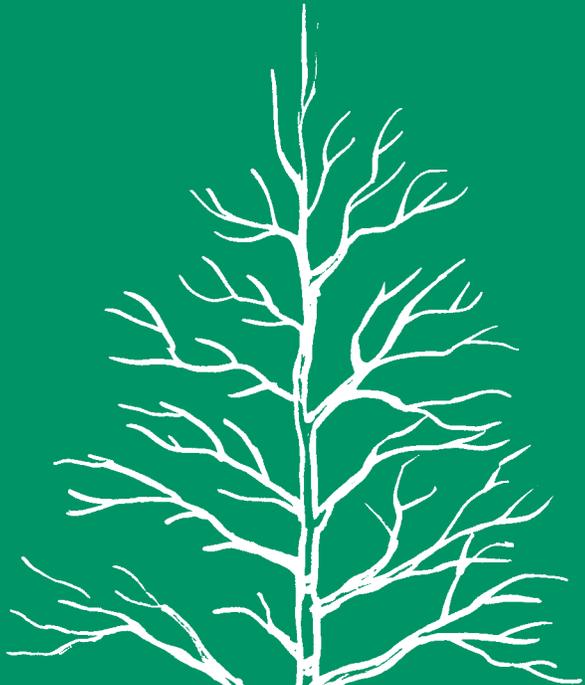


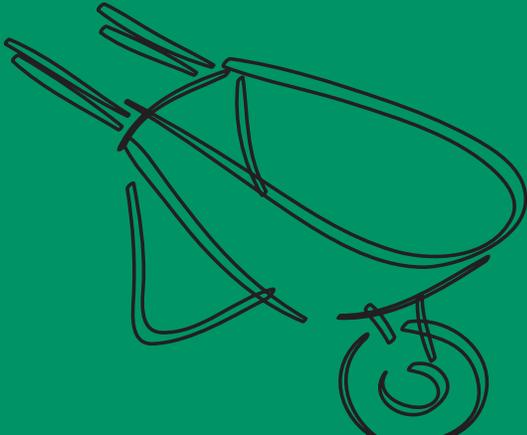
# Planting Ornamentals



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Ornamental plantings on a property help shape and enhance the outdoor environment and experience. Successful, healthy, and long-lived plantings depend on three main factors:

1. Proper site analysis and selection of hardy and healthy plants
2. Proper site preparation and planting techniques
3. After-planting care and maintenance

Underestimating the importance of these three factors can result in disappointment, not to mention expensive, unsightly plantings that grow slowly, die quickly, and are prone to pest infestations. Failing to follow certain fundamental practices is the most common cause of unsuccessful ornamental plantings.

The principles of successful planting do not differ greatly for bare-root, balled and burlapped, and container-grown plants. Each step in the planting process—digging the correct shape and sized planting hole, preparing the planting soil, setting the plant in the hole, watering, and mulching—requires careful attention.

## Purchasing Plants

**Table 1. Selecting quality plants at the nursery/garden center.**

Before you purchase any plants, there are several points to consider.

1. Bare-root material should not have dried out at any time after leaving the production nursery. The entire plant should be alive and fresh-looking with supple, white roots and flexible stems.

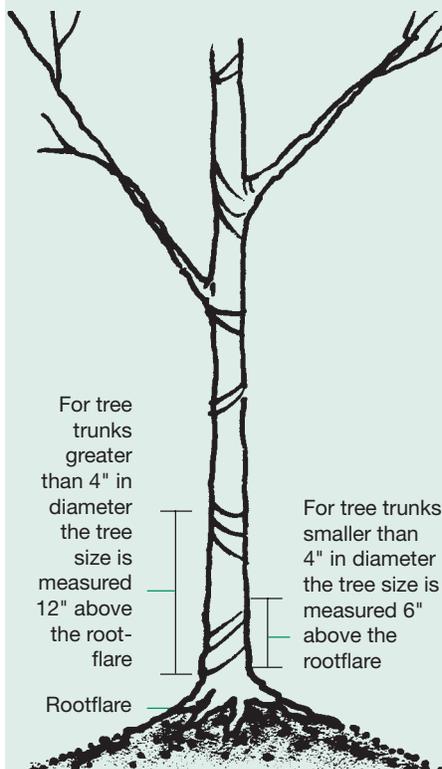
2. There should be no large and stubby roots on either bare-root or balled and burlapped material. Fine, fibrous finger-size or smaller roots will allow the plant to establish faster. Large stubby roots that have been cut by digging would indicate that the plant might not have an adequate root system to support it at the new site.

3. Make sure container-grown plants are not “potted” prior to sale. Container-grown plants should have a fine network of roots where the root ball contacts the container. Potted plants often have evidence of larger roots cut at the surface of the root ball. Plants that are dug from the field and sold in containers should be labeled as such. They should have most of the properties of the balled and burlapped plants.

4. The root ball on all dug material should be firm and solid, and the root covering should be in good condition. Observe whether the root covering is burlap or plastic burlap. Plastic burlap should be completely removed before planting.

5. Make sure the crown and root system are in balance on dug plants. Trees with a trunk caliper (diameter) of 1 1/2 inches at a point 6 inches above the root flare should have a root ball no smaller than 20 inches in diameter, and should be between a minimum of 10 feet tall and a maximum of 13 feet tall. Trees with a 2-inch caliper trunk need a root ball no less than 24 inches in diameter and a height between 12 feet and 15 feet. Larger trees with a 3-inch caliper trunk should have a minimum 32-inch-diameter root ball and be between a minimum of 13 feet and a maximum of 18 feet tall. Caliper measurements for trees measuring up to 4 inches in caliper should be taken at 6 inches above the ground. For larger caliper trees, the caliper measurement is taken 12 inches above the ground. Minimum standards for ball sizes exist for all nursery stock based on their size at the time of digging.

6. The root system on container-grown plants should be just at the outer surface of the root ball inside the container. A fine network of healthy, firm, white or tan roots is ideal, but avoid plants with black, slimy, smelly, rotting roots; a dense mass of roots that have circled the inside of the container; or that have begun to extend out the drain holes in the bottom of the container. Dense, circling roots on such plants often result in a girdling root system later in the life of the plant. Such a condition may result in a shortened life and reduced plant quality. Moderate circling roots can be managed by scoring with a sharp knife at planting time to promote new lateral root growth and reduce long-term impact on plant quality.



Purchase plants from a reliable nursery or garden center. Plants from the nursery industry are generally of better quality than those collected from the wild. The roots on field-grown nursery plants are pruned frequently during the production cycle, which results in a more compact root system and allows the plants to become established faster. Most nursery-produced plants are given optimum levels of plant nutrients, water, and pest control to create a quality product for the home garden and landscape trade. More tips for selecting quality plants are listed in Table 1.

Nursery plants are available in three forms depending on how they are produced or harvested from the nursery: bare-root, balled and burlapped, or container-grown. The terms “bare-root” and “balled and burlapped” reflect how plants are offered for sale, while the term “container-grown” describes how the plant was produced prior to sale. The advantages and disadvantages of each form are detailed in Table 2. All three types of plants must be protected from moisture loss once they are harvested and moved from the nursery or garden center.

