

Transplanting Trees and Shrubs

W.M. Fountain, C.A. Kaiser, M.L. Witt, J.R. Hartman

"He who plants a tree plants hope." Properly planted trees or shrubs offer a great deal of satisfaction and aesthetic appreciation to the person planting and caring for them. Besides giving you the joy of watching them grow with each passing year, trees in the landscape will reduce your heating/cooling budget, increase your home's value and make selling it easier. Trees and shrubs are also valuable for adding privacy and attracting wildlife to the neighborhood. Unfortunately, you cannot start out with mature specimens. The care taken at planting and in the early years will determine what the tree or shrub looks like at maturity, if indeed it makes it to maturity.

Types of Nursery Stock Available

Woody plants are produced and sold in 3 different forms: container-grown, balled-and-burlapped and bare-root (Figure 1). Each has its own unique characteristics and planting requirements and no one type of purchase is always best.

Container-grown trees and shrubs are generally much smaller than balled-and-burlapped plants. They are well established in the container and may be kept easily until planting time as long as they receive a daily watering. Container-grown plants are less expensive to ship because they are grown in a light weight, artificial soil. Another advantage is that the root system is completely intact because the plant has grown in the container since it was a

seedling. A disadvantage to container grown plants is that once planted in the landscape, the roots are often slow to break out of the artificial mix into the native soil. Also, the artificial mixes dry out much more rapidly than the surrounding soil, so watering is very important.

The root system of a **balled-and-burlapped** plant is cut when it is dug at the nursery. The root ball is usually wrapped in burlap or placed in a wire basket in preparation for sale. These plants need to be kept in a sheltered place outdoors until they can be planted. While balled-and-burlapped plants can be held for short periods of time after purchase, the sooner they are installed, the better. They are heavy because of their large soil/root ball, so shipping them for long distances is not economical. Therefore, chances are your balled-and-burlapped plant was grown in a nearby nursery. However, the weight makes the plant difficult to handle. You must dig the hole to the correct depth before lowering the plant into it. Often these plants are too heavy for one person to lower into the hole and you may need help. Never drop the soil ball into the hole since it will crack and break roots. Also, never pick up the plant by holding the trunk—the roots cannot support that much weight.

Bare-root plants are normally kept in cold storage (40°F) until they are sold. Prompt planting while the plant is still dormant is important. Roses, fruit trees, hedges and perennials are commonly sold as bare-root plants. This method of shipping plants long distances is the cheapest

