

Department of Horticulture

Purdue University Cooperative Extension Service West Lafayette, IN

PLANTING LANDSCAPE TREES AND SHRUBS

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Trees and shrubs add beauty and value to residential and commercial property. They help modify microclimates around buildings and outdoor living areas. Best of all, trees and shrubs are not difficult to establish and maintain.

To achieve success with landscape trees and shrubs, correct plant selection, proper timing of planting, and correct planting techniques should all be employed. Selection includes choosing the proper species and selecting the appropriate root condition for successful transplanting. Timing the planting operation can be crucial to the survival of many tree and shrub species. In addition, proper planting techniques are important for economy of effort in the planting operation and for the long-term survival and vigor of the tree or shrub. It is all a matter of knowing what, when, and how to plant for success.

Plant Selection

The selection of any plant for a landscape should be based on the functional role the plant will play in the overall landscape. Aspects such as a plant's mature size, canopy form, environmental requirements, and root growth pattern are all important.

The condition of the root system at transplanting is a critical characteristic to consider when choosing a plant for your landscape. The root condition will determine how the plant should be handled. Trees and shrubs are usually nursery grown, and such plants are pruned and trained to develop strong canopy forms and root systems. They most often succeed in their new location. Avoid moving plants from the wild because many of the roots are cut off of a wild plant in the moving operation, and they seldom transplant successfully.

Nursery stock is available in several root forms: bare root, machine-balled, balled and burlapped, and containerized. When small deciduous trees and shrubs are dormant, they can be safely dug without soil adhering to

the roots. These are bare-root plants which are usually the least expensive nursery plants. However, success with bare-root plants requires that the purchaser protect roots from drying out and mechanical damage. Bare-root plants may have their root systems densely packed in sphagnum peat moss or wood shavings and wrapped with plastic. Those plants are called machine-balled, and they are handled much like bare-root stock. The peat ball should be removed at planting to ensure root-soil contact.

Balled and burlapped (B & B) plants have been dug from a production field with an undisturbed ball of soil around the roots. The soil is wrapped in burlap, usually bound with twine and pinned together with nails, and may be further secured in a wire framework or basket.

Containerized plants are sold growing in a pot. They may have grown in the container for a year or more in a nursery, or they may be bare-root plants which were planted in the pot earlier in the same growing season. Also, the plant could have been field-grown, dug with a soil ball, and placed in a pot. Both B & B and containerized plants are usually more expensive than bare-root or machine-balled plants. However, since soil is moved with the root systems at planting time, fewer roots are disturbed, thus allowing for a greater likelihood of survival. All landscape plants can be handled as B & B or containerized plants.

Timing: When to Plant

Trees and shrubs generally do best if planted in the early spring before or just as new growth starts. The second best time for planting is in the fall, because plants are essentially dormant in the fall and the conditions provide the greatest chance for successful establishment. However, containerized stock or B & B plants can be planted any time the soil can be worked. Certain species of trees are known to be slow to establish new roots (see Table 1). These trees should be planted only in the spring.

Table 1. Some slow-to-root trees that should be planted in spring.

Scientific Name	Common Name
<i>Acer rubrum</i>	Red Maple
<i>Betula spp.</i>	Birches
<i>Chamaecyparis nootkatensis</i>	Nootka False Cypress
<i>Cornus florida</i>	Flowering Dogwood
<i>Crataegus spp.</i>	Hawthorns
<i>Koelreuteria paniculata</i>	Goldenrain Tree
<i>Liriodendron tulipifera</i>	Tulip Tree, Tulip-poplar
<i>Magnolia spp.</i>	Magnolias
<i>Nyssa sylvatica</i>	Black Gum
<i>Populus spp.</i>	Poplars
<i>Prunus spp.</i>	Stone Fruits (Peach, Cherry, etc.)
<i>Pyrus calleryana</i>	Callery Pear
<i>Quercus alba</i>	White Oak
<i>Quercus coccinea</i>	Scarlet Oak
<i>Quercus macrocarpa</i>	Bur Oak
<i>Quercus phellos</i>	Willow Oak
<i>Quercus robur</i>	English Oak
<i>Quercus rubra</i>	Red Oak
<i>Salix spp.</i>	Willows
<i>Tilia tomentosa</i>	Silver Linden
<i>Zelkova serrata</i>	Japanese Zelkova

Desirable and marginal transplanting times vary according to specific plant type and different root conditions. Figure 1 illustrates the best and/or acceptable times for planting trees and shrubs in central Indiana.

Preplant Operations

Plant Care

Begin plant care immediately upon receipt of stock. Protect roots and crowns from mechanical damage, drying, and overheating. It is best to plant as soon as possible.

Balled and burlapped or containerized plants should be handled only by the soil ball or pot. Never lift such a plant by the trunk or crown. If planting is delayed, place plants in a cool, sheltered area. Water as needed usually once per day to keep the ball or container soil moist. Do not allow the root ball or the container to stand in water.