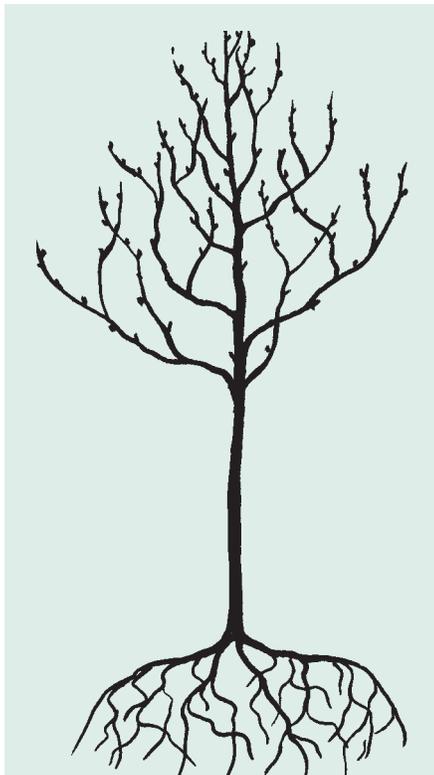
**Table 2. Advantages and disadvantages of bare-root, balled and burlapped, and container-grown nursery stock.**

ADVANTAGES	DISADVANTAGES
<p><b>Bare-root</b></p> <ul style="list-style-type: none"> <li>● Less expensive</li> <li>● Roots adapt and establish into new planting sites faster</li> <li>● Easy to transport and handle because they weigh less</li> <li>● Large-scale plantings are possible with less expense and easier handling</li> </ul>	<p><b>Bare-root</b></p> <ul style="list-style-type: none"> <li>● Not practical for large plants</li> <li>● Roots may dry out before planting</li> <li>● Small plant sizes make them vulnerable to damage by animals and humans</li> <li>● Must be handled when dormant</li> <li>● Trees may require staking after planting</li> </ul>
<p><b>Balled and burlapped</b></p> <ul style="list-style-type: none"> <li>● Greater survival, especially for larger plants and evergreens</li> <li>● Larger specimens are available</li> </ul>	<p><b>Balled and burlapped</b></p> <ul style="list-style-type: none"> <li>● The size and weight of the planting ball makes these harder to handle</li> <li>● Often over 95 percent of the roots are left behind when dug</li> <li>● Availability is limited by season</li> <li>● The texture of the soil of the root ball may dramatically differ from that of the planting area, causing the ball to dry out</li> <li>● Careful handling is required to prevent breaking or damaging the root ball</li> <li>● Before planting, all twine, wires, and treated burlap must be removed or adjusted to ensure long-term survival</li> <li>● The root flare of the tree must be identified to assure planting at the proper depth</li> </ul>
<p><b>Container-grown</b></p> <ul style="list-style-type: none"> <li>● Lighter weight than balled and burlapped plants</li> <li>● Better survival rate than bare-root</li> <li>● Greater availability than bare-root and balled and burlapped</li> <li>● All the roots are moved with the plant at transplanting</li> </ul>	<p><b>Container-grown</b></p> <ul style="list-style-type: none"> <li>● Harder to handle than bare-root stock</li> <li>● Possible root problems including encircling roots and root bound plants because of being in the container too long</li> <li>● The root ball may be grown in a soilless mix and should be completely covered by planting hole soil to prevent drying out of the root ball</li> <li>● May require additional irrigation due to the soilless mix</li> <li>● May be more expensive than field-grown plants</li> </ul>

## Bare-root

Bare-root plants are harvested from the nursery with no protection over their root systems. They are quite vulnerable to the elements, especially moisture loss. Traditionally, only smaller deciduous trees, shrubs, and some ground covers were offered for sale as bare-root plants. In all instances, the plants were small. Recently, city foresters and street tree commissions have adopted bare-root planting of larger street and shade trees for new street tree planting programs. The reduced cost and ease of handling bare-root trees are attractive for street tree programs that have limited funding and that rely on neighborhood volunteers to do the planting. However, the use of bare-root street trees is limited by local availability in the nursery trade and by the fact that not all shade and street trees are adapted to planting as bare-root stock (Table 3). Bare-root plants should be planted in the early spring or early fall while they are dormant (Figure 1).

**Figure 1. Bare-root tree.**



**Table 3. A brief list of trees that have been successfully planted bare-root.**

Scientific name	Common name
<i>Acer campestre</i>	Hedge Maple
<i>Acer x freemanii</i>	Freeman Maple
<i>Acer platanoides</i>	Norway Maple
<i>Acer pseudoplatanus</i>	Sycamore Maple
<i>Acer rubrum</i>	Red Maple
<i>Acer saccharum</i>	Sugar Maple
<i>Acer x truncatum</i>	Shantung Maple
<i>Amelanchier</i> spp.	Serviceberry
<i>Cladrastis kentukea</i>	Yellowwood
<i>Cornus racemosa</i>	Gray Dogwood
<i>Fraxinus</i> spp.	Ash
<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Thornless Honeylocust
<i>Gymnocladus dioicus</i>	Kentucky Coffeetree
<i>Malus</i> spp.	Crabapple
<i>Platanus x acerifolia</i>	London Plane Tree
<i>Pyrus calleryana</i>	Callery Pear
<i>Quercus bicolor</i>	Swamp White Oak
<i>Quercus robur</i>	English Oak
<i>Quercus rubra</i>	Northern Red Oak
<i>Robinia pseudoacacia</i>	Black Locust
<i>Sorbus aucuparia</i>	European Mountain Ash
<i>Syringa reticulata</i>	Japanese Tree Lilac
<i>Tilia</i> spp.	Linden
<i>Ulmus</i> spp.	Elm

## Balled and burlapped

A balled and burlapped plant is dug from the field with a protective ball of soil over the root system. The ball is held intact with a wrap of burlap, a wire cage, or other support material. All ornamental trees and shrubs, regardless of their size, can be transplanted as balled and burlapped plants. The size of the tree directly influences the size of the soil ball required to successfully dig and transplant the plant. The larger the soil ball, the heavier and more difficult the task of digging, transporting, and planting. The American Nursery and Landscape Association has adopted a series of standards for nursery stock, including minimum ball sizes for balled and burlapped trees and shrubs. Table 1 outlines the standards, but for more information talk to your nursery or county extension agent. Balled and burlapped plants are most safely transplanted when they are not actively growing. They are available in most nurseries in the spring and early fall (Figure 2).

**Figure 2. Balled and burlapped tree.**



## Container-grown

Container-grown plants spend their entire production cycle in a container, so there is no damage to the root system at harvest or sale. Plants grown in containers can be successfully planted any time the soil is not frozen, because none of the roots have been damaged from digging. However, successful planting is more probable in the spring or early fall planting periods. There is a limit to the size of plants grown in a container, but nurseries are using larger containers all the time (Figure 3).

**Figure 3. Container-grown tree.**



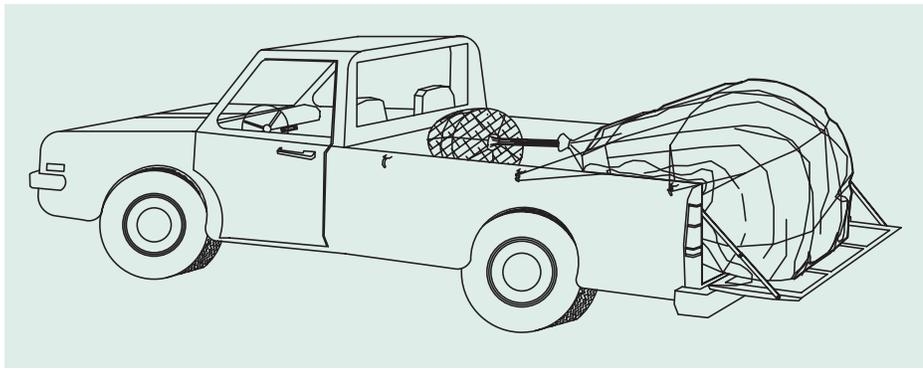
## Care of Plants before Planting

Protect the foliage, branches, and roots of all plants while they are being transported from the nursery or garden center to the planting site. Always handle or carry plants by their root balls, not their trunks or stems. If you allow the tops of the plants to extend from a vehicle, the foliage and branches can lose valuable moisture. Before you leave the nursery or garden center, the branches (canopy) of trees and large shrubs should be carefully wrapped in burlap or a tarp and secured with rope to reduce moisture stress. After you cover the top of larger plants, they should be laid horizontally in the bed of a truck or trailer and tied down for the ride. Large plants should not be transported while standing straight up in the back of a truck or trailer. Smaller plants can be carried inside the vehicle or bunched together and securely covered with a tarp or burlap in the back of a truck or trailer. The entire plant should be protected against loss of moisture at all times before it is planted (Figure 4).

