total rain and irrigation).

Fertilize annuals soon after planting. They need additional fertilization every four to six weeks to keep them blooming and looking their best.

After the flowers fade, some gardeners remove the spent blooms. This is called deadheading. Deadheading may stimulate the plant to produce more flowers (annuals

often respond in this way). Although some plants require deadheading to look their best, the decision to deadhead is personal. Some homeowners like the look of dried flower heads on their plants while others do not. Some dried flowers also provide food for wildlife in winter and will drop seeds, sometimes producing new plants in the spring.

Growing Flowers in Containers

One of the most popular ways to grow flowering plants is in containers. You can use containers to add a splash of color wherever you want — by your doorstep, on a patio, even indoors.

Many different types of containers will work, but always use a container that has drainage holes in the bottom. Garden soil drains slowly and is usually not recommended for containers. Instead use a soilless potting mix that contains ingredients such as peat, perlite, and vermiculite. These mixes are readily available at garden centers.



Always use containers that have drainage holes on the bottom.

Outdoor container plants need frequent watering, often once and sometimes even twice a day during the hottest weather. Make sure to water these plants thoroughly, so water runs out the drainage holes. Flowering plants grown in outdoor containers need more frequent fertilization too, often every two to four weeks, to keep them looking great.

Growing Flowers

Purdue Extension offers publications on growing Flowers in Indiana:

- *Growing Perennial Flowers* (HO-61-W)
- *Recommended Perennial Flowers* (HO-79-W)
- *Flowering Bulbs* (HO-86-W)
- *Annual Flowers* (HO-80-W)
- *Growing Annual Flowers* (HO-99-W)
- *Ornamental Grasses for Indiana Landscapes* (HO-219-W)
- *Container and Raised Bed Gardening* (HO-200-W)
- *Diseases of Landscape Plants: Powdery Mildew* (BP-5-W)
- *Flower Garden Pests* (E-70-W)
- *Spider Mites on Ornamentals* (E-42-W)

Download them free from the Education Store:

www.the-education-store.com

Find recommendations for other states by contacting your cooperative extension service (see the back inside cover).

Solutions to Common Flower Problems

Even the best flowers have an occasional problem. The ones you'll encounter most frequently are:

- Powdery mildew
- Aphids
- Spider mites

Each of these problems — and recommendations for managing them — is discussed on the following pages.

Powdery Mildew

Some flowering plants are prone to a fungal disease called powdery mildew, which looks like white powder sprinkled on the top of the leaves.

Some varieties of zinnia, bee balm, garden phlox, some shrubs (such as old-fashioned lilac), and roses get powdery mildew on a regular basis. Some plant varieties are resistant to powdery mildew infection. Check the plant's label, especially when purchasing bee balm and garden phlox, to make sure the variety you have chosen is mildew resistant.

Powdery mildew is usually easy to diagnose. If you are unsure if this is the problem, your extension office can help with the diagnosis.

Because many plants will survive a powdery mildew infection, chemical control is not usually recommended. Good gardening practices, such as selecting resistant varieties and giving plants the space they need, may help reduce powdery mildew.

If you decide to use a fungicide, choose one labeled for powdery mildew and your plant. Treat at the first sign of mildew, and always read and follow label directions. The fungicide will not cure leaves that are already infected, but it will keep new leaves from getting the disease.



Photo by Mary Welch-Keesey

Powdery mildew symptoms look like a white powder on the upper surface of leaves.

Plants to Avoid

Not all plants are good additions to your yard or garden.

In Indiana, information to help you avoid plants that spread is available from Purdue Extension publication HLA-1-W, *Spreading Ornamental Plants: Virtues & Vices*.

Download it free from the Education Store:

www.the-education-store.com

In Indiana, more information about invasive plants is available in plant assessments developed by the Invasive Plant Species Assessment Working Group at:

www.in.gov/dnr/4619.htm

In other states, more information is available from the USDA National Invasive Species Information Center:

www.invasivespeciesinfo.gov

Aphids

These small insects come in many colors — black, yellow, orange, green, and red. They feed on plants by sucking juices out of the stems and leaves.