Bare-root plants may be held for several days in a cool, sheltered location. Cover roots with a moist mulch material such as sawdust or sphagnum moss, and water daily. Don't submerge roots in water. For holding a longer period of time, "heel in" or temporarily plant the bare-root stock in a sheltered spot. To heel in stock, dig a trench with one sloping side deep enough to accommodate roots (Figure 2). Spread the roots in the trench; rest the trunk against the sloping side. Mulch the roots and the lower stem with soil, sand, sawdust, or sphagnum moss. Keep the mulch moist until the plants are placed in a permanent location.

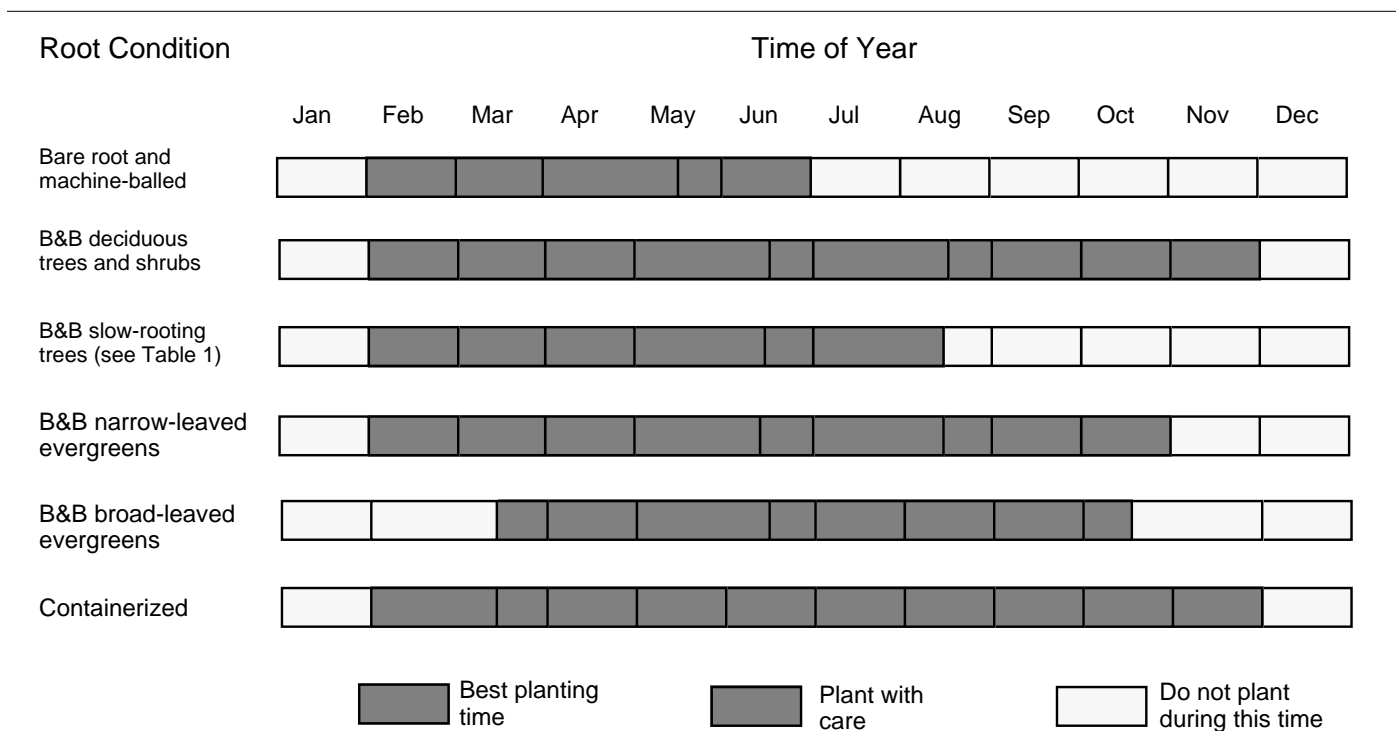


Figure 1. Preferred and acceptable planting times for nursery stock in central Indiana.



Figure 2. Heel in bare-root stock (to be held for some time before planting in a permanent location).

Soil Preparation

Soil preparation is the most important step in the planting operation. Provision for adequate drainage and soil aeration, to assist in establishing vigorous root growth, is usually the goal. On well-drained sites, increasing the soil's water-holding capacity may be important.

Soil types vary, not only between regions, but also between areas of a single site. Fill soil, used to alter grades in new construction, can result in drastic changes in soil conditions within a short distance. Know your soil conditions before you plant. Subsurface drainage can be checked by digging a hole and filling it with water. If the water doesn't drain away within two hours, subsurface drainage is inadequate and should be improved.

Improving soil drainage and aeration on a large scale is difficult and expensive. Filling and regrading water-collecting areas, installing drain tiles, or incorporating organic matter in conjunction with deep spading or plowing are suggested treatments. If extensive site preparation is not possible, be sure to select plant species that can tolerate soggy or clayey conditions. Avoid plants that are totally unable to withstand "wet feet" (see Table 2). With enough effort, species of shrubs or small ornamental trees requiring good drainage can be established on poorly drained sites. Follow guidelines in the section ("Planting in Heavy Soil.")