If your plants are delivered by express or freight, remove them from the package as soon as they arrive. Do not remove the covering from the roots, whether they are balled or bare-root. Make sure the material around the root system is moist—plants are often shipped on the dry side to reduce transportation costs. Keep the root system moist at all times to prevent the roots from drying.

Plant the materials as quickly as possible after they are brought to the planting site. If you have to wait, protect them from exposure to drying wind and sun by keeping them in a sheltered, shaded area. The soil around the roots of balled and

Figure 4. Proper transporting of a tree.



burlapped plants should be kept moist with periodic sprinkling. Avoid soaking the root ball, because this adds extra weight and may cause the soil to become “fluid” and move away from the root system. A layer of plastic around the root ball will also help to retard moisture loss. Do not enclose the entire plant in plastic; heat buildup inside the plastic may injure the plant.

Container-grown plants will survive quite a long time before they are planted since they are an entire plant in a single unit. They also should be watered regularly to maintain a uniform level of moisture in the root system. If they are placed in a protected area, they will do very well until planted.

Bare-rooted plants are the most fragile and need considerable care before they are planted. If they will be planted within a few days after arrival, simply keep the packing material around the roots moist. If the planting time will extend beyond this period, keep their root systems moist by temporarily planting them (heeling-in) in moist sand, sawdust, peat moss, or soil. Larger plants should have their roots covered with moist peat and burlap. Plastic sheeting will also help reduce excessive moisture loss from the root system.

## Pruning before Planting

The principles of “preplant” pruning recommended for ornamental plants have changed markedly over the years. All pruning concepts for ornamentals differ considerably from the pruning needs of fruit trees. The pruning needs of new ornamental plants should be confined to cosmetic purposes only. The concept of cutting the top growth back to balance the loss of roots during digging in the nursery has been proven wrong. Research indicates that allowing all the leaves to remain in the plant canopy at planting will speed the development of a new and stronger root system to support the plant at the site.

Cosmetic removal of damaged stems and branches should be done at planting. It is often easier to make a few minor cuts in the tops of a taller specimen while it is on its side next to the hole. Some cosmetic pruning can also be done to maintain the natural form of the plant, whether it is bare-root, balled and burlapped, or container-grown.

Pay close attention to the condition of the roots on bare-root material before planting. Damaged or broken roots on bare-root plants should be cut cleanly to remove any ragged edges that result from digging in the nursery. A new, clean cut will close better after planting. Also consider removing excessively long roots that may not fit into the planned size of the hole. Roots should never be bent to fit the hole size or shape: either shorten the root, or increase the size of the hole.

## Soil Modification before Planting

Most plants grow best in a well-drained, rich garden loam. Unfortunately, most home properties do not contain ideal soil. Construction practices often remove much of the quality topsoil while leaving only the poorer, slowly drained subsoil as a landscape-growing medium.

If the existing soil drains well and does not contain great amounts of either clay or sand, it will probably support most plant growth with little or no further modification. Research suggests that optimum plant establishment is possible when plants are set into existing soils with good internal water drainage. The same research also indicates that incorporating large amounts of organic matter into the backfill of individual specimen trees and shrubs set into a single hole may be harmful to their survival. The higher amount of organic matter often holds too much water around the root system, and the plant smothers from lack of soil oxygen.

In most Pennsylvania soils, some soil modification may be beneficial before planting individual trees or specimen shrubs if the modifying materials are kept to a maximum of 10 percent of the total volume of backfill material placed around the root system. Common materials used for modifying soils are peat moss, well-rotted sawdust, composted materials such as yard waste, and cow manure. Incorporating any of these materials will improve the structure and water-holding capacity of the backfill soil. Never incorporate sand alone in a heavy or clay soil; the resulting mixture will be very similar to concrete when the soil is wet or dry.

All organic matter soil amendments should be mixed uniformly into the backfill.

It is difficult to alter or modify the soil fertility for individual specimen plants. Research indicates that good physical soil quality can be more important to initial plant establishment than fertility. The developing root system needs optimum levels of air and water to become established at the site. All but the poorest soils will generally have enough fertility to aid in the new root growth on these plants.

Testing the soil before selecting plants can prevent the all-too-common problem of choosing a plant or group of plants that have a soil pH or nutrient requirement that cannot be easily met. A soil test mailing kit can be purchased from the Penn State Cooperative Extension office in your county. Soil test data will provide valuable information on adjusting soil pH and fertility to increase the success of any planting program.

Soil pH requirements vary from plant to plant. If the soil test indicates that the soil pH differs greatly from the needs of the plant, you may wish to consider alternate plants that will fit the existing pH levels of the site. It often takes several years to raise or lower the soil pH more than one pH unit. Planting beds that have had their soil pH artificially adjusted will require constant monitoring and maintenance of the pH.

As a further word of caution, attempts to make large, rapid pH adjustments can alter the soil chemistry to a point where either nutrient deficiencies or toxicity may be produced. If you choose to adjust the pH, do it while preparing the soil before planting. Incorporate proper amounts of lime or soil-acidifying materials required to adjust the pH to the crop needs as noted on the soil test report.

Traditionally, phosphorus (superphosphate) at the rate of 1/4 cup thoroughly mixed with each bushel of backfill or 2/3 cup of bone meal has been recommended to aid in root growth after transplanting. Research has not supported this claim; however, Pennsylvania soils that are low in phosphorus can benefit from such an amendment. The other two major plant nutrients, nitrogen and potassium (potash), can be added later to the surrounding soil as the plant establishes itself. Phosphorus does not move easily through the soil and should be incorporated into the root zone, while nitrogen and potash materials are more water-soluble and will leach into the root area.

## Preparing the Planting Hole

### Specimen Plants

Specimen plants are generally planted alone, apart from other similar plants. Planting them usually involves digging a single hole in the lawn or mulched bed. Such specimens include most of the shade trees, and many small flowering trees or large-maturing shrubs.

When digging a single hole, it is essential to make it deep and wide enough to accommodate the roots of the plant, whether it is bare-root, balled and burlapped, or container-grown. A hole that is 1 to 2 feet wider than the diameter of the root ball, but no deeper than the root ball, will allow ample room for good backfill soil around the roots. Research indicates that larger specimen shade trees and most flowering trees will establish better when set on the firm soil in the bottom of the planting hole. Do not loosen the bottom of the hole or add topsoil below the root ball of larger plants. The added weight of such plants often results in settling of the root ball and possible root damage.

When digging the hole for individual plants, discard any existing sod or place it in a compost pile. Place the good topsoil in one pile next to the hole and the poorer subsoil in another pile. Do not use sod or any other materials in the bottom of the planting hole. The root system of the plants should only be exposed to quality backfill soil. If the subsoil and/or topsoil is heavy clay or otherwise extremely poor, you may wish to amend the backfill soil with organic matter. (See section on soil modification.) With proper soil preparation, much of the native soil dug from the planting hole may be used in the backfill operation.

