General Gardening Practices

chapter 9

UNIVERSITY OF WISCONSIN–MADISON • DIVISION OF EXTENSION
FOUNDATIONS IN HORTICULTURE

In a nutshell...

- Gardens are not maintenance-free; general techniques apply to most of what you want to grow.
- Remember: Start small. Plant the right plant in the right place. Take time to enjoy your garden.
- Mulching and adding organic matter are key practices that prevent or mitigate many common garden problems.
- Check the resources at **hort.extension.wisc.edu** for issues not covered in this chapter.

MASTER GARDENER
UNIVERSITY OF WISCONSIN–MADISON
DIVISION OF EXTENSION

Introduction

There is no such thing as a maintenance-free landscape. All plants need some care or management, unless they are growing in the wild. Although some plants require specialized care techniques, many practices used to maintain healthy and attractive plants are applicable to a wide variety of plants—including annual and perennial flowers, vegetables, fruits, trees, and shrubs. This chapter provides a solid foundation, based on university research, for these common gardening practices.

Learning objectives

1. Become familiar with the variety of techniques available for gardening and IPM.
2. Learn methods for garden and landscape maintenance.
3. Understand the impact of cultural methods on plant health.
4. Understand that different plants need different conditions and how matching them to your site environment is important.
5. Understand how hardiness zones impact plant selection.

Before you plant

Site selection

Before you put any plants in the ground, you need to choose where to put them. Think about the role the plants will play in the landscape and whether they will be used as individual specimen plants—such as a tree planted in the middle of a lawn—or in a grouping as in a defined planting bed. Light exposure, soil type, existing features, proximity to structures, and other factors will play a part in this decision.

When designing permanent beds, it is important to make them only as wide as you can access from paths, so you won't need to step in the beds. A common permanent bed width is 3½ feet. See chapter 16, Landscape Design for more detailed ideas on designing and planning before you plant.

Soil is, without a doubt, the most critical factor in gardening success. Very few home landscapes have ideal soil—many have been affected by home construction, compaction, and grade changes, among other things. Yet those "plant care" tags on most garden plants tend to specify an "evenly moist, well-drained soil"—an ideal that is difficult to find in the Midwest, with our wet springs and hot, dry summers.

Adequate organic matter is key. Organic matter provides plants with nutrition—healthy soils require little or no fertilization and less watering than poor soils. Organic matter also nourishes organisms that create and

maintain quality soils. Soil pH heavily influences plant health and survivability as well; some plants are tolerant of a wide range of pH, some prefer acidic conditions, and some alkaline. Regardless of what types of plants you desire, take soil samples so you know the properties of your soil, research what your plants need, and take the time to make the necessary adjustments. It's much easier to do so before you plant than after, and you will kill far fewer plants in the process. See chapter 2, Soils.

Proper plant siting—often referred to as "right plant, right place"—is essential. Consider the eventual mature size of each plant and give it adequate room to grow. This may seem obvious, but many people select a plant that will outgrow the area and feel that they can prune, shear, or otherwise restrict its natural growth to make it fit. You can do this to some degree, but most often the plant eventually wins out. It also creates unnecessary garden labor. It's better to select species and cultivars that will fill the space over time without your intervention.

Right plant, right place also refers to understanding a plant's cultural conditions and meeting them. Sunlight, pH, fertility, water needs, and urban tolerance are some site conditions necessary for a healthy plant. Using native plants is a popular but not fail-safe approach; even if a given plant was indigenous to your site at one point in time, the conditions may have changed so much over time that it may no longer thrive.

Plants have differing light requirements. Some prefer full sun, and others need shade. A common categorization is:

- Full sun: 6 hours and more sunlight.
- Part sun: 4–6 hours, generally afternoon sun.
- Part shade: 2–4 hours, generally morning sun.
- Full shade: Less than 2 hours of sunlight (few plants tolerate this).

Many resources will reference a plant's "tolerance"—for instance they will label a plant shade-tolerant. Note that this means it will tolerate shade but not necessarily thrive in it.

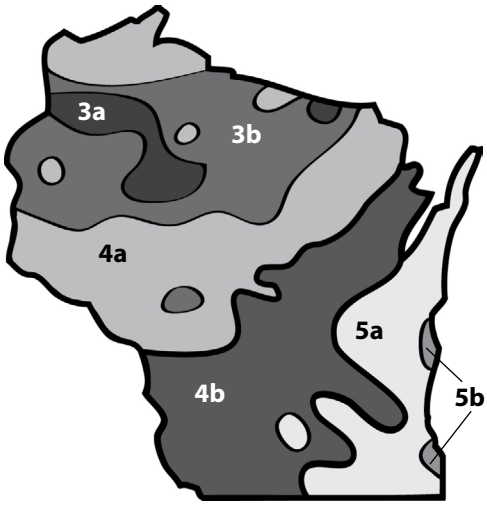
Choosing hardy plants

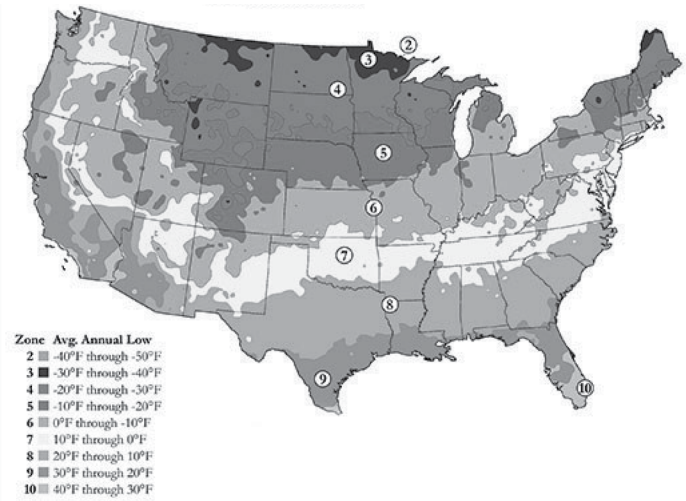
Not all plants will survive Wisconsin's harsh winters. The first step in selecting perennial plants that will thrive in your Midwest garden is to know your cold hardiness zone.

The U.S. is divided into 10 growing zones (figure 1). Each of the zones shows an average minimum winter temperature. All plants, shrubs, and trees are classified according to the minimum winter temperature they can reliably survive. Some plants that are perennials in warmer zones are grown as annuals in cooler climates.

Wisconsin's growing zones are zones 3, 4, and 5. Colder climate zones are divided into A and B sections, with A being the colder portion. Note that the map is revised periodically to reflect changes in actual climate.

FIGURE 1. Wisconsin and U.S. growing zones





For example, if you live in zone 5A, plants listed as zones 5 and lower are likely to survive the area's winters. If you live in zone 4, however, zone 5 plants would not likely survive.

It is important to remember that zone alone does not ensure survivability. An unseasonably bad winter, drought, poor soils, and many other conditions can cause plants to die. What is often not mentioned is that survival using zone designation is based on the assumption that you have proper soil conditions, including but not limited to drainage, porosity, organic matter content, and pH, as well as geographical, environmental, and cultural considerations.

- Most bigleaf hydrangeas (*Hydrangea macrophylla*) are hardy to zone 5 but do poorly in alkaline soils.
- Many coral bells (*Heuchera* hybrids) are perfectly hardy to zone 4 but languish without adequate organic matter and evenly moist soils in hot Midwest summers.
- Many of the zone 5 beardtongues (*Penstemon* species) that thrive in the harsh winters of Denver will fail in a Midwest winter because they require very sharp drainage, which is common in Colorado but not in Wisconsin.
- Some perennials and bulbs require a certain amount of winter cold to flower and begin spring growth. Lilacs are a good example; they are perfectly hardy in the southern U.S. but need a cold period in order to stimulate flower buds. Apples also need a cold dormancy period to flower and fruit.