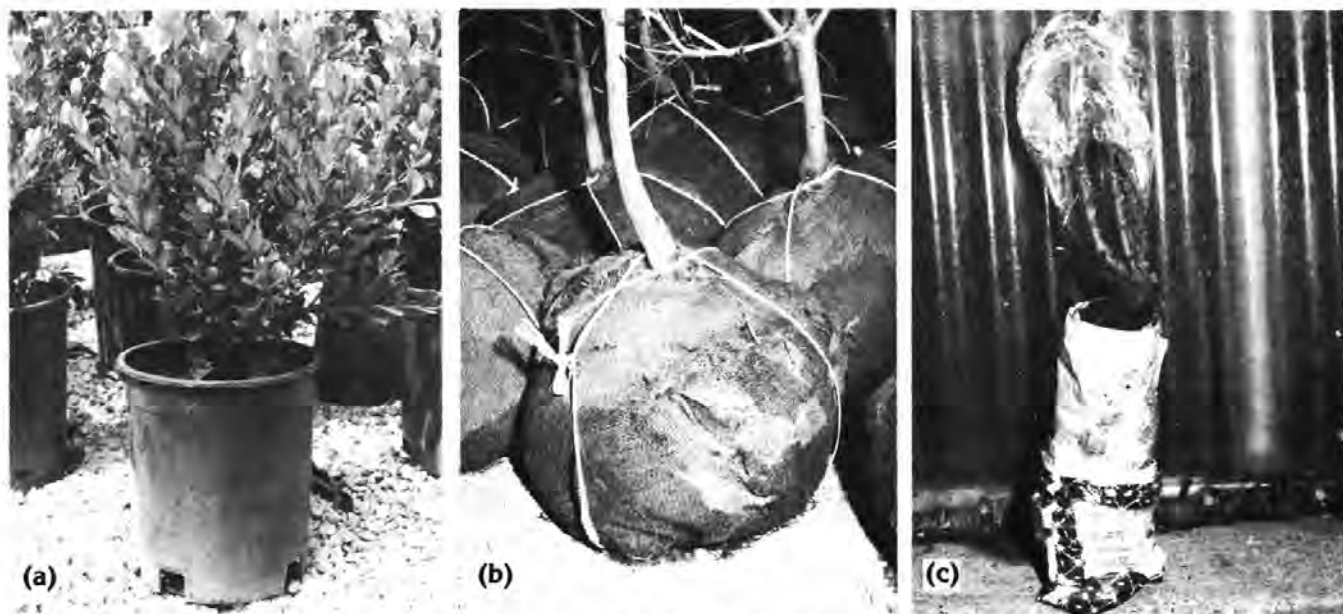


Figure 1.—Planting material may be (a) container grown, (b) balled-and-burlapped or (c) bare-root.

and results in the greatest savings for the customer. A disadvantage to bare-root plants is they suffer a great deal of root loss when they are dug and the soil is removed from their roots. Because of this loss, bare-root plants must be handled with more exacting care.

Proper Planting Techniques

Special Handling Required Before Planting

The major site of root regeneration is the severed root end of balled-and-burlapped plants. Consequently, take care to keep the roots, especially the outer root ends, from drying. Keep the soil ball moist until the tree or shrub is planted, but never leave the plant standing in a tub of water. A thorough soaking with a hose usually works well.

Bare-root trees and shrubs have a better chance of survival if you plant them in the spring before their active growth starts. Never allow the roots to dry out because they will die. Dampened sawdust, loose compost or potting mix are packed around the plants before shipping and should be kept moist at all times. If bare-root plants cannot be planted immediately after purchase, they can be "heeled in." To do so, make a bed of damp, well aged sawdust or loose compost 8-24 inches deep and put the plant's roots in it until planting. During dry periods, the beds need to be watered. Before planting, soak the roots in water for 30 minutes while you prepare the hole.

Selecting the Site

The growing site should be carefully selected. Consider not only where the plant will look good, but also where it will grow successfully. Be sure the tree or shrub will be able to reach full maturity without growing into overhead wires, buildings, fences, other plants, driveway areas, etc. Choose a site where the soil is deep, fertile and well drained. Trees and shrubs growing in soils poorly drained due to compaction, high clay content or rock near the surface will have problems with surface roots, lack of hardiness, poor leaf color and fall color, limited stem growth, limited flowering and problems with diseases and insects.

Sun and wind exposure should also be taken into account before planting.

Raised Beds—One solution to landscaping poorly drained soils is to plant in a raised bed (Figure 2). The bed must be deep enough to contain the plant's roots. The root system of a tree obviously will occupy a greater volume than a small shrub's. A general rule of thumb is to use a depth of at least 18 inches for small shrubs and 30 inches for trees. The raised bed area should extend to the tips of the farthest branches (the dripline) of the plant being



Figure 2.—Raised beds provide one solution for planting in poorly drained soil.

installed. Realistically, you should expect to replace trees in raised beds every 15 to 20 years. The root system will have filled the bed by then and the plant's height will make it less stable in storms.

Dig the Hole

Size—The planting hole should be large enough to accommodate the roots without twisting and breaking either the roots or the soil ball (Figure 3a). The hole for balled-and-burlapped and container-grown plants should be as deep as the root ball. Bare-root plants require a hole that is slightly deeper than the root system.



Figure 3.—Steps in transplanting a tree or a shrub.

(a) Dig the hole to accommodate the existing root zone of the plant.