Table 2. Some commonly used landscape plants that *do not* tolerate wet soils ("wet feet").

Scientific Name	Common Name
<i>Abies concolor</i>	White Fir
<i>Acer saccharum</i>	Sugar Maple
<i>Cercidiphyllum japonicum</i>	Katsura tree
<i>Cladrastis lutea</i>	Yellowwood
<i>Cornus florida</i>	Flowering Dogwood
<i>Fagus spp.</i>	Beeches
<i>Hedera helix</i>	English Ivy
<i>Pinus strobus</i>	White Pine
<i>Quercus rubra</i>	Red Oak
<i>Rhododendron sp.</i>	Rhododendrons & Azaleas
<i>Taxus sp.</i>	Yews
<i>Tilia cordata</i>	Littleleaf Linden
<i>Tsuga canadensis</i>	Canada Hemlock
<i>Vinca minor</i>	Myrtle

Planting Instructions

General

When planting a landscape plant in well-drained soil, dig the hole at least 1 foot wider than either the root spread, soil ball, or container size of the plant to be planted. The finished hole should have a firm, flat bottom or one which matches the shape of the bare root system. Hole depth should be approximately the same depth as the depth of the root system. Do not plant any landscape plant deeper in its new location than it grew at its previous location. If the hole is dug too deep, adjust by backfilling, but make certain to adequately firm the backfill to prevent the plant from settling.

Soil for backfilling should be the same soil that came out of the hole; it is best to mix topsoil and subsoil together. A sheet of plastic or canvas placed adjacent to the hole makes a convenient location for mixing, and it facilitates clean up afterwards. On exceedingly well-drained or light soils, amend the original soil by thoroughly mixing one part of a good grade sphagnum peat moss with two parts soil. Such soil amending is only of marginal value for plants with extensive root systems such as large trees; however, it may be beneficial for shrubs and small trees. To avoid root burn, do not add dry fertilizers or fresh manure to the backfill mix. Do not amend backfill soil on a heavy soil site (see "Planting in Heavy Soil").

Bare-Root and Machine-Balled Stock

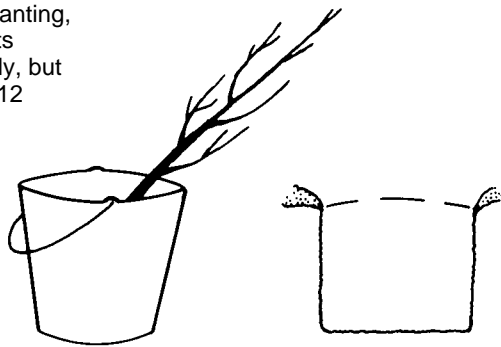
Most bare-root plants come packaged in moist material. Carefully remove the packing material and examine the roots, then cut off damaged roots with a sharp knife. It is advisable to soak plant roots in water for several minutes immediately prior to planting. Do not allow roots to stand in water for more than 12 hours.

Throughout the planting operation, protect the plant's roots from drying. Even while digging the hole, keep roots covered with damp burlap, moist sphagnum moss, or other material to avoid root exposure to sun and air.

Machine-balled stock should not have plastic wrap removed until the hole is dug. After the wrapping material is removed from the root ball, pull the peat ball apart gently to allow root-soil contact, but do as little damage to roots as possible. Proceed immediately with planting.

Once the hole is prepared, position the plant exactly at the same level at which it was growing previously (Figure 3). Place it in the center of the hole, and carefully begin to backfill the soil. Work the soil in and around the roots, and then firm the soil with your hand. Do not tramp or pack the soil tightly. Continue filling the hole until it is three-fourths full.

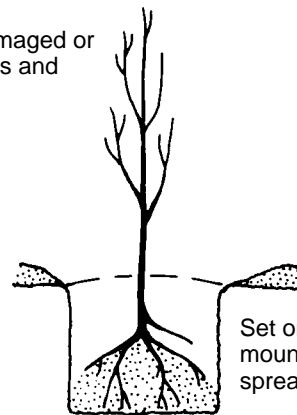
Before planting, soak roots thoroughly, but not over 12 hours.



1

Dig a generous-sized hole at least 1 foot wider and the same depth as the root system.

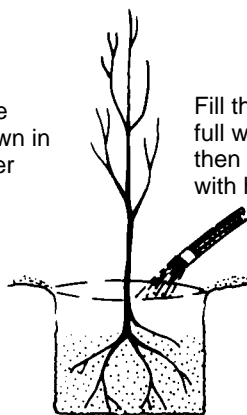
Prune damaged or weak roots and branches.



2

Set on firm mound of backfill; spread roots.

Plant at same depth as grown in nursery, never deeper.

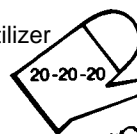


3

Fill the hole 3/4 full with backfill; then water; tamp with hands.