Other plants have what is called a **provenance**. This means their native range is so large that it covers a range of zones. Eastern redbud (*Cercis canadensis*) is native from Florida's zone 9 to Wisconsin's zone 5 so it is labeled as hardy to zone 5. Stock sourced from Georgia seed, however, will only be hardy in the area it is from and will die in the Midwest. This creates a problem because it is usually difficult to determine the original seed source for such plants.

Areas of the yard protected by walls, buildings, hedges, and trees can create **microclimates** by affecting wind flow and temperature, leading to frost pockets or warm spots. These microclimate areas may let you grow perennials that would not normally survive the winter or create an area where plants freeze earlier or the ground stays cold longer in the spring. Take these situations into consideration when choosing your garden site and plants.

Cold winter temperatures are not the only reason zone-appropriate plants don't survive winters in the Midwest. Some make it through the coldest temperatures of January and February only to be exposed to alternating freezing and thawing in March and April. The resulting heaving of soils can break up shallow roots and kill plants. To encourage deep roots, create deep, porous soils with good drainage, water and fertilize properly, and keep your plants healthy enough to expend their energy on root growth.

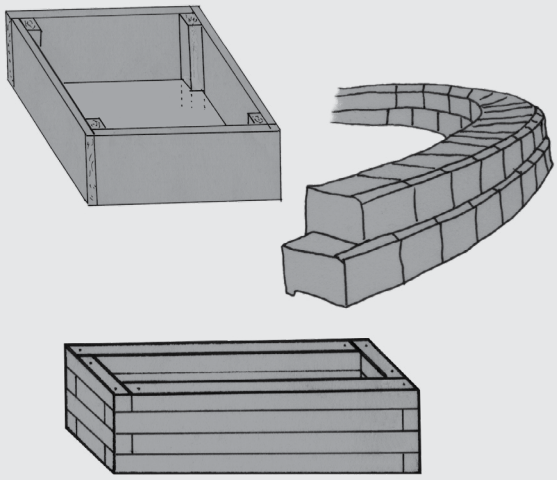
Other than dense, compacted, organically depleted soils, the biggest killer of plants is planting the wrong plant in the wrong place. The key is to first determine if a plant fits your zone designation and then determine if your site can meet its ideal cultural needs.

Preparing a planting bed

After carefully considering the suitability of your site, define the area to be planted. Ideally you will begin preparing the site the year prior to planting. Take a soil sample for testing. The results will tell you pH, percent organic matter, and an estimate of plant-available nutrients. Taking samples the year before planting allows time to adjust soil pH, phosphorus, or potassium in advance. Another benefit is that soil worked in the fall will dry out faster and warm up earlier the next spring, making it possible to start planting earlier. For sites with poor or heavily compacted soil, raised beds are an option.

Raised bed gardening

- Raised beds are useful in situations where soil or drainage is poor or where more visual impact is desired. Raised beds also help make gardening more accessible. The soil in raised beds warms up sooner in the spring as well.
- You can build raised beds with a variety of materials, including landscaping timbers or 2-inch thick boards (preferably untreated), stones, concrete landscaping blocks, or by simply mounding soil to the desired height.



- Annuals are better suited for raised beds than perennials, because the soil freezes harder in winter than it does with in-ground gardens, which may damage perennial roots.

If mounding, pile the soil 6 to 12 inches above the surrounding grade.

- Monitor the soil moisture in raised beds, which may dry out faster than in-ground gardens.

Removing turf and weeds

There are several ways to turn lawn into a new garden space. Existing turf can be dug out, smothered by covering with black plastic or a thick layer of organic matter such as newspaper, or killed with a non-selective herbicide such as glyphosate.

- Digging out the grass is the most labor intensive, but requires little planning ahead. This option can be problematic, however, because some grass roots will remain in the soil and regrow in the new garden.
- You can smother the grass with very thick layers of newspaper, grass clippings, compost, mulch, or a layer of plastic, but this requires planning in advance. It will take a month or more for the grass beneath the smothering layer to die.
- A faster alternative is to use a non-selective herbicide (such as glyphosate) to kill the grass and any existing weeds. The grass should start to turn yellow in 10 to 14 days, although you can remove or till it before that time.

For vegetable gardens, any dead plants should be removed prior to working or tilling the soil. Areas that were recently lawn might contain wireworms and white grubs that can damage the roots of new plantings for up to a year. Planting vegetables into recently killed or tilled turf may pose further problems as the large amounts of un-composted organic matter can attract insects such as seed corn maggots to the garden.

If the area has been weedy for some time, control the weeds before you plant, preferably during the previous year. Working the soil will bring weed seeds to the surface, where they will have sufficient light to germinate and grow. Before these plants produce seeds themselves they should be smothered, killed with an herbicide, or tilled again. Tilling will bring up more weed seeds—repeat the process until most of the seeds have germinated and weeds killed.

Preparing the soil

The best time to add organic matter is when you are preparing your planting beds. Apply a 4- to 6-inch layer of organic matter such as well-rotted manure, compost, leaf litter, peat moss, or coir (see box). Although peat moss is a good source of organic matter, it is not a renewable resource so you may want to avoid using it. Spread the organic matter on the surface and work it into the soil to a depth of 6 to 8 inches.

What is coir?

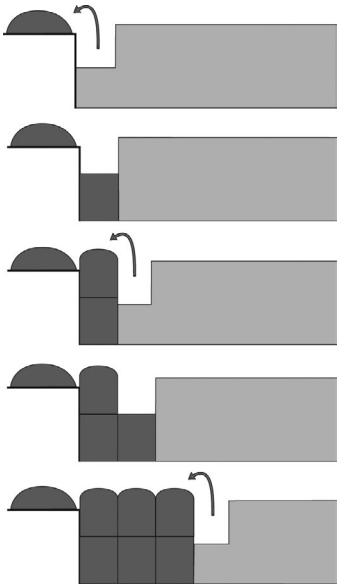
Coir is a substitute for peat moss that is renewable since it is a by-product of coconut production. It improves drainage and air space in heavy soils in the same way as peat moss, plus it breaks down more slowly, re-wets more easily, and compresses into smaller bales. Unlike peat moss it is not acidic and will not ward off water mold fungi or acidify the soil. Coir is sold in two grades: one with larger chunks suitable for use as a mulch and another that has only fine fibers and can be used as a soil amendment.

The method you choose to prepare the soil depends on your site, physical abilities, and preference. Small areas can be turned with a shovel or spading fork. Rototillers can incorporate organic amendments more easily than with a shovel. However, frequent rototilling can be detrimental to soil structure. Unnecessary tillage of any type is not good because it promotes soil compaction.

Double digging is a process of improving the soil by mixing and incorporating amendments to a much deeper level than normal tilling or digging. This is strenuous, labor-intensive work, but perennials will greatly benefit from the rich, deep soil.

- To begin, dig a trench the depth of a shovel (10 to 12 inches) across one end of the bed and set the soil aside (see figure 2).
- Then, dig up and loosen another shovel's worth of soil below that, adding compost and/or other soil amendments.
- Remove the next shovel-width of soil and place it above the area you previously dug to replace the top layer. Continue until the entire bed has been dug. Replace the soil from the first trench in the last area.