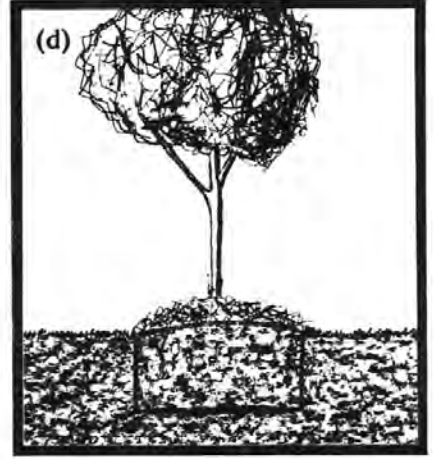
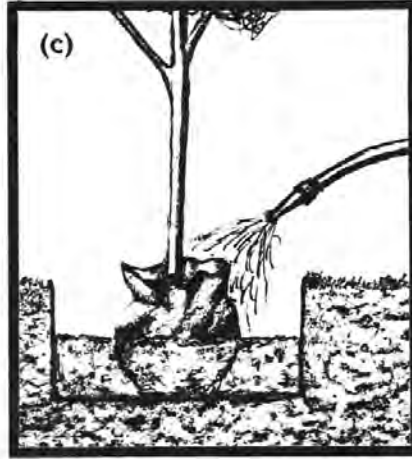
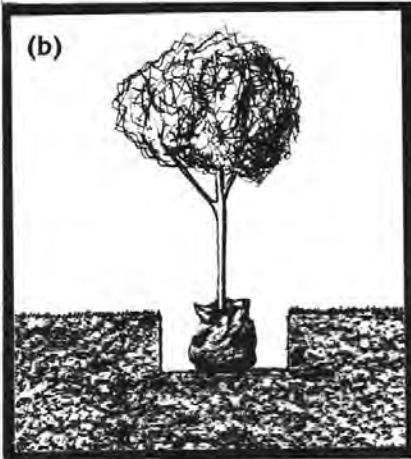


Figure 3.—(b) Plant at the proper depth. Loosen the burlap from around the trunk. (c) Add topsoil until the hole is half full. Tamp lightly and water thoroughly. (d) Fill the remainder of the hole with soil and then water thoroughly. Add a 3-inch layer of mulch.

What to Dig With—Hand digging the hole with a shovel is the best method. Whenever an auger (Figure 4) or posthole digger is used, the sides of the hole are likely to be slick. If so, use a spade or other tool to scrape and loosen the sides of the hole. Also, soils high in clay should not be dug when they are wet because the metal shovel will leave the sides of the hole slick like the side of a glazed pot. The roots must be able to penetrate all sides of the planting hole, but if the surface is glazed, most of the roots approaching this layer will be unable to grow through it to establish roots in the surrounding soil.

Remove Damaged Roots

Remove broken, dangling roots from container-grown and bare-root plants. Make clean cuts using a sharp knife or pruning shears. Similarly, diseased roots and dead root tips should be removed past the point of damage. Damaged root tissues are a good entry site for root rotting fungi. In addition, cutting these roots back will encourage branching.

Remove Packing Materials (If It Doesn't Rot, Remove It)

Metal or plastic containers must be removed from container-grown plants prior to planting. Tap the container on the bottom and sides to loosen it from the soil ball.

All nursery tags and the string, twine or wire used to attach them to the trunk or branches should also be removed.

Some balled-and-burlapped plants are prepared using synthetic or plastic burlap. These materials have been used in the nursery industry when plants have to be held for more than a couple of weeks. It does not rot on top of the ground and it will not rot under ground. Roots are not able to go through the plastic and, if it is not completely removed, the plant will be pot-bound in the landscape. In addition, metal baskets (Figure 5) and twine should be removed from the root ball prior to planting. These materials, if left on, will result in girdling as the roots enlarge.

If the burlap is biodegradable (usually tan in color with no hint of plastic), it may be left on the ball. However, some synthetic burlaps superficially look and feel like burlap. If you are unsure of the nature of the fabric, remove it or cut it away from the root ball. Be sure, also, to remove the plastic string or twine which secures the burlap and is wrapped



Figure 4.—Digging the planting hole with an auger.



Figure 5.—Metal baskets should be removed from the root ball before planting.



Figure 6.—Non-biodegradable twine used to hold the burlap in place on a balled-and-burlapped tree was not cut at planting. The tree died when the twine girdled the trunk.

around the trunk. Figure 6 shows what can happen when this twine is left around the trunk. It is also a good idea to pull the burlap away from the trunk. Nursery nails used to secure the burlap do not have to be removed.

Spread Out the Roots

The roots of bare-root plants should be spread out in the planting hole. Cramping all the roots into the bottom of the hole will turn the roots and can result in girdling root problems in years to come (Figure 7).

If container-grown plant material is root bound at transplanting, the roots may continue to spiral around within the planting hole. To prevent this, the mass of roots which encircle the container should be cut or disturbed by pulling them apart. This action prevents continued circling which can later develop into girdling roots. Using a sharp knife, make vertical cuts one inch deep at 4 to 6 different locations around the root ball (Figure 8).



Figure 7.—Girdling roots can result when the roots are turned in the planting hole at transplanting. Note the natural flare at the base of the trunk is missing around most of this tree. This usually indicates a girdling root problem is "strangling" the side of the tree where roots are absent.