### Shrub and Ground Cover Beds

When planting shrubs and ground covers in groups for a specific landscape effect, it is often easier to consider the entire area to be planted as one single hole. If the bed can be worked up to a depth of 10 to 12 inches, you will have most of the labor for planting done. When the root system of larger shrubs requires a hole deeper than 12 inches, you will have to apply the same principles used for specimen plants.

Working the soil in the entire area will improve the root development for all the plants. Root penetration will be much easier and faster when each individual shrub or ground cover plant does not have to establish itself in small holes opened in the native soil of the site. In addition, any needed soil amendments can be incorporated more easily and mixed with all the soil available to the roots.

If the soil at the planting site is very shallow or poor, you may wish to consider replacing it with better quality topsoil. When this is necessary, you should remove the soil to a depth of 12 to 15 inches and blend the new topsoil with the existing topsoil to aerate a transition zone between the existing soil and the new soil. For marginal cases of poor-quality soil, it may be more practical to remove some of the soil, mix it with good topsoil and organic matter, then restore the original level of the soil in the bed.

When total soil removal from the bed area is not practical, it may be helpful to consider incorporating raised planting beds into the area if the proposed landscape design will accommodate such modification. Raised beds use better topsoil as the growing medium, which is placed on top of the existing site soil. Some topsoil should be incorporated into the existing site soil to provide a transition between the poor and better growing soil. Soil depths in a raised bed should be adequate to support all the roots of the plants used. The edges of the raised beds should also extend horizontally far enough to provide for the growth of the roots over time.

## General Planting Recommendations

Each plant form—bare-root, balled and burlapped, and container-grown—has specific requirements to consider when planting, and these will be discussed in further detail for each plant form. However, some planting procedures are universal across the plant forms. These procedures are outlined below.

1. The sides of the planting hole should be tapered, with the opening being wider than the bottom and large enough to accommodate the roots and soil ball.
2. The sides of the planting hole should be roughened or scored with a shovel or pickax to break up any smooth surface or glazing created from the backward pressure of the shovel while digging the hole. This polished or compressed layer of soil around the sides of the planting hole will often be dense enough to slow the outward movement of new roots into the soil surrounding the hole.
3. Do not dig too deep—the root flare or collar of the tree should be at the final soil grade or slightly higher. The root collar is the juncture between the stem of the plant and the root system. This point is often associated with a gentle flare when the stem merges into the root system.
4. Before backfilling, make sure the tree or shrub is properly positioned and upright in the planting hole. The plant may require some support while you backfill.

5. Gradually add backfill soil over and among the roots of bare-root plants, and firmly pack soil against the root ball of balled and burlapped and container-grown plants to eliminate air pockets.
6. Continue filling the planting hole and firming the soil until the hole is about half full. At this point, fill the hole with a gentle stream of water and allow it to soak into the soil to settle it and remove air pockets. Avoid a strong stream of water, which may puddle the soil and damage the smaller pores needed for soil aeration for the roots. When the water has drained, continue filling the hole with soil as recommended under the specific planting system below.
7. Once the hole is filled as directed and all specific planting directions are met, provide a ring of soil several inches high around the edge of the planting hole to hold moisture and fill again with water.

## Special Planting Requirements for Bare-Root Plants

The hole for bare-root plants should be large enough to permit the roots to spread out in a normal manner without cramping or twisting. If the roots are curled around the side of the hole, they will tend to continue to grow in that direction and not extend out into the surrounding firmer soil to anchor the plant in the ground. Either trim the longest roots to fit the hole or increase the size and shape of the hole to accommodate the existing root system.

The hole should be deep enough to allow for the natural existing downward spread of the root system. If the subsoil is very poor or heavy clay, breaking up the bottom of the hole to allow for better drainage may help. Punching holes into the bottom of the planting pit itself will create escape channels for water to drain away from the root system.

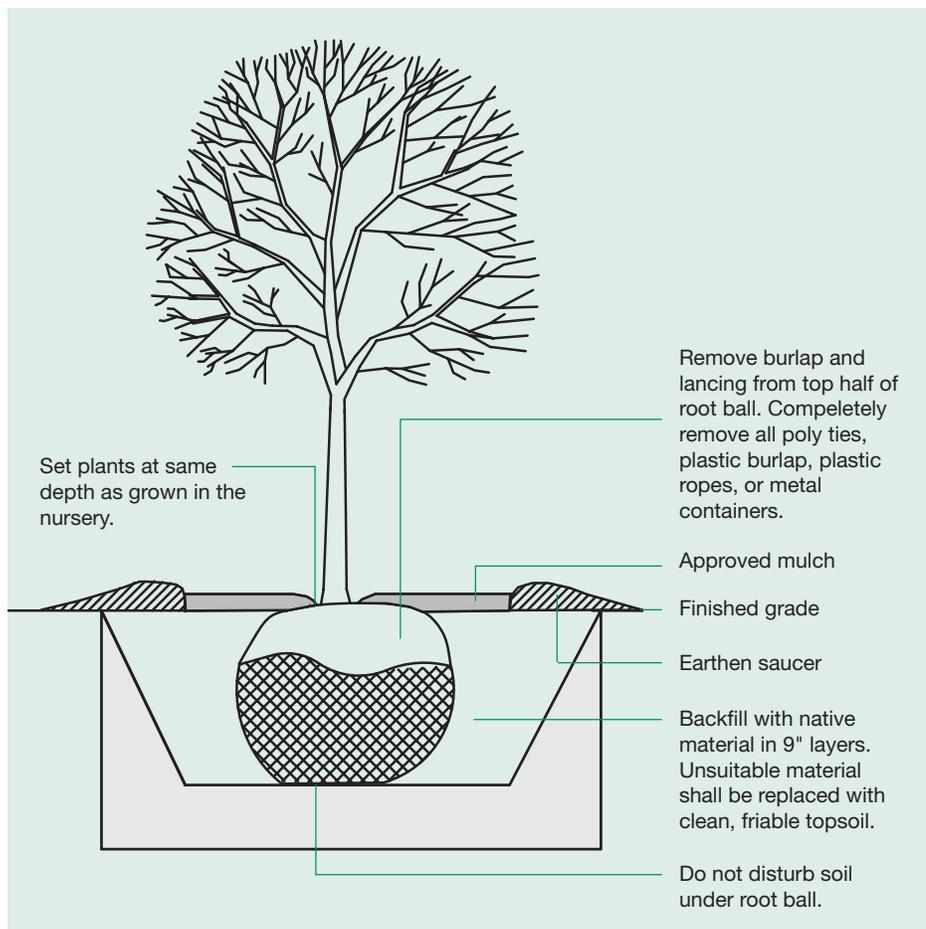
A firmed cone of soil should be placed in the bottom of the hole at a height that will allow the plant to sit at the same height it grew in the nursery. The root collar, flare, or point where the root system and plant stem join should be at the final soil grade or slightly higher, but never lower for ornamental plants.

## Special Planting Requirements for Balled and Burlapped Plants

Holes for planting should be prepared as described earlier (1 to 2 feet wider than the diameter of the root ball, and no deeper than the depth of the root ball) to provide adequate space for backfill soil around the root system (Figure 5). If the soil quality at the site is poor, it is advisable to increase the diameter of the hole by 50 percent to allow for a greater amount of better, less compact soil around the root ball.