FIGURE 2. Double digging



After tilling or digging, add any fertilizer your soil test report recommends for the plants you will be growing in this area, if appropriate—trees and shrubs should not be fertilized at planting and nitrogen should not be added in the fall. Apply it to the surface of the tilled garden and work it in by running a garden rake lightly over the soil.

Another method for improving soil before planting a new bed and to protect bare soil from weeds is to plant a **cover crop**. See chapter 14, Vegetables for more information.

In the spring and prior to planting, loosen the soil again and incorporate needed fertilizer, according to the soil test recommendations. Finally, rake the bed smooth in preparation for planting.

Planting

Some garden flowers, vegetables, and small fruit crops are best planted as transplants—small plants complete with leaves, stems, and roots. Trees and shrubs are most commonly planted as large transplants. Others—especially annual flowers and vegetables—can be successfully started inside as seeds or planted directly into the garden bed where they will grow.

Transplants

A variety of transplants are readily available from garden centers, greenhouses, and even by mail. When shopping for transplants, look for sturdy, bushy plants. Avoid leggy, spindly plants that tip over in their containers. Look the transplants over for signs of disease and insects. Yellowing or browning leaves may be signs that the plants previously suffered drought stress or nutrient deficiencies.

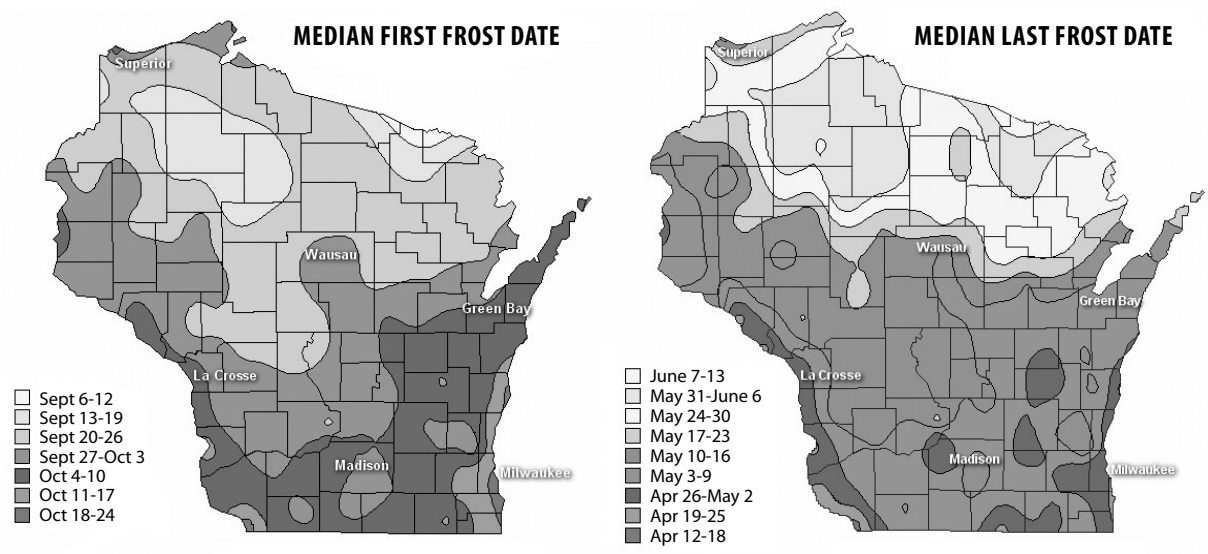
Good quality transplants need not be in flower at the time of purchase. In fact, plants not yet in flower often transplant best because they are better able to recover from transplant shock.

When the danger of damaging frost has passed (see figure 3, median last frost date), transplants grown indoors or purchased elsewhere can be planted outdoors in their permanent growing location, after **hardening off** (gradually exposing the young plants to outdoor conditions). Hardy plants typically can be planted outside two weeks earlier than tender plants, as they are able to tolerate the cooler nighttime temperatures and possible light frosts.

Tips for transplanting success:

- Plant transplants in the evening or on a cloudy day, so that the plants have an easier time recovering from the shock of being transplanted. Shade the transplants if the weather is hot or sunny.
- Lay out the plants so that there is enough space for them to attain their mature size.
- Water the plants the day before transplanting or soak the transplants well before taking out of their containers.
- Protect tender transplants from strong winds.

FIGURE 3. Average day of first and last frost in Wisconsin



Source: Wisconsin State Climatology office (1971-2000)

Carefully remove the transplant from its container, being careful not to damage the roots or stem (figure 4). Push the root ball out of flexible containers, or use a knife or other tool to gently lift the roots out of more rigid containers. If the roots have become a bit root-bound in the container (the root mass retains the shape of the container when removed), gently break apart the root ball prior to planting. Being root-bound is common on older transplants; you'll need to break the root ball apart to encourage the roots to grow out into the surrounding soil. Very tight root balls may need to be cut vertically in several places to encourage new root growth and branching.

Dig an ample hole in the already prepared garden to accommodate the roots of each plant without crowding them. The depth of planting is critical.

- If you are using plants purchased in containers, simply set them at the same depth at which they were growing.
- Tomato plants benefit from being planted in a trench and covered up to the first set of true leaves.
- Determining how deep to place dormant plants can be more difficult. If old stems are present, you can observe them to gauge the depth at which the plant grew the previous season (based on color differences on those old stems).
- Trees and shrubs have special considerations (see chapter 11, Woody Ornamentals).

Firm the soil around the plant, being careful not to compact the soil. Water well to settle the soil and remove any air pockets. If the bed has not had fertilizer incorporated prior to planting, apply a liquid starter fertilizer solution a few days after planting. A starter fertilizer has a higher percentage of phosphorus than the other nutrients, which encourages root formation.

Water the new transplants well for the first week while they acclimate to their new, harsher environment. Removing flowers allows plants to spend their energy on growing a good root system and encourages branching and more flowers later on.

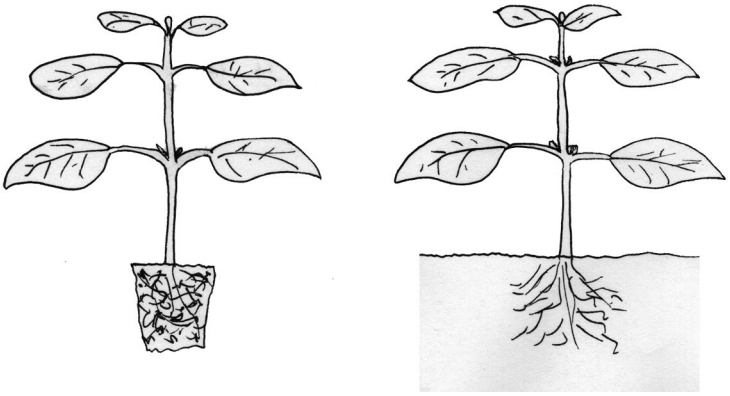
Seeds

Starting seeds indoors is another way to have transplants available to set outdoors once the threat of killing frosts has passed. By starting seeds indoors, you can have a blooming garden 4 to 6 weeks earlier than if you direct seed to the flowerbed. Another advantage to growing plants from seed is that you have far more varieties to choose from than you would if buying transplants from your local greenhouse. You can also grow far more plants for the cost.

Growing quality transplants can be simple if you follow some basic cultural practices. For information on starting seeds indoors, see chapter 19, Plant Propagation.

FIGURE 4. Transplanting from containers

Carefully remove root ball from container. Gently break apart roots and firm soil around base of plant.



Direct seeding outdoors

Some annuals do not transplant well; others grow so quickly from seed that starting them as transplants is not necessary. If seeding directly outdoors, prepare the flowerbed and level the surface. Be sure to break up any clumps of soil so that the surface has a fine texture.