Fill basin with water. Add topsoil to reshape basin.

fertilizer



4

Finish filling with backfill; do not tamp.

Form basin; fertilize and mulch.

Figure 3. Proper planting of a bare-root plant in well-drained soil.

Fill the hole full of water, and let it soak away. This settles the soil and eliminates air pockets around the roots. Do not pack the soil after it is watered. Straighten the plant if necessary, and finish filling the hole with soil.

Construct a watering basin by forming a 2- to 3-inch rim of soil in a circle 2-3 feet larger than the diameter of the hole (Figure 4). Prepare a fertilizer solution with a water soluble fertilizer (20-20-20 or similar analysis). It is best to use the rate recommended on the label. Fill the basin with the fertilizer solution, usually 2 to 3 gallons are necessary for each plant. Do not use any more fertilizer at planting time or during the first growing season.

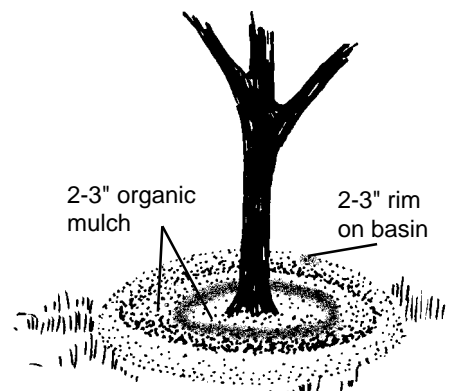


Figure 4. A completed planting job with watering basin and mulch in place.

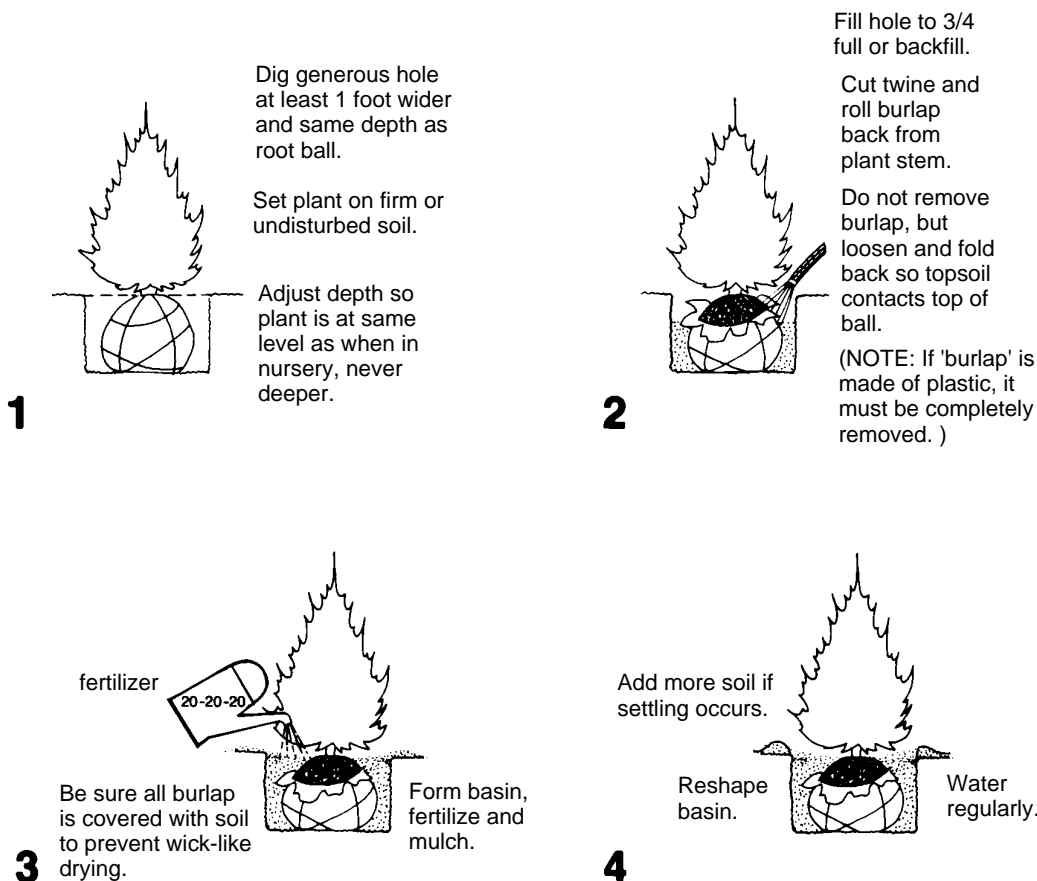


Figure 5. Proper planting of a balled and burlapped plant in well-drained soil. Handle balled and burlapped plants carefully. Do not drop. Lift or carry by holding the soil ball, not the plant.

After watering, add a mulch of 2 to 3 inches of bark or other coarse material over the entire watering basin. Do not place any mulch against the trunk of the tree or the stems of shrubs. Be sure to maintain the soil rim around the basin to catch water during rains and to hold water that is added during the summer.