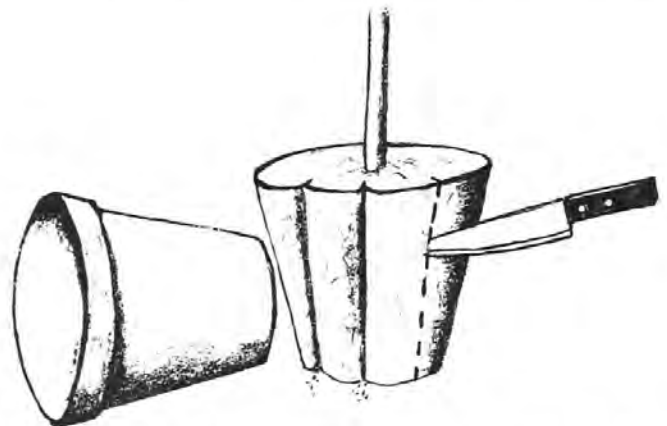


Figure 8.—Before planting, use a sharp knife to cut into the spiraling roots of pot-bound, container-grown plants.



Figure 9.—A fairly abrupt change in coloring on the trunk indicates the previous soil line.

The Fill Soil—Generally, the best thing to put back in the planting hole is the same soil that came out of it. Soil amendments (such as peat moss, pine bark, etc.) are expensive, difficult to mix evenly and do little to help the plant re-establish itself in its new location. Often the roots will grow very well in the amended soil, but fail to penetrate the side wall of the planting hole.

If an entire bed is being prepared, amending heavy soils to provide improved aeration and water movement will improve root growth.

Soil amendments are necessary when planting rhododendron and azalea beds. Mix sphagnum peat moss thoroughly into the planting area using a 1:1 ratio of peat moss to soil. Often raised beds are built for these plants and large amounts of peat moss are incorporated into the entire area to keep the soil pH around 4.5 to 5.0.

Add Mulch

Adding a layer of mulch (bark, wood chips or stone) three inches deep (Figure 3d) will help control weeds and conserve soil moisture. Black plastic mulch is good for annual plantings, such as annual flower beds and vegetable gardens but should never be used for perennial beds, because the roots under the plastic cannot get enough oxygen. The roots grow poorly and the plants decline prematurely when insufficient oxygen is available to the plant. Some of the new fiber mulches may overcome this problem.

Staking Is Usually Unnecessary

Trees and shrubs should be staked only when there is danger that they will be blown over by high winds. The trunk diameter and strength usually increases faster in unstaked plants which are allowed to move with the breeze. Root development is also faster for unstaked trees.

Even though staking is not recommended, especially for small trees, if you think it is necessary for particularly top-heavy trees, be sure to place the stakes correctly. While two or three stakes can be used, we recommend using three (Figure 10). Using a single stake as shown in Figure 10a is not recommended since the stake can rub against the trunk, causing injury.

Put the stakes outside the planting hole area, where the ground is firmer, and far enough into the ground to prevent their being pulled out. Whether the stakes are short (Figure 10c) or long (Figure 10b), attach the securing lines about two thirds of the way up the plant. Use metal wires to guy the tree. An old piece of rubber hose around the wire will protect the tree from being girdled (Figure 11). If the tree is large, use turnbuckles on each of