While the seeds of hardy annuals can be sown as soon as the soil can be worked in spring, don't be too eager to plant. If the soil is very cool and wet, seeds will germinate more slowly; the longer a seed takes to germinate, the more chance there is that fungal diseases, rodents, or birds will destroy it. Tender annuals should not be seeded until the soil temperature reaches 60˚F.

Plant seeds directly into the garden in the same way as if planting indoors. One drawback of seeding directly into the garden is that the surface of the soil may crust over, preventing water infiltration and creating a barrier for small seedlings to emerge through. This is especially problematic in clay soils. To prevent this, sow your seeds and then cover them with a layer of vermiculite, compost, or sand.

Keep the seedbed moist until most of the seeds have germinated. You may need to mist them several times a day. Covering the seedbed with newspapers or other kind of mulch until the seeds begin to germinate can help keep the seeds evenly moist. Remove the mulch promptly when germination begins so that the seedlings are not physically restricted and get adequate sunlight.

When seedlings are a few inches tall or have developed their first set of true leaves, thin the bed or transplant to the recommended spacing for the species.

Maintaining the garden

Mulch

Mulch is a layer of organic or inorganic materials placed over the soil surrounding plants. Mulch serves to:

- Preserve soil moisture.
- Suppress weed growth.
- Prevent soil splash, reducing the transmission of soil-borne diseases to plants.
- Slowly add organic matter to the soil.
- Moderate soil temperature fluctuations—preventing newly planted herbaceous perennials and woody landscape plants from heaving in the winter.

Organic mulches

A wide range of organic materials can be used as mulch, including marsh hay, newspaper, straw, chopped leaves, grass clippings, cocoa bean hulls, compost, finely shredded wood or bark, or pine needles.

Inorganic mulches

Inorganic or synthetic mulches include clear, black, or colored plastic. Plastic mulches raise soil temperatures, which can make it possible to plant some vegetable crops—like tomatoes, peppers, and eggplants as well as the vine crops such as squashes, melons and cucumbers—earlier in the spring.

- Black plastic will warm the soil by 5 degrees on average and kill weeds by blocking light to them.
- Clear plastic will warm soil by 10 degrees; however, since weeds under clear plastic still get light they will continue to grow rather than die.

Keep the following in mind when considering inorganic mulches:

- Though plastic will retain moisture, it is not permeable and will not allow rain to pass through to the soil. Any crops mulched with plastic will need to be irrigated.

- Plants growing in holes cut into plastic weed barrier will not be able to spread as they normally would.
- Plastic does not add any nutrients or organic matter to the soil and instead it will need to be picked up and taken to the landfill after use.

Using mulch

Beds with herbaceous perennials and shrubs around the bases of trees can be mulched with materials that break down relatively slowly, such as wood chips or shredded bark. These may need to be topped off or reapplied every 2 to 4 years. Don't till this mulch into the soil, because its high carbon content will use much of the available nitrogen in the soil in the process of breaking down.

Where you work soil each year before planting—such as annual flower beds and vegetables—use lighter weight mulches that break down more quickly and can be incorporated into the soil as amendments each year, including straw, compost, composted manure, or dried grass clippings. Be cautious with fresh grass clippings, as they can burn plants from the heat generated by microbes breaking down the grass. Do not use clippings from lawns that have had a broadleaf weed killer applied in the last 4 to 6 weeks. Residual herbicide in the clippings could cause abnormal growth of susceptible plants.

Place a 2- to 4-inch layer of mulch over the entire bed (use 6 inches of straw since it is fluffier than other materials and will pack down quickly). Keep mulch away from plant stems because it can hold moisture against the stem, leading to stem or bark rot (see figure 5). Apply additional nitrogen to the soil surface over plant roots before applying a layer of mulch to compensate for the nitrogen microorganisms will use while decomposing the organic matter. In areas where slugs are a problem, using only a thin layer of mulch or finer material may discourage slug activity.

Wait to apply mulch used to retain moisture and suppress weeds during the growing season until the soil has warmed thoroughly, some time around the last frost date (figure 3). Because of its insulating properties, mulch applied to cold soil keeps the soil cooler longer, which will slow plant growth.

Mulches used on permanent paths can be different than those used on the beds. In fact, using different mulches in those areas make it clear where to walk. Wood chips are a durable, fairly inexpensive option for paths. While they should never be used on vegetable beds, wood chips are also good for ornamental beds. Leaves can also be used for paths or beds, but, when used on beds, shred them first to make it easier for water to penetrate.

Avoid using stones or rocks—with or without a fabric or plastic weed barrier—as a mulch. Not only does the weight of the rocks compact the soil, the rocks absorb heat and can keep the soil and plants too warm. In addition, leaves and other organic debris settle between the rocks on top of the weed barrier, eventually creating a layer in which weed seeds will germinate. For the same reason, don't use a fabric or plastic weed barrier under organic mulch. As the organic mulch naturally decomposes, allow it to blend with the soil rather than perch on top of a barrier where weed seeds will grow.

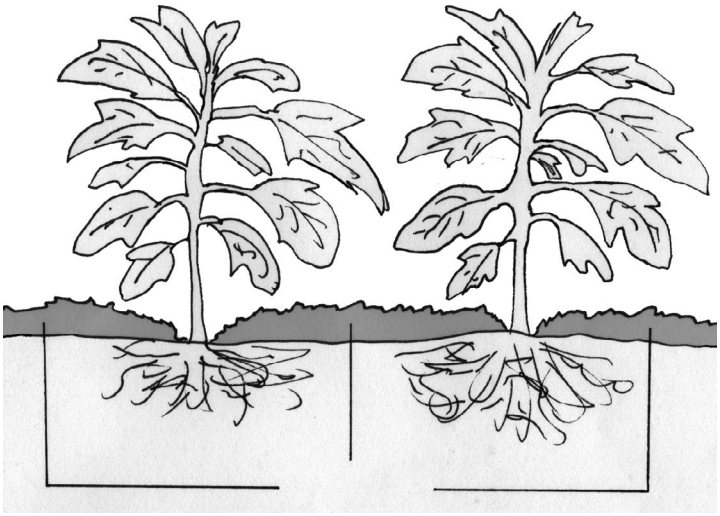


FIGURE 5. Keep mulch away from plant stems

Watering

Water is involved in almost all plant functions. Mineral nutrients from the soil are dissolved in water and carried into and through plants by the processes of **transpiration**, as water is lost through leaves on a sunny, windy day. Photosynthesis requires water, and the carbohydrates that photosynthesis creates are carried throughout the plant in water. Water helps hold plant stems and leaves upright, too—which is why they flop over, or wilt, when dry.

Rarely do summers in Wisconsin provide adequate and regular rainfall for most of our plants to do their best. While supplemental watering is essential for most garden plants, it can also be the cause of serious problems if you don't do it properly.

As a general rule, most plants prefer approximately 1 inch of water a week to thrive, or about 6 gallons per 10 square feet. To measure water from an overhead sprinkler, use a rain gauge or other straight-sided container to collect the water and time how long it takes to collect one inch.

On clay soils the entire inch of water should be provided all at once since it will penetrate slowly and be held in the soil long enough for plants to use it gradually. On sandy soils, where water moves downward and out of the plants' root zones more quickly, apply 1½ inches of water per week in smaller amounts but more frequently. On both types of soil, organic matter in the soil holds more water. In clay soils, it also adds more air spaces, which protects plant roots from suffocating due to waterlogged soil. Both sandy and clay soils will hold moisture longer with a layer of mulch, thereby reducing the need to water as often.