Balled and Burlapped Stock

Remember to handle balled and burlapped stock only by the soil ball, never by the stem or crown of the plant.

Position the plant in the prepared hole so that the top of the soil ball is level with the surrounding soil surface, never deeper (Figure 5). Backfill the hole three-fourths full. Cut all twine or wire away from the top of the soil ball and the stem. Wire baskets should be left on large balled and burlapped stock. Such baskets do not result in root growth problems as the plant ages. Roll back the burlap to below the soil surface. (Note: If the "burlap" is made of plastic, it must be completely removed). Fill the hole with water to settle the backfill. Finish by filling the hole, but do not pack or tramp this soil. Finally, prepare a basin, and mulch and fertilize as described for a bare-root plant.

Containerized Stock

Handle containerized stock with similar procedures and care as for B & B material. Avoid planting too deep! Do not remove the container until the hole is prepared. However, the container must be removed completely if it is metal or plastic. "Plantable" containers, however, may be placed in the ground (see below). Container removal should be done very carefully to prevent a break up of the root ball, especially if the plant is actively growing.

Metal or plastic pots are most often used for container-grown plants, or plants that have been in the pot for at least a full-growing season. Tapered metal or plastic containers can be removed by turning the plant upside down and giving the rim a sharp tap on a raised surface. Cut straight-sided metal cans on two sides, pull away from the roots, and lift the root ball out (Figure 6). Most nurseries will cut metal cans for you. Prior to placing the root ball in the prepared hole, cut any long roots that completely encircle the root ball. Finish planting, mulching, and fertilizing as described for B & B stock.

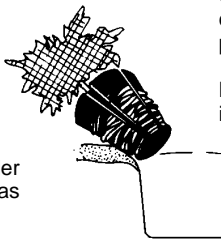
Containers made of papier-mache may be removed; however, the root ball in such a pot is not dense because the plant has not been in the pot a full growing season. The soil of these potted or field-potted plants is likely to fall away from the roots if the pot is removed. Thus, the best planting method (Figure 7) is to position the pot in the prepared hole, at the correct depth

part of the pot which extends above the finished soil line. Just prior to backfilling and using a sharp utility knife, slash the pot vertically from bottom to top, in five to ten locations around the perimeter of the pot. Backfill immediately while the form of the pot and soil ball are undisturbed. Complete the job by backfilling, mulching, and fertilizing as for B & B stock.

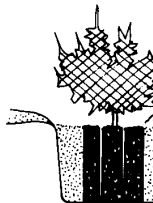
Straight cans; cut on opposite sides and fold back metal.



Hole is 1 foot wider and same depth as root ball.

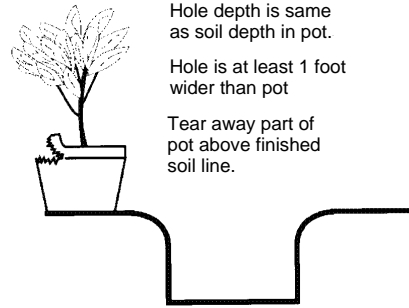
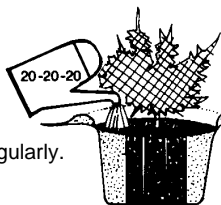


Backfill with soil.
Tamp firm with hands.

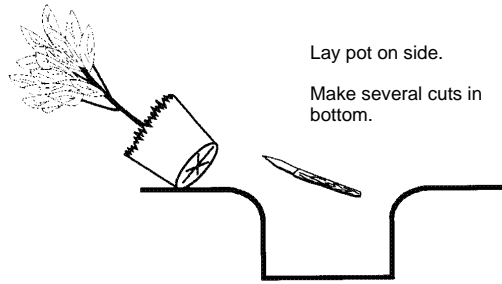


Fertilizer

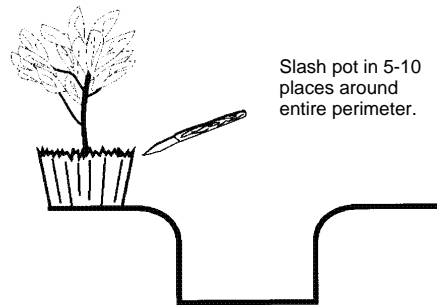
Water regularly.



Hole depth is same as soil depth in pot.
Hole is at least 1 foot wider than pot.
Tear away part of pot above finished soil line.



Lay pot on side.
Make several cuts in bottom.



Slash pot in 5-10 places around entire perimeter.

Form basin, fertilize, and mulch.

Finish filling hole; water.