Many plants can easily survive an aphid infestation, but if the plant begins to suffer (or you just don't like the aphids), they can be removed easily with a strong stream of water. Repeat every few days until no aphids are present.

Aphids are sensitive to insecticidal soap and other insecticides. If you decide an insecticide is needed, choose a product labeled for aphids and your plant, and always read and follow label directions.



Aphids come in many colors and can be easily controlled with a strong stream of water.

Spider Mites

White or yellow speckling on the leaves is often a sign of spider mite damage. Spider mite infestations are hard to diagnose because the mites are barely visible to the naked eye and are often on the undersides of the leaves. Sometimes (but not always) you will see webbing similar to what a spider might leave.

Spider mite problems usually appear in hot, dry weather. Control these pests by washing them off the plants with a strong stream of water, repeating as necessary. Spider mites are also sensitive to insecticidal soap.

If you suspect spider mites, inspect several leaves with a magnifying glass or, in Indiana, seal the leaves in a plastic bag and bring them to your Purdue Extension county office so they can confirm the diagnosis.



Yellow speckling on a plant's leaves may indicate a spider mite problem. These pests are tiny and difficult to see.

Wildlife

While most homeowners thrill to the sight of a cardinal, other animals may not bring such pleasure. Deer, geese, chipmunks, rabbits, and other creatures can damage plants — sometimes severely.

Find more information about managing the wildlife in your yard by visiting the Wildlife Conflicts Information Hotline:

www.wildlifehotline.info

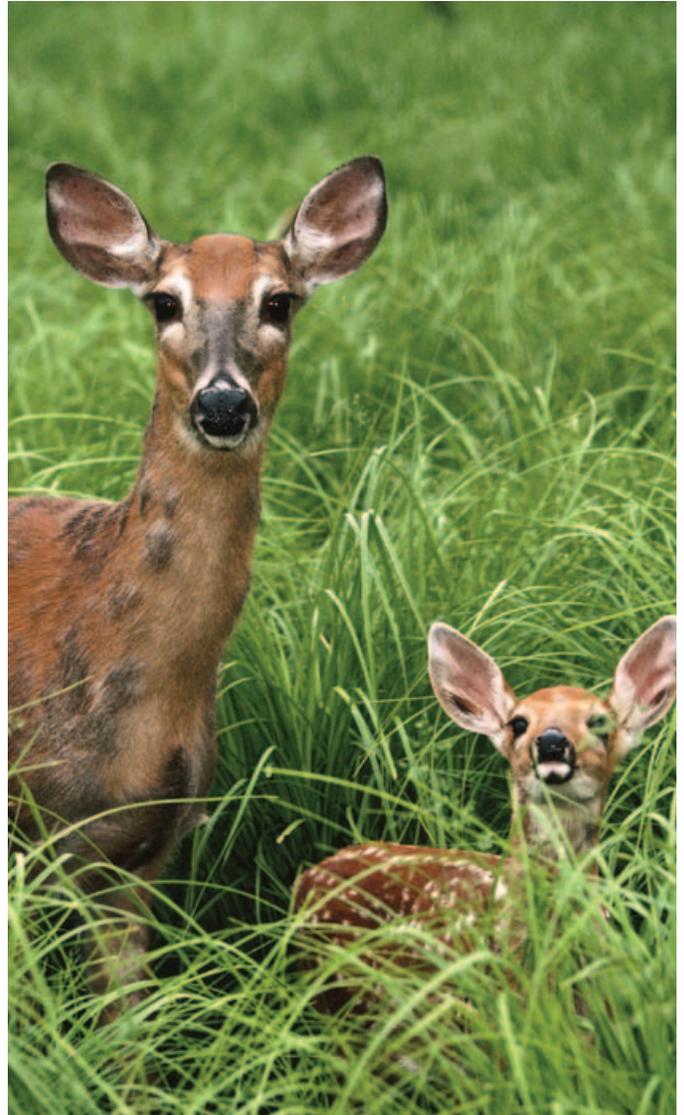
In Indiana, Purdue Extension offers publications on wildlife control

- *Conflicts with Wildlife Around the Home* (PPP-56)
- *Preventing Wildlife Damage — Do You Need a Permit?* (FNR-404-W)

Download them free from the Education Store:

www.the-education-store.com

Find recommendations for other states by contacting your cooperative extension service (see the back inside cover).