Overwatering can be as detrimental as under-watering. Not only does the plant suffer from a lack of oxygen when soil pores are filled with water instead of air, but roots that stay wet too long become susceptible to infection by the root and crown rot fungi that are indigenous to most soils. Water is also involved in fungal diseases that infect leaves, stems, and flowers since their spores usually require a film of water to keep them alive long enough to penetrate the plants' tissues. This is why it is generally best to keep plant leaves and flowers dry as much as possible.

Direct water to the soil and plant roots instead of showering the entire plant. For some plants that are very prone to leaf diseases, such as tomatoes, overhead watering should never be used. Instead, hand water each plant at the base, use a soaker hose, or set up a drip irrigation system on the ground. When overhead watering with a sprinkler is the only practical method—such as for lawns and large garden areas—do so early in the day so that leaves can dry quickly, reducing the time fungal spores can infect plants.

During extreme heat, plants sprayed with water release energy in the form of heat to the water as it evaporates, effectively cooling the plant.

Fertilizing

Different plants have differing nutrient requirements. In general, the more rainfall or irrigation, the more fertilization is required. Some fertilizers contain each of the three primary nutrients (nitrogen, phosphorus, and potassium) while others contain only one or two of them. Some also contain an assortment of micronutrients, which are needed in very small amounts by plants and are often available in sufficient amounts from the soil. In general, clay soils contain more nutrients and hold nutrients longer than sandy soils. Organic matter in both types of soil increases the nutrient-holding ability of the soil and contributes some nutrients as it breaks down.

Always follow package instructions for fertilizer application rates. Over-application of fertilizer can injure roots and cause poor growth, wilting, or plant death.

Excess nitrogen will result in leaves instead of flowers. If flowers are desired or necessary for fruit production, avoid using fertilizers high in nitrogen before flowers have formed or fruits have set. Tomatoes and strawberries are especially responsive to nitrogen and will produce huge plants but no flowers—and therefore no fruits—if nitrogen is used too early or in excess. Once they are in flower, plants generally benefit from fertilization.

Organic or synthetic

Organic and synthetic fertilizers differ in some ways. Nutrients are immediately available from synthetic fertilizers while organic fertilizers release their nutrients slowly over time. And although actual plant nutrients are the same regardless of the source and are used in the same way by plants, some components of synthetic fertilizers can be detrimental to soil microorganisms.

- Synthetic fertilizers have plant-available nutrients in the form of salts that readily dissolve in water. As salts they are capable of burning plant tissues both above and below the ground if over-applied or misapplied.
- Organic fertilizers contain plant nutrients in complex molecules containing carbon, which must be broken down by weathering and microorganisms in the soil before the nutrients are released and available to plants. They are unlikely to damage plant tissues.

For more information, see chapter 17, Organic Gardening.

Fertilizer formulations

Granular fertilizers are sprinkled on the soil and either watered in or shallowly worked in being careful not to damage plant roots. Moisture dissolves the granules, releasing the nutrients. They can be applied in a band alongside the row of plants or in a circle around the base of the plant. Lawn fertilizers are often broadcast over a large area using a fertilizer spreader. Since it must be very uniformly applied, do not attempt to broadcast lawn fertilizer by hand or with a hand-held spreader, even on a small area. Quickly wash off any synthetic fertilizer granules that land on plant tissue, to prevent it from burning.

Soluble fertilizers and liquid fertilizers are added to water and the solution used to water plants. Roots take up fertilizer solution more effectively than leaves; fertilizer sprayed on leaves enters the leaf tissue but does not move to other areas in the plant. Before you apply it to plant roots, however, water the plants with plain water. In dry conditions, the high salt concentration of the soluble fertilizer around the roots can draw water out of the plant, causing even greater water stress. By watering first, the roots and soil have sufficient water so that the concentration of salt outside the root will not be greater than that inside the root. Therefore equilibrium is attained and no further water is drawn out.

Fertilizer spikes can be used in containers for gradual feeding, but are NOT recommended for fertilizing trees and shrubs. Spikes only infiltrate a small portion of the root system and often deliver more nutrients than needed (nitrogen is often the only element needed).

Slow-release fertilizers are synthetic granules coated with a gradually dissolving polymer that releases a little fertilizer with every watering, providing fertilizer for between 3 and 6 months. Many growers use these in container-grown plants and some bagged container soil mixes contain slow release fertilizer; the little balls of fertilizer are easily seen in or on the soil and are sometimes mistaken for insect or slug eggs.

Except under special conditions, most plants do not need fertilizing more than one to three times a year or even less. Annual flowers growing in beds usually need fertilizing every 6 to 8 weeks. Plants growing in containers may need fertilizing once a month because they are watered more often, which washes away nitrogen. Likewise, plants growing in sandy soil need watering and fertilizing more often than plants growing in clay soils.

For more information on plant fertility and fertilizer products see chapter 2, Soils.

Plant supports

Vining plants, very tall plants, and plants with weak stems benefit from supports. Plant supports:

- Minimize disease by reducing a plant's contact with the soil and increasing airflow.
- Improve the quality of harvest by keeping fruits and vegetables off of the soil, allowing them to dry faster, and making them more visible.
- Make it easier to weed plants.
- Reduce the garden space plants take up.

Depending on the plant, supports can be as simple as kite string or as elaborate as a welded arbor. To support single stems, a simple stick, stake, or branch pushed deep into the soil is

sufficient. You can purchase coated wire supports bent into a circle at the top that are ideal for flower stems such as delphiniums and tall lilies.

Multi-stemmed plants or plants grown in rows or groups may benefit from trellises, obelisks, and arbors made from sturdy materials such as wood or metal. Woody and perennial vines that get heavy over the years will need large supports that will hold the plant's weight at maturity. Annual vines such as morning glory and vegetables such as peas, cucumbers, and pole beans can usually be grown on strings or thin wires because they do not get as heavy. Plants that twine only by means of their stems will need closely spaced vertical and horizontal pieces in order to cover the entire structure, if that is what is desired. Otherwise each stem will only climb vertically along one upright each without crossing over. Plants with tendrils tend to cross back and forth and cover the structure more thoroughly.

Plants that do not support themselves at all will need to be tied to the supports—use soft materials that will not damage the stems. Loop the tie around the support then cross it over itself between the support and the stem to form a figure eight before tying it. This will hold the plant to the support structure better, allow for growth of the stem, and prevent the stem from being damaged by rubbing against the support.

Stems and branches from other woody plants make good supports and can be constructed into three-dimensional structures or used as simple "pea stakes." Use stems that are twiggy with a foot or more of stem cleared of branches at the thicker end. Push the thick end into the ground so the twiggy part allows plants to grow among the many small branches. Place stakes in rows where peas are planted or in a ring around a clump of perennials that tend to flop open such as peonies. As the plants grow the stakes will be completely covered by foliage. There are also commercial supports made of wire with grids and three "legs" that can be put in place as the plant begins growth in the spring. Wire hoops of the same design can be put in place around a clump of perennials later in the season if support becomes necessary.

Weeding

The best way to limit the impact of weeds in the garden is to prevent them from becoming a problem in the first place. See chapter 7, Weeds for more information on suppressing or preventing weeds.

No matter what weed management practices you use, some weeds will inevitably find their way into your garden. It is important to prevent escaped weeds from spreading or producing seeds so the seed bank won't increase. If new seed isn't added to the soil, the numbers of weeds emerging each year will gradually decrease.

The common methods for managing weeds in the home garden are cultivation—either mechanically or by hand—or using organic or synthetic chemicals. Chapter 7, Weeds covers these options in detail.