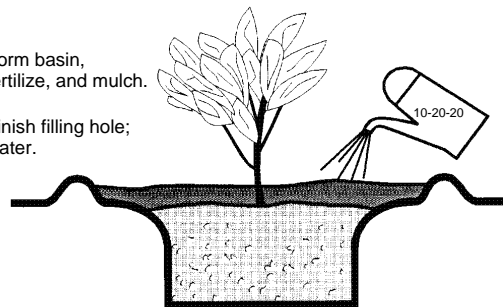


Figure 6. Proper planting of a contain well-drained soil. Roots of container- bind the soil. However, careful handli will prevent injury. Always remove co planting. Cut encircling roots when pr

Planting in Heavy Soil

It cannot be overemphasized that the best solution to the problem of planting in heavy soil is proper plant selection. The choice of plants may be somewhat reduced, but the likelihood of long-term plant survival with minimal maintenance is much greater.

Do not add any backfill amendments when planting in heavy soil. A light, amended soil mix placed where it is surrounded by heavy soil too often results in trapped water, suffocated roots, and a dead plant. Make certain the soil is not deeper in the soil in the new location than it was when growing in the nursery field, or container.

When locating species of small ornamental trees or shrubs that require excellent drainage in poorly drained soils, a raised bed is the only satisfactory alternative (Figure 8). Use a mixture of one part loamy topsoil and two parts sphagnum peat moss. Make the bed at least 6-8 inches high. The width should be at least 4 feet for a shrub and 8 to 10 feet for a small ornamental tree. Begin by rototilling or hand spading the existing soil in the bed location. Then, place a 3- to 4-inch layer of prepared soil mix over the existing soil. Spade or rototill the soil in place. Follow with a second 3- to 4-inch layer of soil mix and a final pass with the rototiller. A wall may be placed around the raised bed to prevent the soil from washing away; however, where space permits, the outer edges may be sloped to the original level of the soil. Remember, this method should be used only when absolutely necessary. Before beginning a planting project requiring this magnitude of effort, reconsider the selection of plant species which is better adapted to the existing soil conditions.

Planting in Excessively Sandy or Light Soil

For extremely sandy soil, use some sphagnum peat moss, and prepare a backfill mixture of one part sphagnum peat and two parts original soil (Figure 9). It is often advisable to dig the hole larger than ordinarily recommended, but set the plant no deeper than it had originally been placed. Backfill with the prepared mix, as recommended previously, and add at least a 3-inch layer of mulch outward from the trunk to a point 2-3 feet beyond the width of the planting hole. Water thoroughly once a week. Be sure to include water-soluble fertilizer in the initial watering and again once or twice during the first season. Watering in succeeding growing seasons may be essential.

Pruning

All plants may be pruned at planting, but it is not required for any. Planting time is an excellent time to remove diseased or damaged branches, basal (sucker) shoots, and limbs formed with extremely narrow crotch angles. For shade trees, planting time may be a good time to select major scaffold limbs which will become the main structure of the tree. Remove excess branches that are not planned to become scaffold limbs.

Staking and Guying

Bare-root trees more than 6-feet tall and balled and burlapped trees more than 10-feet tall should be supported by staking to prevent excessive movement of the root system (Figure 11). Usually a system of three wires attached to three stakes and fastened about two-thirds of

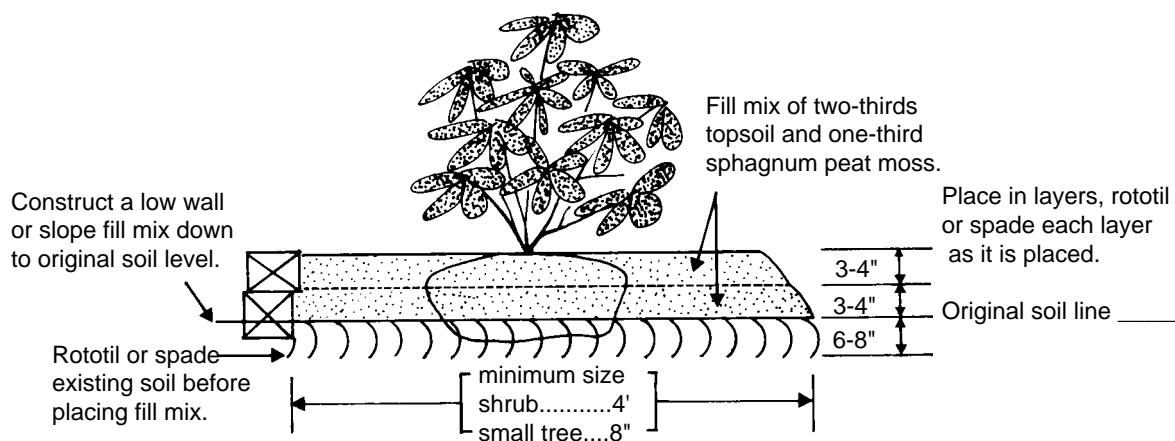


Figure 8. Construction of a raised bed on poorly drained soil.

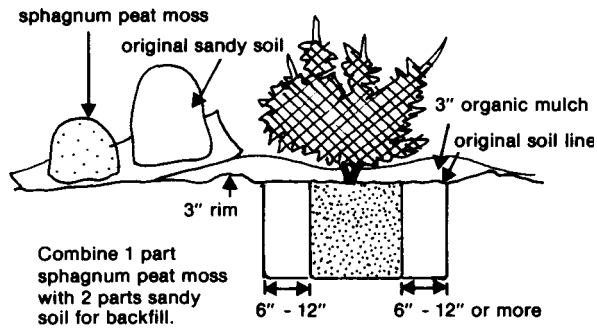


Figure 9. Proper planting technique for sandy soil.