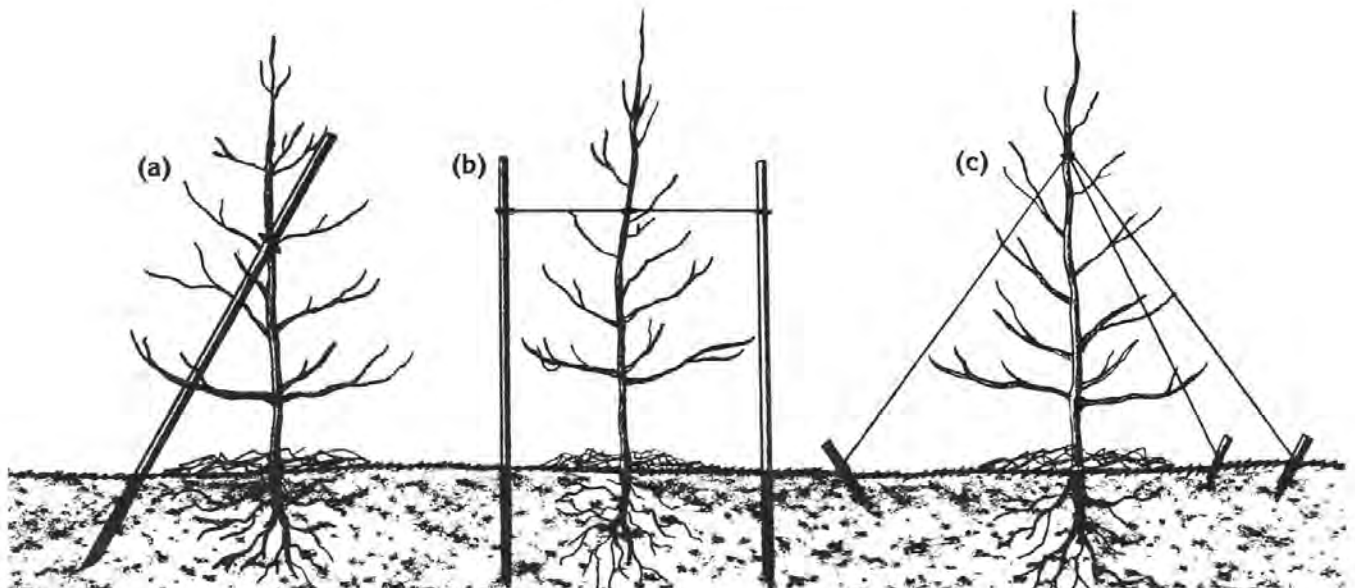


Figure 10.—Staking methods using (a) 1, (b) 2 and (c) 3 stakes.



Figure 11.—Use a rubber hose over guy wires to protect the tree from rubbing injury.



Figure 12.—Tumbuckles can be used on each wire on a stake to take up the slack in the wires. The inset shows a close-up of a tumbuckle.

the wires to take up slack in the wires (Figure 12). It is generally not necessary to leave the staking in place after one year. Check the wires frequently since loose wire can rub the trunk and excessively tight wires can girdle it.

Wrap the Trunk

Newly transplanted trees can be wrapped with one of the commercially available wrapping materials (Figure 13a) to protect their thin bark from sunscald. Wraps help reflect sunlight and add an extra layer of insulation against sudden temperature changes that can occur in the winter. Begin wrapping at the base of the trunk and continue up to the first branches. Overlap each of the previous layers so that water will be shed. Wrap trees during the fall after planting and remove the wrap the following spring. A loose cylinder of screen may also be used effectively as a tree wrap.

Regular Watering is Essential

The effect of extensive root loss must be considered when transplanting bare-root and balled-and-burlapped trees and shrubs. Less than 10% of a tree's root system remains in an average root ball and even fewer roots remain on a bare-root plant. When a substantial portion of the root area is lost, the plant's ability to take up water is also significantly reduced. As a result, transplanted trees and shrubs can experience considerable water stress.

Watering, then, is the single most important thing you

can do for a newly transplanted tree. Trees and shrubs not receiving one inch of rainfall per week will need supplementary watering during the first year after transplanting. In fact, you will need to continue regular watering for 3 years, because trees and shrubs may take that long to become fully established in a landscape.

Supply enough water to soak the soil around the roots at each watering and allow the soil to dry between waterings. A good practice is to thoroughly soak the soil every 7 to 10 days during dry periods. Avoid frequent light waterings since they will encourage root growth near the soil surface.

Needled evergreens (e.g. pine, spruce) and broad-leaf evergreens (e.g. rhododendron) keep their leaves during the winter. Because they continue to lose water through their leaves during this time, evergreens should also be watered during dry periods in the winter as long as the ground is not frozen. Deciduous plants (e.g. maple, oak) are dormant in the winter and generally do not require watering during these months. However, winter watering for deciduous plants will be necessary during winters with little or no rain or snow.

Balance the Top to the Roots?

For years the rule has been to prune tops back so the above ground portions of the plant will be in balance with the root system. While it is true that a large portion of the root system is lost with newly transplanted material, you generally do not need to remove any branches. Leaves are



Figure 13.—Wrap the trunk to prevent sunscald injury.

vital to making the sugars that provide the energy source for forming new roots.

Performing a little corrective pruning, however, may be necessary. Dead, damaged or misshapen branches can create problems later and therefore should be removed at planting time. Do not remove the central stem, do not leave stubs and never top the tree. In short, follow good pruning practices.