Most common garden weed problems can be managed with regular hoeing; when doing so, pull the blade towards you and keep the blade slightly under the soil surface. Don't chop at the weeds. Keep the hoe sharp so it will cut weeds off—not just break off the tops.

Pruning, deadheading, and pinching back

Pruning

Pruning can serve many purposes to:

- Control plant size and shape.
- Remove dead flowers, fruits, and seed heads.
- Stimulate further branching.
- Increase airflow around plants and reduce disease.

Make any pruning cuts at a bud or a branch. Do not leave a stub of stem—this is not only unsightly but, for woody plants, can lead to disease and death of the branch.

As a general rule, prune woody landscape plants shortly before growth resumes in the spring beginning in February until early April. Pruning in mid- to late summer can cause new growth that will not sufficiently mature to survive the winter. If pruning must be done in the fall, November is the earliest to safely do so. Pruning paints and wound dressings are not recommended since there is no advantage to their use and they may actually be detrimental. The only exception to this is for oaks damaged by late spring or early summer storms. These open wounds can attract picnic beetles that carry oak wilt fungus. For more detailed information on pruning trees and shrubs, see chapter 11, Woody Ornamentals.

Deadheading

Deadheading—removing old blossoms—is a technique used for perennial and annual flowers alike (figure 6).

- It is important to remove the entire flower structure, not just the petals.
- Removing faded flowers is important for maintaining the appearance of the garden but also allows the plant to put its energy into building a stronger root system for the following year or encourage additional blooming in some plants (rather than making seeds).
- For plants that reseed readily and become a nuisance in the garden, deadheading prevents or controls their spread.

There are some situations when you may not want to deadhead. For biennials or desired reseeding annuals, such as hollyhocks, annual poppies, or nigella, leave at least a few of the seed heads to continue the plant population. You may also wish to leave the seed heads of some perennials, such as coneflower, coreopsis or rudbeckias, as the seeds provide food for birds and other wildlife or offer winter interest.

Cutting back is like deadheading but is somewhat more aggressive—you usually remove some of the stems and foliage at the same time. For some plants, such as salvias, this encourages a second bloom. It can also be used to stimulate the growth of more foliage, to make the plant more attractive for the remainder of the season.

Pinching back

Pinching back the growing stems of certain plants early in the season encourages the plant to branch (figure 7). The result is a more compact plant, with more flowers, that may not need to be staked. Chrysanthemums and asters benefit from pinching in mid- to late June.

Selectively thinning out stems as the flowers begin forming rather than cutting all of them back is a method used to force a plant to produce fewer, bigger blossoms. **Disbudding** is when you remove the secondary flower buds on each stem while they are still very small so that each stem produces only one larger flower. Peonies often benefit from disbudding but then may need support to prevent the stems from falling over or breaking.

All the material you prune, pinch, or deadhead can be safely composted, as long as it isn't diseased. See chapter 3, Composting.

FIGURE 7. Pinching back

Remove the end of stem just above the next bud(s).

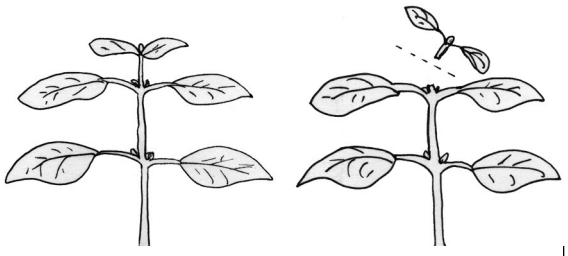
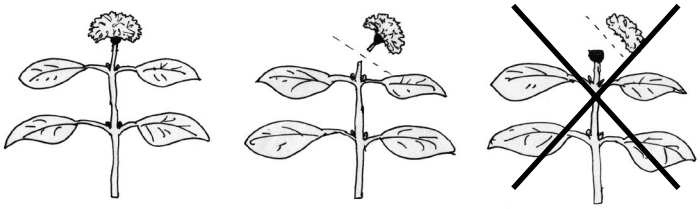


FIGURE 6. Deadheading

Remove the entire seed capsule (middle), not just the flower petals (right).



Fall cleanup

At season's end, deciduous trees lose their leaves, vegetable plants and annual flowers die, and the stems of many herbaceous perennials die down to the ground. Much of this organic yard waste can be composted, especially if you collect the clippings from the last couple times you mow the lawn. Pile them up and run a lawn mower over them or use a chipper/shredder to chop them into smaller pieces to add to the compost pile. Mixing equal weights of green clippings with brown garden debris makes a compost pile that will breakdown relatively quickly. Do not compost diseased plant debris such as:

- Crabapple leaves infected with apple scab.
- Hawthorn leaves infected with rust.
- Tomato plants that had leaf spot diseases (especially late blight).
- Cucumbers and squashes that had powdery mildew.

See chapter 3, Composting for more details. Once you have cleaned up any debris, work organic matter or other amendments into the soil to prepare the bed for the next year.

Many herbaceous perennials should be left standing at the end of the season. Some are attractive enough to add interest to the winter landscape. Others provide seed or fruit or cover for winter wildlife. Chrysanthemums and Russian sage actually survive the winter better if left standing instead of being cut down.

In other cases, removing the plant debris at the end of the season is the best course. Doing so will minimize some disease and insect problems, such as iris borer. Otherwise, it is a personal choice what you care to look at all winter long and what you don't.

Garden tools also benefit from end-of-the-season maintenance. Scrub stuck-on soil off shovels with a dry wire brush. Hone shovels with a file for a clean, sharp edge to benefit next year's digging. Wooden-handled tools should be lightly oiled so they maintain quality. Disinfect and sharpen the blades and oil the gears of any hand tools. Drain any hoses and roll them up. Put any tools away in the garage or shed until you need them in the spring.

Winter protection

Woody and herbaceous perennials transplanted during the current growing season should be winter mulched. The disturbed soil around these plants will absorb more moisture during the fall and winter, causing it to expand and contract more when the upper layers of soil freeze and thaw. This disturbs the root system and can actually heave a plant up out of the ground. A thick layer of organic mulch placed over the root zone in the fall will moderate these temperature fluctuations and prevent heaving.

Don't apply a protective layer of mulch until the ground is frozen a couple of inches deep. In Wisconsin, this could be around Thanksgiving in the north and not until Christmas in the southern parts of the state. If applied while the soil is warm it can delay the onset of dormancy making the plant more susceptible to damage from early freezes.

Non-hardy roses need winter mulching to protect the roots and graft union from freezing. Place a mound of soil around the roots and crown and allow it to freeze a couple of inches deep.

- Traditionally, styrofoam rose cones are placed over the plant after the stems have been cut back enough so that they do not touch the inside of the cone. Cones need to be secured to the ground with pegs or weighted down with bricks. Remove cones on sunny winter days, especially later in the winter, but replace them before nightfall and freezing temperatures. Some have vents in the top you can open to allow warm air to escape.
- An alternative that doesn't require cutting back the stems is to surround the plant with chicken wire and stuff it with dry leaves or straw. Tie the stems together to prevent them from rubbing on the wire.

With either method, in the spring gradually remove the protection as nights get warmer. Stems that were not cut back last fall can be cut now, but only as far as they died back over the winter.

Season extension

In Wisconsin, the growing season doesn't last very long (see figure 3). At both the beginning and end of the season, cold weather can threaten plants and even kill them. The first fall frost is often followed by several weeks of warm weather, however, so protecting tender plants at that time can extend the season of enjoyment. There are many ways to get a jump on the season in the spring and extend the growing season in the fall—possibly even into winter.