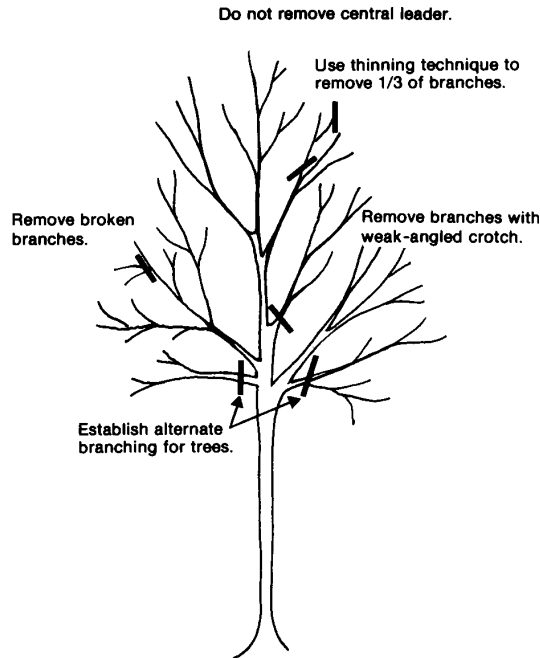


Figure 10. Top pruning of newly planted bare-root trees and shrubs.

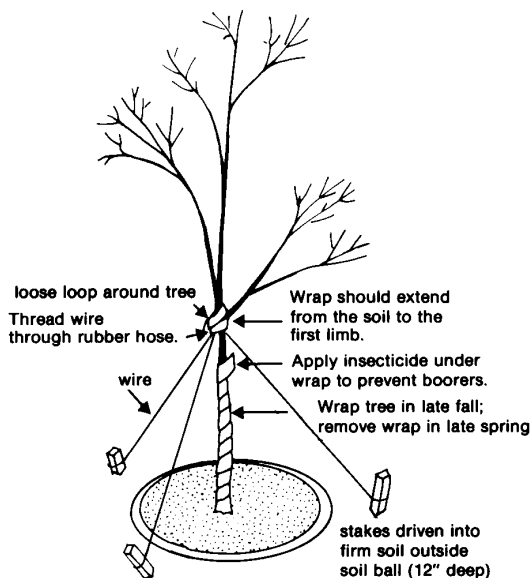


Figure 11. Staking and wrapping a tree.

the height of the trunk is sufficient. The stakes should be driven in firm soil at least 18 inches beyond the perimeter of the planting hole. Anchor the wires securely after each wire has been passed through a rubber hose where it is looped around the tree. Be sure the loops around the trunk are very loose to prevent damage to the tree. Remove the supporting wires within one year after planting from trees up to 2" caliper. Larger trees may require guying for 2 or more growing seasons.

Trunk Wrapping

Newly planted trees, particularly those with thin bark such as red maple, should be wrapped with a commercially available tree wrap sometime in the late fall for adequate winter protection. Wrapping material should be removed in spring. Wrapping should be repeated each fall until the bark becomes rough and corky.

Start the wrap at the base of the tree, and extend it to the first limb. Spiral the wrap around the trunk with each turn overlapping the previous turn by half the width of the material. Secure the wrap with tape, twine, or by looping it back on itself.

Watering

The most important factor in caring for newly planted trees and shrubs is water. You must provide the correct amount of water, because overwatering is just as injurious as underwatering. The soil type and the amount of rainfall will determine the frequency and amount of water needed.

On well-drained soils, apply 1 inch of water per week during the summer and fall. On sandy soils, at least 2 inches of water per week are needed, preferably in two applications of 1 inch each. Poorly drained, clay soils will require less frequent watering.

Water regularly and supplement normal rainfall. Don't just sprinkle by using light waterings. A brief rain shower of 1/2 inch should be supplemented by additional watering. If a heavy rain occurs (2 or more inches), additional watering may still be needed the following week, not in two weeks. Using a lawn sprinkler, place a straight-sided can near the tree or shrub and water until the can contains one inch of water.

Transplanting

Occasionally there is a need to move a tree or shrub from one location in a yard to another. Root pruning should be carried out over a two-year period before the plant is moved. Nevertheless, relocation of large trees is best left to professional nurserymen.

To transplant trees, measure out 9 inches for each inch of the trunk diameter measured at your waist height. For

example, a tree with a diameter of 1-1/2 inches should be root pruned at a point of 13-1/2 inches from the trunk. For shrubs, make the cut half the distance of the radius of the branch spread of the shrub. For example, a shrub with a spread of 36 inches from the center to the outside of the shrub should be root pruned to 18 inches.

