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# transplanting trees and shrubs

Whenever trees and shrubs are purchased and planted, they are being transplanted. These plants are often field-grown and harvested bare-root (without any soil), balled and burlapped (ball of soil and roots wrapped in burlap), or containerized (after being harvested bare-root).

Trees and shrubs harvested in nurseries are often grown using special cultural practices, such as root pruning, to prepare them for eventual harvesting and transporting to the sales area. Field-grown nursery plants may have 75% of their root system intact after they are dug, whereas trees and shrubs dug from the wild or established landscape plantings may only have 25% or less of their root system intact.

Woody plants that are transplanted in the landscape often do not undergo any of the special procedures used in nurseries before the day they are transplanted. The increased stress on these unprepared plants can make the difference between an attractive, healthy plant and an unsightly, declining tree or shrub. Nursery stock grown in containers is often much more tolerant to transplanting than field-grown or established trees and shrubs. For additional information on selecting and planting nursery-grown stock, see NDSU Extension Service Circular H-531, Planting Trees and Shrubs.

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## Consider Transplant Success

Before transplanting a woody plant, evaluate whether or not the tree or shrub is likely to be a successful transplant. Transplanting stresses trees and shrubs. Such stress may cause plants to die or to become unattractive. Plants which are already in advanced stages of decline are especially likely to succumb to transplantation stress. Often a young nursery-grown plant will resume growth sooner than an older transplanted tree or shrub and will provide more long-term benefits in the new planting location. Shrubs have better transplant tolerance than trees, deciduous plants better than evergreens, shallow rooted species better than deep rooted species, and younger plants better than older plants. Some species tend to withstand transplanting better than others (Table). When deciding whether or not to transplant a tree or shrub, or to start over with a young plant, consider the species transplant tolerance, condition of the plant, season to transplant, new planting site conditions, the equipment needed, and follow-up care.

## Season to Transplant

Some species may survive transplanting any time during the year when the ground is not frozen, but woody plants are preferably moved in the spring after the ground thaws and before the buds on the tree or shrub begin to swell. They may also be moved in the fall after leaf drop but before the ground freezes. Fall planting should take place soon after leaf drop, providing time for new water absorbing roots to develop before the soil freezes. This is often difficult to estimate in the Northern Plains. Since evergreens are especially prone to winter browning if planting is delayed until shortly before the ground freezes in the fall, they should be moved late in the summer to early fall. Properly applied antitranspirants may help reduce the effects of winter desiccation in some species. Fall transplant success may be increased by transplanting hardy plants into sites with good soil moisture and wind protection. Woody plants that are transplanted in late spring and early summer, when shoot growth is at its peak, tend to show the greatest transplant injury.

## Transplant tolerance of different tree species.

Common Name	Scientific Name	Transplantability*
Alder	<i>Alnus</i> sp.	Medium-high
American Hop-hornbeam**	<i>Ostrya virginiana</i>	Medium-low
Apple & crabapple**	<i>Malus</i> sp.	Medium-high
Ash, Black**	<i>Fraxinus nigra</i>	Medium-high
Ash, Green	<i>Fraxinus pennsylvanica</i>	High
Birch, Paper	<i>Betula papyrifera</i>	Medium
Birch, River	<i>Betula nigra</i>	High
Buckeye	<i>Aesculus</i> sp.	Medium-low
Elm, American	<i>Ulmus americana</i>	High
Ginkgo	<i>Ginkgo biloba</i>	Medium
Hackberry**	<i>Celtis</i> sp.	High
Hawthorn**	<i>Crataegus</i> sp.	Medium
Honey-locust, Common	<i>Gleditsia triacanthos</i>	High
Kentucky Coffee Tree	<i>Gymnocladus dioica</i>	Medium
Larch	<i>Larix</i> sp.	Medium
Linden, American**	<i>Tilia americana</i>	Medium-high
Maple, Silver	<i>Acer saccharinum</i>	High
Maple, Sugar**	<i>Acer saccharum</i>	Medium-high
Mountain-ash**	<i>Sorbus</i> sp.	Medium-high
Oak, Bur**	<i>Quercus macrocarpa</i>	Medium-low
Pine	<i>Pinus</i> sp.	Medium-high
Plum & chokecherry**	<i>Prunus</i> sp.	Medium-high
Poplar & cottonwood	<i>Populus</i> sp.	High
Russian-olive	<i>Elaeagnus angustifolia</i>	Medium-high
Spruce	<i>Picea</i> sp.	Medium-high
Sumac	<i>Rhus</i> sp.	High
Walnut	<i>Juglans</i> sp.	Low
Willow	<i>Salix</i> sp.	High

\*Relative tolerance of genus or species to transplanting.

\*\*If stored dormant for an extended period of time, may not break bud readily after transplanting.

Note: Container-grown trees (grown in pots for several years) are often more transplant tolerant than field-grown or established trees.

## Site Selection

There are great differences in the environmental requirements for each tree and shrub species. Only transplant a tree or shrub where light, moisture, soil pH, and wind exposure are appropriate for the particular species. All plants require space for root and crown development; therefore, consider mature plant size when planting trees and shrubs.

Soil characteristics are often limiting factors for woody plant survival in a given area. Sometimes the soil is inappropriate for tree growth and will require improved drainage or amendments before trees and/or shrubs are planted at the given location. A soil test should be completed in areas where soil quality is questionable. For more information on soils in rural areas, contact your nearest Natural Resource Conservation Service office.

## Digging

Never allow plant roots to become dry during the transplanting process. Water all woody plants two to three days before digging if the soil is dry. Prior to digging, shrubs and trees with low branches should have these branches tied up to prevent injury during the digging, transporting and planting operations (Figure 1). Marking one side of the trunk will allow a tree to be placed in the same orientation at which it grew in its original location. Consistent orientation may help to prevent sunscald injury to stems.