Before completing the hole, check the root ball on the plant to make certain that the root collar or flare is actually at the top of the root ball and not covered by several inches of soil. At planting, the root collar or root flare should be at the level of the final grade or even slightly higher.

Figure 5. Planting diagram.



If the root collar is covered with a layer of soil inside the root ball, determine the height of the root ball from the collar to the base of the ball. This measurement should be the actual depth of the planting hole to assure that the root system is at the proper depth in the soil. After the plant has been set in the hole, you should remove this excess layer of soil from the top of the root ball to expose the root collar.

Do not remove the burlap before the plant is set in the planting hole. The burlap will decompose in the soil and can be planted right along with the plant. When the water has drained through the soil, continue filling the hole with soil until it is about 3/4 full.

Once the hole is 3/4 full with soil, loosen the burlap and cord around the top of the root ball, if you have

not already done so. The excess exposed burlap and cord can be cut away and discarded, or folded down along the side of the uncovered root ball. Knotted burlap and cord around the base of the plant break down slowly and may interfere with the growth of the plant. Cut and remove all rope used to secure the ball and burlap to the trunk of the tree. Do not allow the burlap to extend above the soil surface, because it will act like a wick and draw needed soil moisture away from the root ball below.

### Treated and Synthetic Root Ball Coverings

Occasionally balled and burlapped plants are sold with rot-resistant materials covering the root ball. This allows the dealer to hold the plants longer in the sales area and retain a quality root ball. If you are aware of this, you can handle the plants accordingly at home. Treated burlap will usually rot and decompose once it is planted in the soil, but at a slower rate than untreated burlap.

Problems can occur, however, with some plastic or plasticlike fabrics that will not decompose when planted into the soil with the root ball. Many of these materials are so tightly woven that the fibers in the covering cannot be pushed apart by the elongating roots. In this situation, the emerging root system is incapable of expanding into the backfill soil and the plant slowly declines, no matter what steps are taken to promote vigor.

To test for synthetic or plasticlike root coverings, light a match and touch several ends of the burlap. Plastic or synthetic coverings will melt when exposed to a flame. The organic, natural burlap that can be planted with the root ball will burn to ash in a flame.

All synthetic root ball coverings should be removed before the hole is backfilled, but only after the plant has been set in the hole. A small amount of backfill soil may be added around the bottom of the ball, or the sides of the hole can be collapsed to widen the hole and stabilize the plant during the removal steps. Loosen the covering and cut away as much as possible before backfilling begins. The small disk of material that will remain under the base of the root ball should not be a factor in the future establishment and growth of the plant. With the covering removed, you will have to be careful not to crack the soil ball or cause it to drop away from the roots before the entire planting operation has been completed. Follow the backfilling and watering steps discussed earlier.

### Wire Baskets

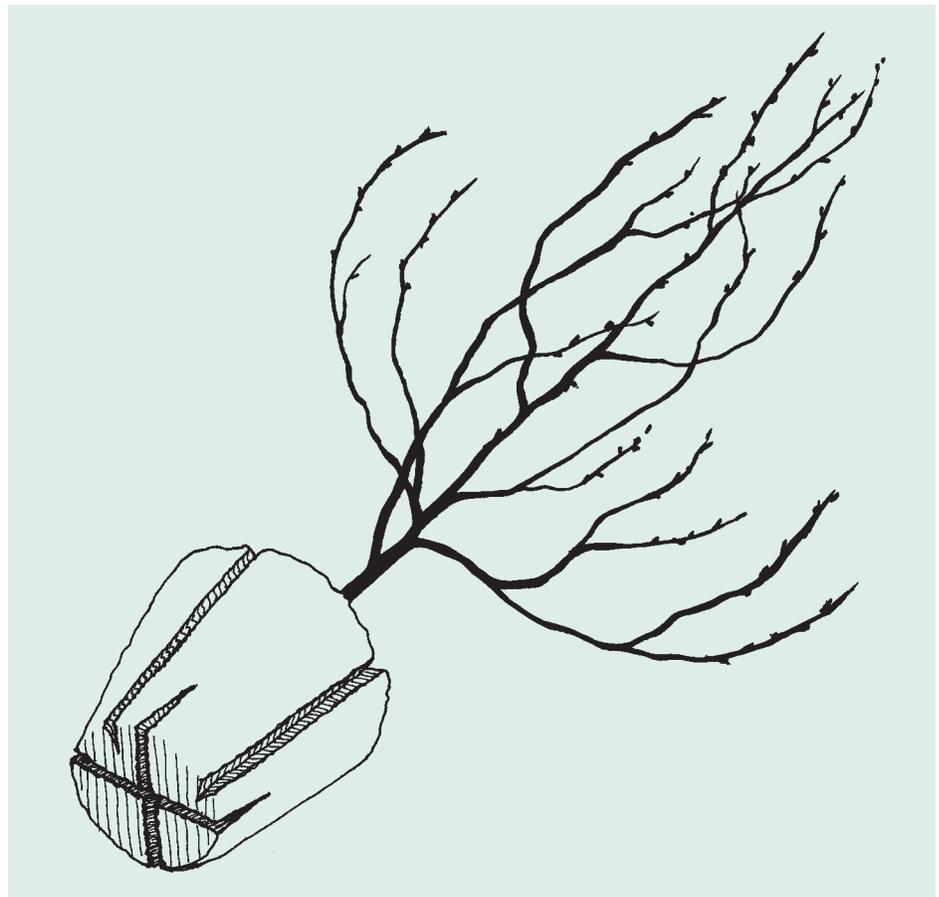
Machine-dug trees are sometimes placed into a wire basket lined with burlap to protect and support the soil ball during shipping and planting. Once in the basket, the burlap covering is wrapped and secured around the ball in a similar fashion to balled and burlapped trees. The size of the root ball and possibility of damaging the root system makes removal of the basket difficult, dangerous, and unnecessary both before and after planting. Depending on the type of wire used in manufacturing the basket, it is unlikely that the wire will rust away quickly. The intact basket can restrict root growth and girdle roots as they grow out from the root ball. As a compromise, and to ensure that the developing roots are not restricted, the upper half of the basket should be removed using heavy-duty wire cutters before the planting process is completed. Once the upper half of the basket is removed, the burlap can be handled as described earlier.

### Special Planting Requirements for Container-Grown Plants

When planting container-grown plants, follow the same preparation in hole size and planting depth as you would for balled and burlapped plants. The container has to be removed from this type of plant before it is set in the ground. Even some of the paper materials used for containers break down slowly enough to restrict optimum root development in the soil. Any circling roots in this type of container will continue in the same direction if the container is set with the plant. Of course, plastic or metal materials would be even more harmful to root expansion. Remove the container by either cutting it away or by inverting and knocking the edge of the container sharply and lifting the container off of the root ball.

One additional operation is needed before the plant is set in the planting hole. Take a sharp knife or digging spade and cut an X mark across the bottom of the root ball. Make the cut about one-quarter the depth of the entire root ball. If there is a tight network of roots around the outer edge of the root ball, you should also make several vertical cuts in the root ball from top to bottom. The vertical cuts do not have to be deep, just enough to cut the pattern of the surface roots. By making these cuts, you will encourage the new developing root system of the plant to expand outward into the backfill soil (Figure 6). If the existing pattern of the roots in the container is not disturbed, the roots frequently tend to grow in the same circular pattern established in the container. The developing root system could strangle itself and cause the plant to decline after a few growing seasons.

Figure 6. Scoring the root ball of a container-grown plant.