During the first year, cut straight down around 2 quarters of the plant on each of two opposite sides (Figure 12). Use a sharp spade to cut 18 inches deep. During the second year, use the same procedure to cut around the remaining 2 quarters of the perimeter of the plant. This two-year process removes many of the long roots and encourages many new roots to grow within the soil ball. The plant is then ready to move at the third season.

Dig 6 inches further away from the trunk than the line where root pruning occurred, and throw the soil away from the root ball. Dig a hole 18 inches deep. When the circular hole is completely finished, gently rock the plant (with the soil ball attached) from side to side. Cut the roots on the bottom of the soil ball and slide burlap under the ball.

Grasp all four corners of the burlap, and lift the soil ball from the hole. Wrap the burlap tightly around the soil ball. Tie the burlap so it will not loosen in handling. Handle the plant carefully, by lifting the soil ball, not the trunk. Do not break the soil ball! Plant as previously described.

Summary

1. Plan before planting. Have a landscape plan.
2. Handle the plants carefully at all times.
3. Follow the recommendations on planting time.
4. Make the hole large enough; make it at least 1 foot wider and the same depth as the soil ball, the container, or the bare root.
5. Never plant deeper than the depth in which the plant was originally growing.
6. Take proper precautions when planting in heavy, poorly drained, or sandy soils.
7. Do not fertilize in the first year except at the first watering.
8. Prune bare-root stock at planting to improve plant form and solve problems.
9. Support tall trees by at least three wires and stakes.
10. Carry out an accurate watering program for the entire first season.

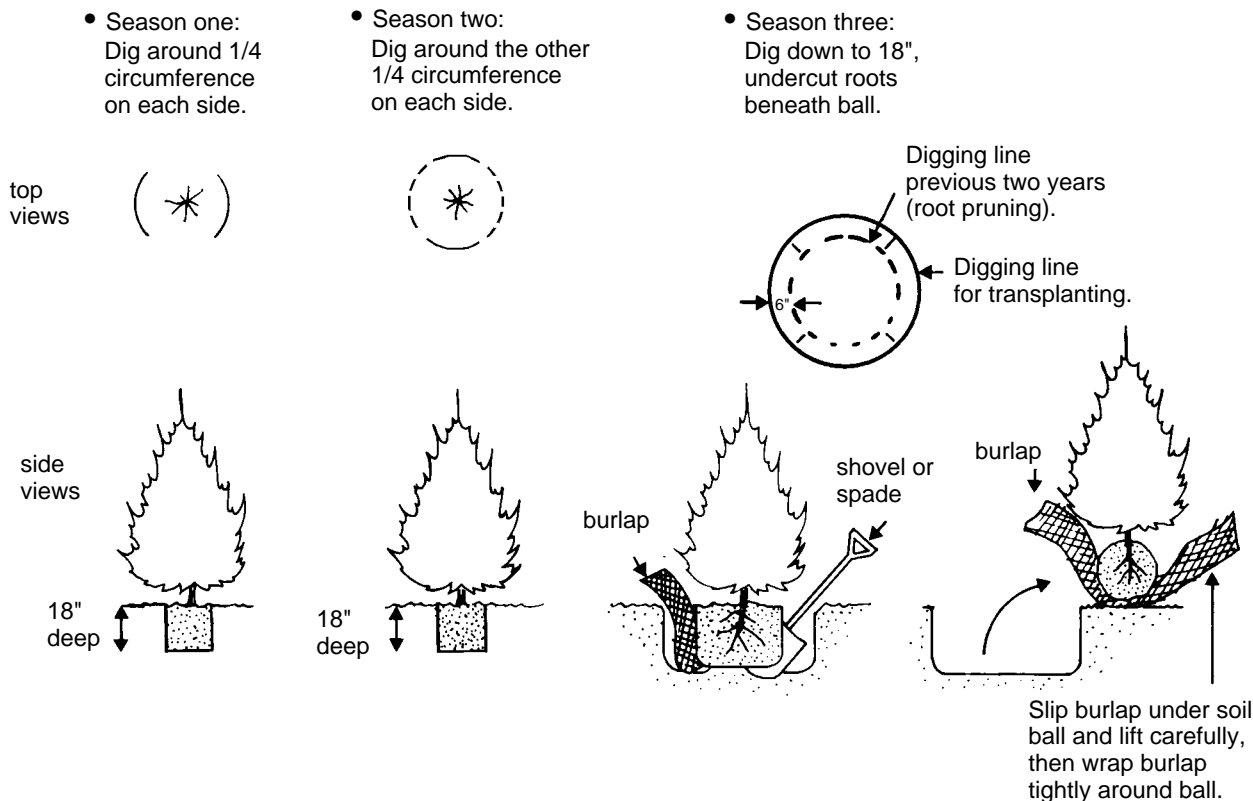


Figure 12. Two-year sequence for root pruning and third year transplanting of a tree or shrub.

*The previous edition of this bulletin was authored by P. Carpenter.

For more information on the subject discussed in this publication, consult your local office of the Purdue University Cooperative Extension Service.