Fertilize

Allow the plant to remain in its new site for a year before fertilizing. Plants generally do better if allowed to recover from the initial shock of transplanting before fertilizer is applied. Soils capable of supporting growth over a period of years are more than fertile enough to satisfy the plant's demands the first year.

The goal during the first year is the re-establishment of the root system, and not promotion of growth to the plant's above-ground portions. Fertilizer can actually cause production of more leaves than the root system is capable of supporting.

If someone insists on using fertilizer immediately after transplanting, a water-soluble formulation high in phosphorous and low in nitrogen would be best. This type of

fertilizer is commonly used for all types of transplants.

During the fall following transplanting, apply 1/3 lb of ammonium nitrate or 1 lb of 10-10-10 per 100 square feet of root area. In successive years, this amount can be increased to 2/3-1 lb of ammonium nitrate or 2-3 lb of 10-10-10 per 100 sq ft root area. If your lawn is being fertilized, there should already be a sufficient amount of fertilizer available to the tree roots.

Transplant Shock

Whenever a tree or shrub is moved from one growing site (e.g. a nursery) to another (e.g. your landscape), it is stressed. When great care is taken to minimize the stress through proper transplant techniques and maintenance, the plant is likely to recover rapidly and become well established in the new site. Unfortunately, all too often the opposite occurs—the tree or shrub suffers "transplant shock" from careless or improper transplant methods, and recovery is hindered. Poor growth, wilting, yellowing, premature leaf or needle drop and dieback are typical symptoms of transplant shock (Figure 14). Trees or shrubs unable to recover, continue to decline and eventually die.



Figure 14.—Transplant shock symptoms may become evident during the first 3 years after planting.



Figure 15.—Failure of the roots to emerge from the original root base of this container-grown plant resulted in transplant shock symptoms.

A tree or shrub may take as long as 3 years to recover from the stress of transplanting. Even with good root regeneration, the transplant often will not show much top growth until the roots reach their original expanse prior to digging. Failure of the plant to regenerate new, healthy roots or to establish its root system in the new site is frequently the underlying cause of transplant shock (Figure 15). Such root-related problems may be traced to one or more factors: stresses which occurred when the plant was removed from the original site, injury in transit, improper planting techniques and/or poor cultural practices.

Causes

Some of the specific causes of transplant shock and related problems are listed below:

Poor Plant Material

- Species not hardy in Kentucky.
- Plant not healthy and vigorous.
- Root ball too small for the amount of top growth.
- Plant roots not kept moist between digging and transplanting.
- Leaves of plant not protected from wind during transport from the nursery to the home landscape.

Undersirable Growing site

- Soil poorly drained (e.g. subsoil or other high clay

content soils).

- Planted near a downspout, resulting in wet feet problems.
- Extremely compacted soil in planting area.
- Shade loving tree or shrub planted in full sun, or vice versa.

Poor Transplant Techniques

- Root ball allowed to dry out before planting.
- Root ball allowed to freeze prior to planting.
- Mechanical injury during digging, moving or transplanting.
- Hole dug too small, crowding roots.
- Sides of hole "glazed," preventing further root penetration.
- Twine or wire holding nursery tags left on, girdling the tree.
- Plastic (non-biodegradable) "burlap" or twine left around the root ball.
- Container grown plant is root bound, and roots continue to grow around in a spiral, rather than growing outward.
- Planted at the wrong depth, either too deep or too shallow.
- Failure to use tree wrap to protect young tender bark from exposure to the sun.
- Tree wrap left on trunk longer than through the winter.
- Excessive use of fertilizer at planting, burning roots.
- Turfgrass growing too close to the trunk (no mulch used), an invitation to injury from mowers, string trimmers, etc.

Poor Follow-up Cultural Practices

- Improper watering—little or no watering, excessive watering (especially problematic in heavy clay soils), or frequent light sprinkling.
- Application of high levels of nitrogen, resulting in excessive top growth compared to the root growth.

Recommendations

Prevention is the key to minimizing transplant shock. Only healthy, hardy landscape material should be planted using the techniques described above. Take the following steps if your tree or shrub is already planted and now showing transplant shock symptoms:

- (1) If the tree or shrub needs to be moved to a better site, do so.
- (2) Alleviate or correct as many stresses as possible.
- (3) Prune out dead and dying branches.
- (4) Water thoroughly with the equivalent of 1 inch rain per week during dry periods.
- (5) Fertilize as described above.