Although beautiful, some animals (like deer and rabbits) can damage plants in your yard.



Additional Resources

The resources listed in this section provide more information on the topics covered in this guide. Indiana residents can request copies of Purdue Extension publications from their county offices. Anyone can download or order copies from the Purdue Extension Education Store:

www.the-education-store.com

Purdue Extension Publications

Pesticides and Pesticide Safety

- Pesticides and the Home, Lawn, and Garden* (PPP-29)
- Pesticide Safety and Calibration Math for the Homeowner* (PPP-39)
- Landscape Pesticide Application Equipment: A Guide to Selection and Calibration of Liquid Sprayers* (PPP-47)
- Pesticides and Pest Prevention for the Home, Lawn, and Garden* (PPP-34)

Climate and Soil

- Collecting Soil Samples for Testing* (HO-71-W)
- Landscape Plants for Shady Areas* (HO-222-W)
- Landscape Plants for Areas with Full Sun* (HO-223-W)
- Landscape Plants for Acid Soils* (HO-224-W)
- Landscape Plants for Sandy Soils* (HO-225-W)
- Landscape Plants for Moist to Slightly Moist Areas* (HO-226-W)
- Landscape Plants for Wet Areas* (HO-227-W)

Lawns

- Establishing Turfgrass Areas From Seed* (AY-3-W)
- Establishing a Lawn from Sod* (AY-28)
- Purchasing Quality Grass Seed for Your Lawn* (AY-25-W)
- Maintenance Calendar for Indiana Lawns* (AY-27)
- Mowing, Thatching, Aerifying, and Rolling Turf* (AY-8-W)
- Fertilizing Established Lawns* (AY-22)
- Irrigation Practices for Homelawns* (AY-7)
- Seeding a Turf Area in the Spring* (AY-20)
- Lawn Improvement Programs* (AY-13)
- Improving Lawns in Shade* (AY-14)
- Groundcovers for the Landscape* (HO-105-W)
- 7 Steps to a Better Home Lawn* (AY-32-W)
- Should I Hire a Professional Lawn Care Service?* (AY-26)
- Control of Broadleaf Weeds in Home Lawns* (AY-9-W)
- Control of Crabgrass in Home Lawns* (AY-10-W)
- Identification and Control of Perennial Grassy Weeds* (AY11-W)
- Japanese Beetles in the Urban Landscape* (E-75-W)
- Wildlife Conflicts Management: Moles* (ADM-10-W)

Trees and Shrubs

- Planting & Transplanting Landscape Trees and Shrubs* (HO-100-W)
- Trees Need a Proper Start — Plant Them Right!* (FNR-FAQ-18)
- Landscaping Over Septic Systems with Native Plants* (HENV-15-W)
- Fertilizing Woody Plants* (HO-140-W)
- Pruning Ornamental Trees and Shrubs* (HO-4-W)
- Trees Need a Proper Start — Prune Them Right* (FNR-FAQ-19-W)
- Should Newly Planted Trees Be Staked and Tied?* (FNR-FAQ-6)
- Transplant Shock of Trees and Shrubs* (BP-31-W)
- Leaf Scorch of Trees and Shrubs* (BP-25-W)
- Winter Injury of Ornamentals* (BP-2-W)
- Iron Chlorosis of Trees and Shrubs* (BP-27-W)
- Diseases of Landscape Plants: Leaf Diseases* (BP-143-W)
- Japanese Beetles in the Urban Landscape* (E-75-W)
- Crabapples Resistant to Apple Scab and Japanese Beetle in Indiana* (ID-217-W)
- Bagworms* (E-27-W)