## Guying

Research findings suggest that trees and larger shrubs that are allowed to flex in the wind after planting tend to have stronger stems and trunks. The regular movement of the stems builds a stronger cell system internally in the trunk while it is in the nursery. However, there is also the possibility that such plants will tip or lean slightly prior to sale. Minor adjustments to the position of the plant in the planting hole can alleviate minor twists or curves in the trunk or stem.

In a permanent landscape setting, newly planted trees and larger shrubs should not require staking or guy wires to keep them upright unless the trees were planted bare-root or are planted in an area that is open, windy, or has heavy pedestrian traffic. The dense canopy on shade trees and larger shrubs may offer enough wind resistance to cause some tipping or movement of the plant in the planting hole. Staking holds the plant firmly in place, and allows for faster root development.

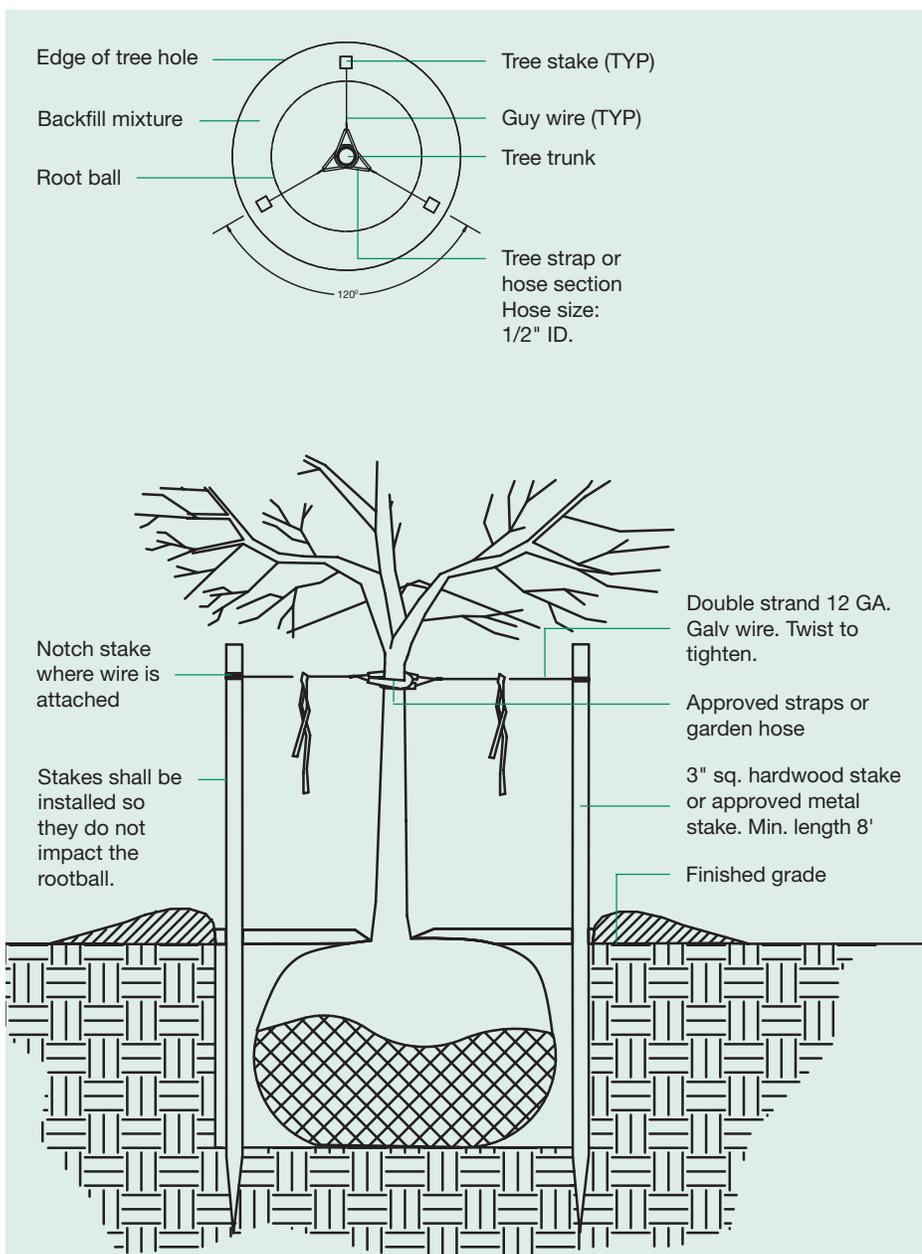
As a compromise to staking, it is recommended that the support material be loose enough to allow for some movement of the stem or trunk in the wind. Such support will provide the desired flexing of the stem for the development of added strength, but will not allow any serious movement of the root system that would alter the plant's landscape effectiveness.

There are several methods of staking and guying. Trees 2 inches in caliper or less can be supported by a 2-by-2 stake extending up to the first whorl of branches on the trees. Usually a stake at least 8 feet long is needed. The stake should be driven into the planting hole along the side of the root ball after the plant is set, but before soil has been placed around the root system. The tree can be attached to the stake by a single loop of rope, tree strap, or a wire running through a piece of hose. Cross the hose or rope between the stake and the tree to prevent chafing the bark. Never wrap a wire or other support tightly around a plant stem. As the stem grows and expands in diameter it will grow over the material and strangle the plant (Figure 7).

Another method of support for trees larger than 2 inches in caliper is to guy the tree with wires. Three guy wires are attached to the tree at equal distances around the trunk. The wire is run through a piece of hose encircling the trunk at a crotch. Where wires are used, anchor stakes should be driven in the ground at a 45° angle, and 1/2 the height of the tree away from the trunk (Figure 8).

As soon as the tree has become established, the support stakes and guy wires can be removed. They should never be left on longer than a full year after planting.

Figure 7. Tree guying diagram for small trees.



## Wrapping

Protecting the trunks and branches of newly planted deciduous trees with tree wrap has become a questionable practice. It has often been suggested that such wrap harbors insect pests that may bore into the trunk. Tree wrap applied in the nursery or garden center before the plants are sold often covers serious defects, such as pruning wounds, bark damage, cankers, or insect injury on the trunk.

Tree wraps do have an advantage when applied and used properly: they will protect the tree trunk and bark from damage during transit from the nursery and while handling the plant before planting. Once the plant is set in the hole, the wrap can be safely removed.