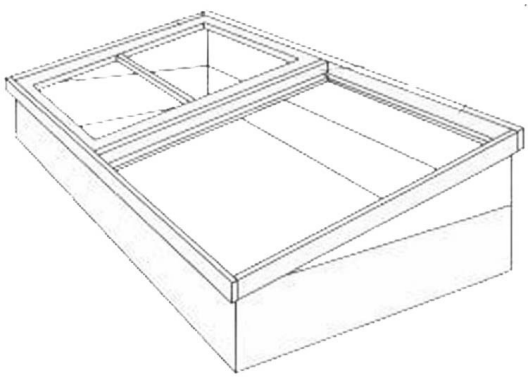
Individual plant covers

Tender plants may need protection from freezing in either spring or fall. There are many devices that can be used to individually cover plants for protection against cold temperatures in the spring.

Cloches are the oldest—and arguably still the most effective—plant-protection device. They are essentially mini-greenhouses, keeping plants a few degrees warmer than ambient temperatures for frost protection. Cloches used to be made of glass, but plastic ones have become more common. Putting cloches over newly planted seeds—for example, hills of melons or squash—help warm up the soil.

Wall O'Water and similar plant-protecting tepees utilize water to provide insulation around individual small plants. These are made of plastic, with baffled chambers as the walls. When filled with water they can protect tender plants even when temperatures drop into the teens.

FIGURE 8. Cold frame



Covering plants

When early frosts are predicted in fall, tender annual flowers and vegetable plants that are still producing, such as tomatoes and peppers, can be protected with coverings put over the plants before sunset. The sun's heat stored in the soil during the day will radiate up under the cover at night enough to raise the temperature around the plant, even if just the top and part of the sides are covered. Bed sheets, drop cloths, blankets, plastic sheets, or specialized plant covers or fleeces can be used. Remove the covering, especially if it is plastic and can hold enough heat to damage the plants, once the sun comes up. Winter squashes, pumpkins, and gourds should also be protected if they are to be stored. Once exposed to frost they will not store for as long but will still be fine for decorations or immediate consumption. Late in the season, when daytime temperatures are too cool for further ripening, covering the plants at night is no longer beneficial.

Cold frames

A cold frame is essentially a miniature greenhouse that collects and preserves heat to protect plants and seedlings from cold weather. A cold frame may give you another 45 days or so of growing season, even if there is snow on the ground.

The frame is a bottomless box, usually constructed from wood, with a slanted, tightly fitted top made of old windows or other transparent or translucent material (figure 8). A typical cold frame is approximately 3 feet wide and 6 feet long, with an 18-inch-high back that slopes down to 12 inches high in the front. The most effective cold frame has a southern or western exposure with a glass top at a 30- to 45-degree angle to take advantage of the sun's low position in the sky.

You can purchase ready-made cold frames or construct one yourself with scrap lumber and glass or plastic—or use bales of straw as walls and an old storm door for a lid.

You can plant directly in the soil beneath or place plants in pots inside the frame. Cold frames are ideal for hardening off flats of tender young annual and vegetable transplants in the spring or for a fall crop of lettuce, spinach, and radishes.

The hardest part of using a cold frame is keeping it from getting too hot. When the sun is bright, the temperature inside can climb quickly and injure plants if the cold frame is not vented.

- Placing shade cloth or a floating row cover over the top of the cold frame can help prevent overheating.
- On warm days you may need to prop the lid an inch or more to let heat escape, but remember to close the lid before the sun sets. A thermostatically controlled vent opener can be purchased to do this automatically.

Floating row covers

Floating row covers are made of lightweight material, usually spunbond polyester, that is translucent and allows sunlight and water to pass through. They do trap some heat—providing three or four degrees of protection—but don't cause excessive heat buildup when it's warm. Row covers:

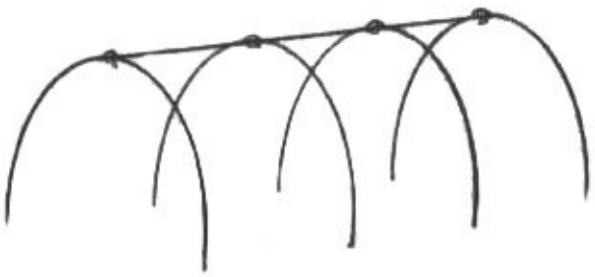
- Keep plants warmer and help them grow faster.
- Retain soil moisture and can help germinating seeds.
- Provide a physical barrier to pest insects and larger critters like rabbits and birds while plants are getting established.
- Protects crops from frost.

Floating row covers can be used in a variety of ways in the garden.

- Lay the material flat on the soil over a newly planted seedbed to retain moisture, prevent seeds from washing away in heavy rain or watering, and keep birds and other wildlife from eating the seeds.
- Place the row covers loosely over growing plants as a barrier against insect and some wildlife pests, reducing pest damage and the need for other management methods. Leave enough extra material so the plants underneath can grow and not be restricted by the fabric.
- Leave row covers on plants such as broccoli or lettuce, which do not need insect pollination, all season long, but remove them when flowers such as with squash or pumpkins need to be pollinated.

To hold the floating row cover in place, use wire anchors or mound soil along the edges of the fabric to hold it down. Alternatively, the fabric can be draped over supports to create a tunnel (figure 9). This works especially well for tall plants or for a few plants, such as spinach, whose delicate leaves can be abraded by the fabric when it moves in the wind. Be sure to anchor all sides by weighting edges with soil, boards, landscape staples, or other items, but allow for easy access to flip back the cover for weeding. Row covers are sold in a variety of sizes and lengths and can be reused for several seasons with proper care.

FIGURE 9. A tunnel frame



Water for temperature control

Water is sometimes used for temperature control of plants that are either too hot or too cold. Both employ the physics of the change of phases of water from liquid to a solid or liquid to a vapor. Water can be used to provide heat to plants in the process of changing to ice when unseasonable frosts threaten tender plants. In this case, the water must be applied as long as ice is forming or the plants will freeze, too. Stop watering when temperatures are again above 32˚F.

Bed renovation

You may need to renovate garden beds for a number of reasons:

- The perennials are crowded, causing fewer blooms and smaller flowers.
- Weeds have taken over the bed.
- The gardener wants to change a color theme.
- The garden has been inherited and the new owner is not satisfied with it.

Once the decision is made to renovate a bed, stop and re-evaluate the site before beginning. Consider what changes have taken place since the bed was originally planted.

- Have trees and shrubs matured, creating more shade and less light?
- Has the soil been tested recently?
- Has organic matter been added to the soil?
- Are the objectives for the bed the same today as they were when the bed was created?
- Has the time for maintenance increased or is there less time?
- Do you have enough time (and energy) to renovate the whole bed at the same time or should the work be done in sections?

Look over the existing plants and determine which you want to replant and those that you intend to give away, and mark these plants.

Renovation work is best done in early spring when the plants are 4 to 6 inches tall or in the fall after the plants have finished blooming. Make sure you have enough time to complete the entire process before starting to dig plants.

To begin the renovation process, spread out a large tarp, preferably in the shade, near the garden. Place those plants that are to be replanted on the tarp and water the roots well. Place the plants you intend to give away in containers, water them well, and place them in the shade. After all the plants that are to be saved have been removed, spray any remaining plants and weeds with a non-selective herbicide. It may require several applications before everything is killed.