Flowers

- Growing Perennial Flowers* (HO-61-W)
- Recommended Perennial Flowers* (HO-79-W)
- Flowering Bulbs* (HO-86-W)
- Annual Flowers* (HO-80-W)
- Growing Annual Flowers* (HO-99-W)
- Spreading Ornamental Plants: Virtues and Vices* (HLA-1-W)
- Ornamental Grasses for Indiana Landscapes* (HO-219-W)
- Ground Covers for the Landscape* (HO-105-W)
- Annual and Perennial Vines* (HO-21-W)
- Container and Raised Bed Gardening* (HO-200-W)
- Hanging Baskets* (HO-126-W)
- Diseases of Landscape Plants: Powdery Mildew* (BP-5-W)
- Flower Garden Pests* (E-70-W)
- Spider Mites on Ornamentals* (E-42-W)

Wildlife

- Conflicts with Wildlife Around the Home* (PPP-56)
- Preventing Wildlife Damage — Do You Need a Permit?* (FNR-404-W)

Organic Gardening Resources

From Purdue

Common Natural Enemies (E-92-W)

Using Organic Fungicides (BP-69-W)

Organic Vegetable Production (ID-316)

Purdue Alternative Control Outreach Research Network (ACORN)
www.agriculture.purdue.edu/acorn

From Others

Organic Gardening Resources from eXtension
www.extension.org/pages/Organic_Gardening_Resources#

National Sustainable Agriculture Information Service
www.attra.org
Especially the Ecological Pest Management Tool

Other Purdue Resources

Purdue Plant and Pest Diagnostic Laboratory
www.ppd.l.purdue.edu

List of Commercial Soil Testing Laboratories
www.agry.purdue.edu/ext/soiltest.html

Purdue Turf Fertilizer Calculator
www.agry.purdue.edu/turf/fertcalc/Fertilization%20calc.html

Wildlife Conflicts Information Hotline
www.wildlifehotline.info

Purdue University Consumer Horticulture
www.hort.purdue.edu/ext/conhort.html

Purdue Master Gardener Program
www.hort.purdue.edu/mg

Other Resources

Using Mulches in Managed Landscapes, Iowa State University Extension publication SUL 0012
www.extension.iastate.edu/Publications/SUL12.pdf

International Society of Arboriculture
www.treesaregood.org or (217) 355-9411
University Diagnosticians
www.apsnet.org/directories/univ_diagnosticians.asp

Indiana Gardener's Guide, Jo Ellen Meyers Sharp and Tom Tyler, revised edition, 2003.

The Well-Tended Perennial Garden, Tracy DiSabato-Aust, expanded edition, 2006.

Manual of Herbaceous Ornamental Plants, Steven M. Still, 1994.

Armitage's Garden Perennials, Allan M Armitage, 2000.

Dirr's Hardy Trees and Shrubs, Michael A. Dirr, 1997.

Manual of Woody Landscape Plants, Michael A. Dirr, fifth edition, 1998.

Go Native! Carolyn Harstad, 1999.

Other State Extension Services

Illinois

University of Illinois Extension
www.extension.illinois.edu

Iowa

Iowa State University Extension
www.extension.iastate.edu
Hortline
(515) 294-3108

Kentucky

Kentucky Cooperative Extension Service
ces.ca.uky.edu

Michigan

Michigan State University Extension
www.msue.msu.edu
(888) MSUE-4MI (678-3464)
Gardening in Michigan
www.migarden.msu.edu

Minnesota

University of Minnesota Extension
www.extension.umn.edu

Missouri

University of Missouri Extension
extension.missouri.edu
(800) 292-0969

Ohio

Ohio State University Extension
extension.osu.edu
Buckeye Yard and Garden onLine
bygl.osu.edu

Pennsylvania

Penn State Cooperative Extension
extension.psu.edu

Wisconsin

University of Wisconsin-Extension
www.uwex.edu

eXtension

eXtension connects users with land-grant universities and experts across the country
www.eXtension.org



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