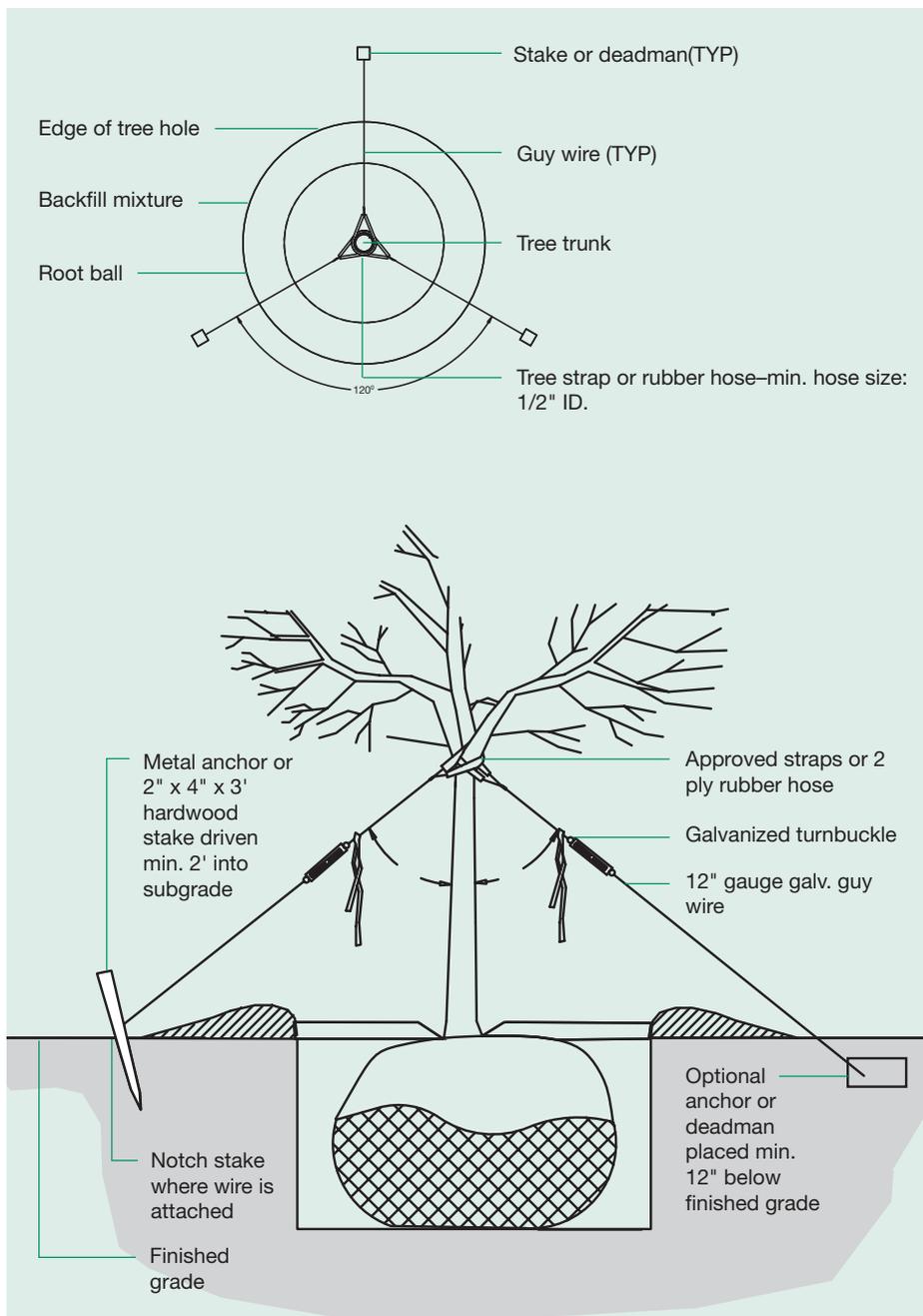
If you decide to use tree wrap, select one of the various commercial paper products or cut 2- to 3-inch-wide strips of burlap. Start the wrap on the larger branches and work down the

trunk to the ground. Overlap each spiral turn about 1/2 the width of the strip so that a double thickness is applied. Bind the wrap loosely with cord or string, starting at the base of the trunk and winding upward to the opposite direction of the wrap.

If you decide to keep the tree wrap on for a short period of time after planting, check the cord or string from time to time to make sure it is not cutting into the bark. The trunk of the tree can begin growing in diameter shortly after it is set in the ground, so careful attention is needed. If it appears that the cord is cutting into the bark, either loosen it slightly or remove it from the trunk. Tree wraps can be used for temporary protection on trees with thin or tender bark during the winter months to prevent frost cracking or sunscald. The wrap should be applied starting at the bottom with each turn slightly overlapping the top edge of the previous turn. This assures that the lower edge of the wrap remains open, allowing moisture to escape from under the wrap on warm days.

Wrapping is not practical on most small shrubs and evergreens; however, they still lose valuable moisture from their foliage and stems. Depending on their location and size, you may wish to consider wind breaks such as snow fencing or burlap barriers, or using an antitranspirant to protect your shrubs and evergreens from moisture loss. These materials are available at most garden centers. Antitranspirants form a protective covering over the foliage and stems to prevent excessive moisture loss. They have been helpful in hot weather and at exposed locations where moisture loss is above normal. Follow the product's directions for proper application and use.

Figure 8. Tree guying diagram for large trees.



## Mulching

Another useful practice to help conserve moisture for the plant's use is mulching. By placing a layer of mulch over the root system and surrounding soil, you will prevent evaporation of moisture from the soil surface. The mulch will also help to stabilize soil temperatures, control weed growth, and reduce bark damage from mowers and weed whips. Mulching can be used to advantage under specimen plants as well as in shrub beds after they are planted. Mulch around plants set in early fall will prevent rapid freezing and thawing of the soil during winter and early spring.

A variety of materials will function as mulch. However, for the best appearance you might consider such materials as shredded tree bark, aged or composted wood chips, or commercial bark chips. Well-aged compost may also be a possibility if its particle size and appearance are not objectionable.

Proper application of the mulch is important. To be effective, a 2- to 3-inch layer of the material should be applied to the soil surface. Any less than that will not control weeds or reduce moisture loss; more than 4 inches will be of little advantage for weed/moisture control, and may even be harmful to the root system. Deep layers of mulch tend to smother roots by excluding air from the soil.

Organic mulch material should not come in contact with the stem of the plant. Simply scoop the mulch away with your hand once the plant or bed area has been covered. Mulch piled against stems and trunks creates several future health problems for trees and shrubs, including keeping the bark continuously wet, promoting disease and rapid decay of both the

bark and wood of the plant, increasing the plant's susceptibility to temperature extremes in the winter, and rodent damage. For the safety of the plant, keep all mulch material from touching the bark. Inorganic materials like stone chips, gravel, or river rock will not hold moisture, but may be abrasive against the bark, which will also injure the stem and lead to plant damage.

Synthetic fabric and plastic sheeting can also serve as a mulching material in certain applications. They are probably most effective in larger areas that have not been planted as shrub beds or where the area will not be disturbed for long periods of time. These products are used under layers of other mulch and function by excluding light from the soil surface, thereby preventing most weed growth.

There are several disadvantages with these products when used directly over the root systems of many plants. Plastic sheeting in particular tends to smother the root system by preventing the exchange of soil gases with the atmosphere as well as the entrance of oxygen into the soil. Plastic sheeting will also limit the entrance of moisture into the soil either from rainfall or irrigation, keeping the soil slightly drier. Likewise, in very wet soils the plastic sheeting may keep the soil too wet and reduce the amount of soil aeration available to the root systems of the plants under the mulch. If you already have extensive areas mulched with plastic sheeting, it would be advisable to puncture the plastic in a number of places with a spading fork to allow for water penetration and the exchange of oxygen and soil gases. The small punctures will not compromise the weed-controlling ability of the plastic. Small collars of plastic under decorative mulch layers around the base of larger trees do not generally cause damage to the plants.

Landscape fabrics, on the other hand, do allow for the movement of water into the soil and the exchange of oxygen and soil gases with the atmosphere. When a layer of organic or inorganic mulch material covers these fabrics, it is possible for weeds to germinate in the upper layer of mulch. As the roots penetrate downward, they pass through the fabric and firmly anchor themselves in the soil layer below. When this occurs it is very difficult to pull the weeds without disturbing the entire surface layer of the mulched bed.

Under certain situations, it has also been observed that plant roots tend to form at the interface between the soil surface and landscape fabric instead of penetrating deeply into the soil where they will be able to survive adverse conditions. The zone under the fabric contains optimum conditions for root growth: moisture, oxygen, and darkness. Roots will grow and survive in this location as long as conditions are optimum. However, during dry periods this interface layer will dry out to a point where the root system may be injured. Landscape fabrics are probably most useful on sloping sites that do not contain plants, and where the surface mulch serves some aesthetic purpose in the design. The physical properties of landscape fabrics do allow them to bind well with most organic mulch materials and prevent mulch movement on sloping areas.