Meanwhile, keep the dug-up plants well watered. Most plants can survive out of the ground for at least a week if they are not allowed to dry out. After the remaining plant material in the bed is dead, amend the soil by adding 4 to 6 inches of organic material. Incorporate the amendments into the soil and rake the area in preparation for replanting. Place the saved perennials, and any new ones, in the bed according to the new garden design. Water the new plantings frequently the first season.

Growing in containers

Even if you don't have space in your yard (or have no yard) or have soil problems, you can still grow flowers or a mini-garden of vegetables in containers. All you need is a small, sunny space such as a windowsill, patio, balcony, or doorstep. Annual and perennial flowers, foliage plants, and many vegetables are quite suitable for container culture, although some varieties are better suited than others. Some trees and other woody plants can even be grown in containers.

Containers

Almost any container can be used as long as it has adequate drainage. Since plant roots need oxygen, they will not grow in soggy soil (except for aquatic or bog plants).

- If water is allowed to pool in the soil near the bottom of the container, plant roots will be shallow and more susceptible to drought. Roots exposed to consistently wet soil will also be subject to root rot.
- You may need to create or enlarge existing holes to improve drainage.

Choose a container of suitable size for the plant you are going to grow in it and big enough to allow for ample root development. Small pots (6 to 10 inches) are suitable for small plants—such as herbs or a single alyssum plant—but you will need larger pots for a mixture of flowers and at least a 5-gallon container for most vegetable crops, such as tomatoes or peppers.

Growing media

Soil-less planting mixes that provide good drainage and moisture retention are best for container gardening. Many commercial brands are available. Make sure the mixture has been sterilized to eliminate weed seeds and disease organisms. Use the soilless mix straight or combine it with some compost. This will be lighter in weight and provide better drainage than full garden soil.

The containers should be at least 6 to 12 inches deep. Large containers more than 12 inches deep can be partially filled with non-biodegradable plastic foam or packing "peanuts" or other materials to create less weight and use less soil mix. Cover the foam with a sheet of plastic with drainage holes punched in it or a piece of landscape fabric, and pour the planting mix over the plastic or fabric.

Varieties for containers

When growing vegetables in containers, choose compact varieties or those developed especially for growing in containers. For example, a number of tomato varieties produce full-sized fruits on dwarf plants. Many seed catalogs indicate varieties suitable for containers. Among flowers and foliage plants, select cultivars that are appropriate for the size container you are planting.

Water and fertilization

Plants in containers, especially hanging baskets, typically dry out faster than in-ground gardens because they have limited soil volume from which to remove moisture and are exposed to warmth and drying breezes from all directions. Containers need frequent watering to keep the plants from wilting, but the exact frequency will depend on temperature, container size, rainfall, and other factors. If you let them become very dry, the soil medium may pull away from the edges, allowing water to run to the drainage holes without re-wetting the root zone. If that happens, place the container in standing water for 30 minutes to rehydrate the soil. A layer of mulch can be applied to the pots to retain moisture. Allow the soil to dry out somewhat between watering to prevent waterlogging, which can kill plant roots.

Soil-less mixtures in containers do not hold nutrients as long as in-ground soil, so regular fertilization is necessary. Slow-release fertilizers, available from most garden centers, are an effective way to provide fertilization. Alternately, a dilute fertilizer solution or liquid organic fertilizer should be used periodically in place of plain water to prevent nutrient depletion. The actual amount to use will depend on the plants' requirements and rate of growth.

Water until it drains out of the drainage holes to prevent the buildup of soluble salts, which can damage roots. Be sure to empty any catch tray a half hour after watering, or the salts will be taken back up into the soil.

End-of-season care

Remove the planting medium from your pots and use it as organic matter in the garden. Wash the containers with soapy water and follow with a rinse with a 10% bleach solution to disinfect them. Then move the containers into the garage or under an overhang next to the house to protect them from the cold.

Conclusion

Matching the needs of a plant to a given site is the cornerstone to success in the garden—otherwise known as the concept of "right plant, right place." This will determines the amount of work you need to put into the plant—watering, pruning, and fertilizing, etc. It's important to recognize these gardening concepts, applicable to all types of gardens, as key cultural and mechanical practices in your integrated pest management toolbox. Plants need to be installed properly, cared for adequately, and maintained as necessary.

The general techniques for this are the same for almost all types of plant. Once you master the basics, you can then focus on learning the nuances of particular techniques and honing your skills. These specific details will be addressed in the upcoming chapters.

Resources

Wisconsin Horticulture publications are available at hort.extension.wisc.edu.

FAQs

Can you recommend some garden tools for pruning, weeding or digging, etc.?

There are so many choices, so choose what is comfortable for you and best gets the job done.

What should I plant?

Consider what type of gardens you enjoy and how much work you want to do.

Can you give some recommendations for raised beds or containers?

Recommendations for raised beds are similar for in-ground gardens. Consider sun needs of plants and access to a water source. Size and depth of the containers should be based on what you want to grow.

Should I be fertilizing every week?

No. It's easy to over fertilize and cause excess vegetative growth or root burn. Soluble salts from fertilizers can also quickly build up in containers.

What's the best kind of mulch?

For permanent plantings such as shrub beds, shredded wood mulch is great because it lasts longer and helps control weeds. For perennial beds, shredded wood works well, as would other organic materials such as pine needles, compost, chopped leaves, or dry grass clippings. For annual or vegetable beds worked every year, use dry grass clippings, compost, straw, pine needles, or cocoa bean hulls, all of which decompose faster.

Should I use landscape fabric or plastic, etc.?

No. Landscape fabric or plastic as a liner under mulch in ornamental plantings can do more harm than good. It can be used in the vegetable garden under warm season plants such as tomatoes or eggplants to help warm the soil and keep the plants productive.

Gardening Practices, practice exam questions

1. **Concepts associated with "right plant, right place" include**
   a. Matching the plant to soil type
   b. Choosing perennial plants for your proper cold hardiness zone
   c. Placing juglone resistant plants in areas where walnut trees are present
   d. All of the above
2. **When transplanting, which is TRUE?**
   a. Tease apart tightly balled roots
   b. Tomatoes can be planted deeply
   c. Pinch off any flowers
   d. All the above
3. **Mulch can be used to**
   a. Preserve soil moisture
   b. Suppress weed growth
   c. Add organic matter to soil
   d. All the above
4. **The most effective coldframes**
   a. Face north or east
   b. Face south or west
   c. Utilize bottom heat
   d. Do not freeze
5. **Which of the following is not an organic mulch?**
   a. Chipped or shredded bark
   b. Grass clippings
   c. Leaves
   d. Landscape fabric
6. **The zone 4 rating of plants indicates its:**
   a. pH preference
   b. Water tolerance
   c. Cold hardiness
   d. None of these
7. **Which of the following would not likely survive in cold hardiness zone 4?**
   a. A plant labeled for zone 2
   b. A plant labeled for zone 3
   c. A plant labeled for zone 5
   d. All of the above
8. **General gardening practices fit into an IPM plan by**
   a. Being chemical management techniques
   b. Being cultural and mechanical management techniques
   c. Utilizing only naturally produced products
   d. None of the above
9. **In general, proper watering techniques for plants**
   a. Minimize leaf wetness
   b. Are best done earlier in the day, not at night
   c. Applied to the base of the plant
   d. All of the above
10. **A cultural technique to minimize pest damage in a garden includes:**
    a. Using disease resistant varieties
    b. Using a variety of different plants to promote beneficial insects
    c. Using a soaker hose to ensure your plants get appropriately watered
    d. All of the above

Answer key
1. (d) 2. (d) 3. (d) 4. (b) 5. (d) 6. (c) 7. (c) 8. (b) 9. (d) 10. (d)