## Watering

Watering newly set plants after the initial planting is essential for survival. The amount of water needed and when to apply it will depend upon rainfall, moisture-holding capacity of the soil, drainage, and the type and texture of the soil. Watering at 5- to 7-day intervals during the first growing season is usually advisable unless the site dries out faster. Light watering will keep the soil surface wet and encourage undesirable shallow root development. A rule of thumb is to provide 1 to 2 gallons of water per inch of trunk caliper. When watering newly set plants, it is very important to soak the root ball sufficiently and to soak the backfill soil to the depth of the roots. This is best accomplished with a slow, soaking watering. Watering containers such as a tree irrigator bag, a 20-gallon green perforated bag that wraps around the tree (Figure 9), or gallon water jugs with holes punctured in the bottom can be spaced around the trunk above the root ball.

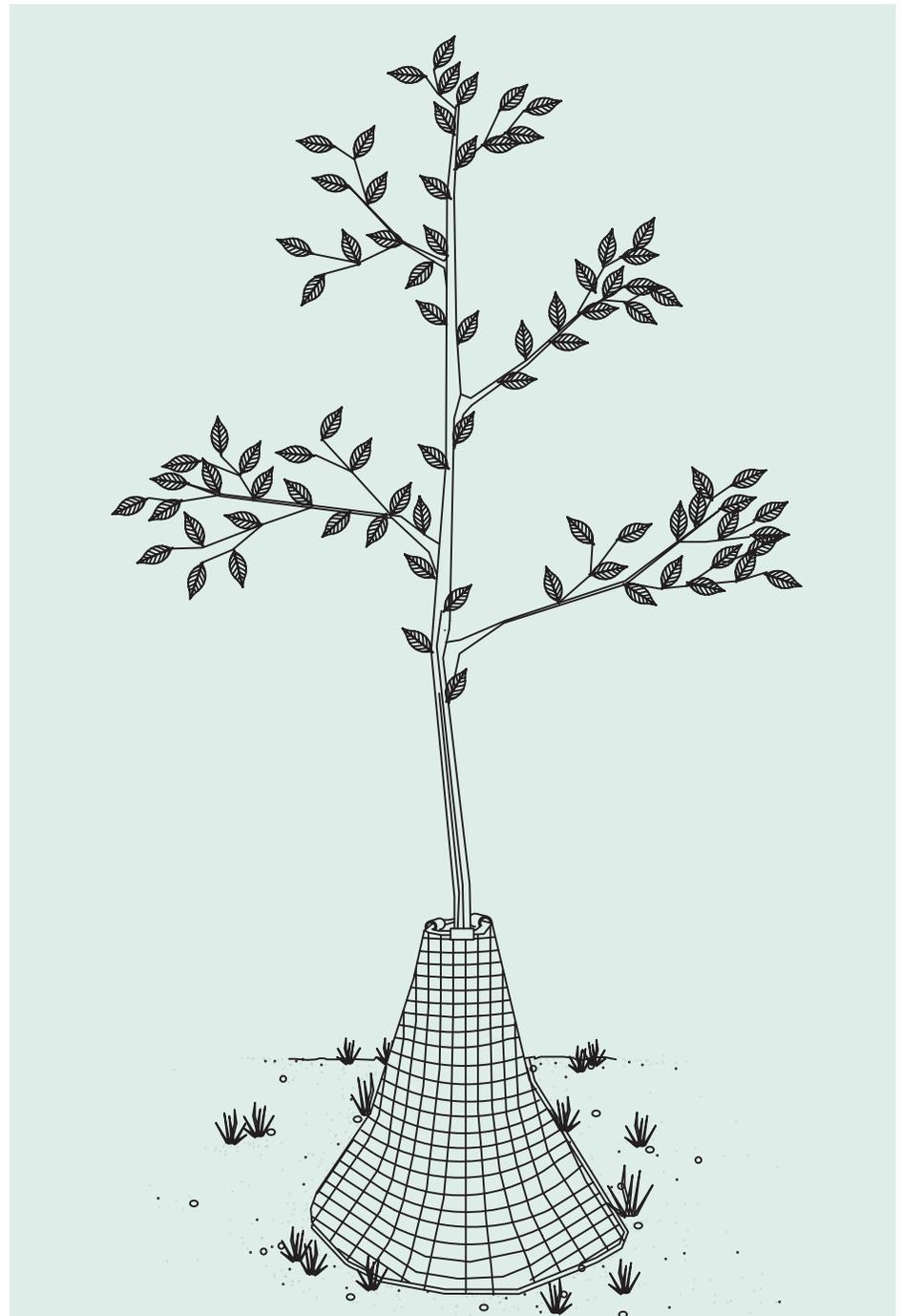
It is equally important not to overwater newly set plants in sites where the natural soil drainage is slow. It is possible to fill the planting hole and backfill soil with water and drive out all soil oxygen if water is applied faster than it can drain away from the root system.

As the plants become established in the planting site, it is also advisable to extend the area of water application away from the original planting hole. The surrounding soil needs to be kept moist in order to support the new roots expanding beyond the backfill material. A deep root system encouraged by keeping the soil moist around the entire root area will generally produce a better and stronger plant that is able to withstand dry periods later.

Rapid water loss through the foliage on hot, humid summer days often results in wilting and death for many newly set plants. Although the soil is sufficiently supplied with moisture, this condition can occur if the roots cannot function well enough to make up the transpiration loss. Misting the tops of newly set plants will help avoid this condition, but should not be looked upon as a replacement for optimum soil watering practices.

The antitranspirants mentioned earlier can also be used with some success in controlling excessive moisture loss for brief periods shortly after plants are set. As the leaf expands, the material becomes less effective, so repeated applications may be necessary. Follow the package directions for proper application of any material used on the plants.

**Figure 9. Tree irrigator bag around a newly planted tree.**



## Care After Planting

Attention to the following items will help ensure proper establishment of your newly set plants, whether they are specimen, shade, or evergreen trees; small flowering trees; or shrubs and ground covers set in a landscape border.

1. Maintain optimum moisture in the soil at all times. Do not overwater so the soil becomes saturated. Slightly dry roots will go dormant and come back with moisture, but roots injured from overwatering are gone forever and weaken the plant.
2. On larger plants that are staked or guyed, maintain solid support for the first year or until the plant has established during its first growing season.
3. Keep the mulch layer at an optimum depth on the soil surface under the plants. Keep all mulch material from touching the plant stems.

4. No fertilization is needed for at least the first growing season after planting. Fertilization can start the second season after planting for most landscape plants and the third season for larger trees. Fertilizer application rates should follow a soil test report recommendation relative to the plants chosen. However, if a test report is not available, a light application of a slow-release fertilizer in the fall of the year after leaf color is sufficient. As soon as the plants are dormant, apply a fertilizer with a nitrogen (N), phosphorus (P) and potassium (K) ratio of 3:1:1 or 3:1:2. Commercially available fertilizers with analysis of 18-6-12, 24-8-16, or 15-5-5 are good examples. The slow-release fertilizer should be applied at a rate equivalent to 2 to 4 pounds of N per 1,000 square feet. For an 18-6-12 fertilizer this would equate to 1 to 2 pounds of fertilizer per each 100 square feet of surface area under the plants. Keep the fertilizer about a foot away from the stems of shrubs and the trunks of larger trees. Most of the active root system will be out away from the main trunk. Water the plants well after the application of fertilizer.

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