North Dakota state law requires anyone who plans to dig more than 12 inches deep when planting a tree to call

1-800-795-0555 at least 48 hours before digging begins. This law was established to protect utility systems and people who dig around them.

A sharp spade should be used when digging trees to assure root wounds are clean cut. Although leaving a soil ball attached to the root system will cause less root injury, soil is heavy and sometimes it is more convenient or even necessary to transplant a tree without a soil ball.

Deciduous trees with a stem diameter of less than 1 inch and small deciduous shrubs may be dug either bare root or with a soil ball. Larger plants should only be dug with soil attached. Bare root transplanting should only be done in the spring and care must be taken to prevent damage to roots when removing the soil. Most shrub species require a root ball diameter of about two-thirds of the branch spread. The soil ball for trees should be a minimum of 12 inches for each 1 inch of trunk diameter.

Large shrubs and trees should have a trench dug deep enough to get below all of the major roots (usually 15 to 24 inches). The trench should be dug completely around the tree or shrub to be transplanted. This will provide the angle necessary for the spade to undercut roots directly under the soil ball (Figure 2). Shrubs under 4 feet tall do not typically require trenching because the soil balls are small enough for the spade to make the undercut without a trench. All roots around the plant must be severed before any lifting takes place. If the plant is removed from clay soils, any glazing of the soil ball should be roughened before burlapping or potting.

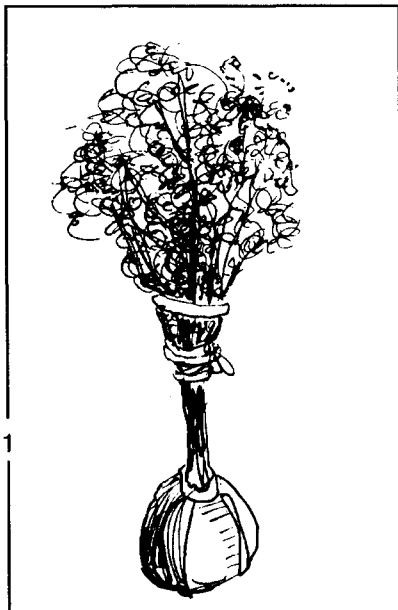


figure 1

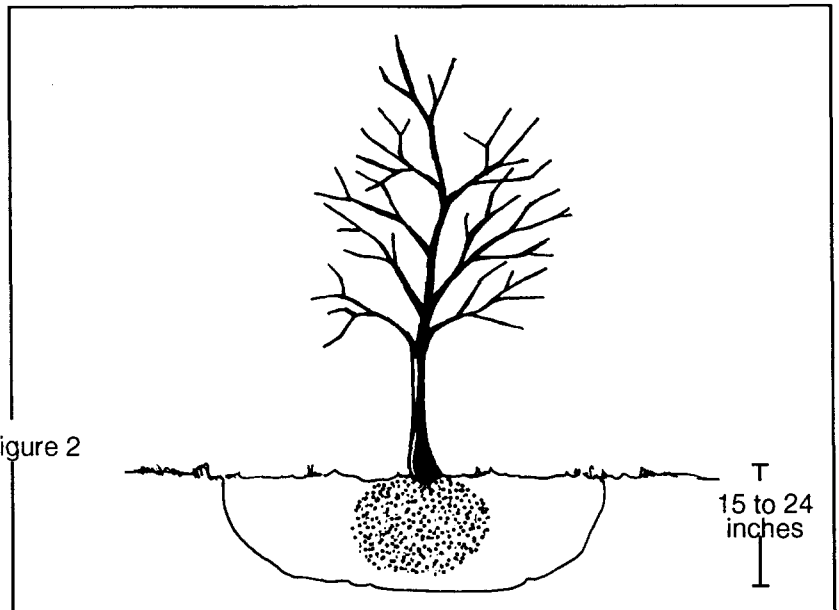


figure 2

## Storing and Transporting

Trees and shrubs that have been dug for transplanting should be planted as soon as possible. Cover a root ball with damp material which will retain moisture (burlap, peat moss, canvas, plastic, etc.) until planting. Plastic should only be used in shaded areas for less than a day or heat injury and/or root suffocation may occur. When a tree or shrub is stored, it should be protected from direct sunlight, winds, and temperature extremes. If any woody plants cannot be planted for more than a week, their roots should be covered with a mulch or moist soil and the plants should be placed in a shaded area. In all cases root systems should not be allowed to dry out. Dry roots can severely decrease the potential for transplant success.

Trees and shrubs must be protected when transporting to a planting site. Covered trucks and vans are best, but if a pickup truck is used, a tarp must be in place to protect the plant canopies and roots from drying winds in transit.

## Planting

Proper planting holes are important in tree survival. Holes should be two to three times wider than the root ball (Figure 3). If the soil is clay and the sides of the hole become glazed during digging, the sides of the hole should be roughened with a spade. Prewater holes before planting in dry soils. This prevents initial postplant water from migrating away from the root ball. Plant at the same depth that the tree or shrub was growing in its previous location. When the soil is of poor quality, dig the hole a few inches too deep and replace with topsoil.

Damaged roots should be clean-cut with a sharp blade prior to planting. If any circling or kinked roots are discovered during the transplanting procedure, sever them to prevent future girdling of the plant. Orient the tree or shrub in the same direction, relative to the sun, as it was facing in the previous location. For additional information about planting trees and shrubs see NDSU Extension Service Circular H-531, Planting Trees and Shrubs.

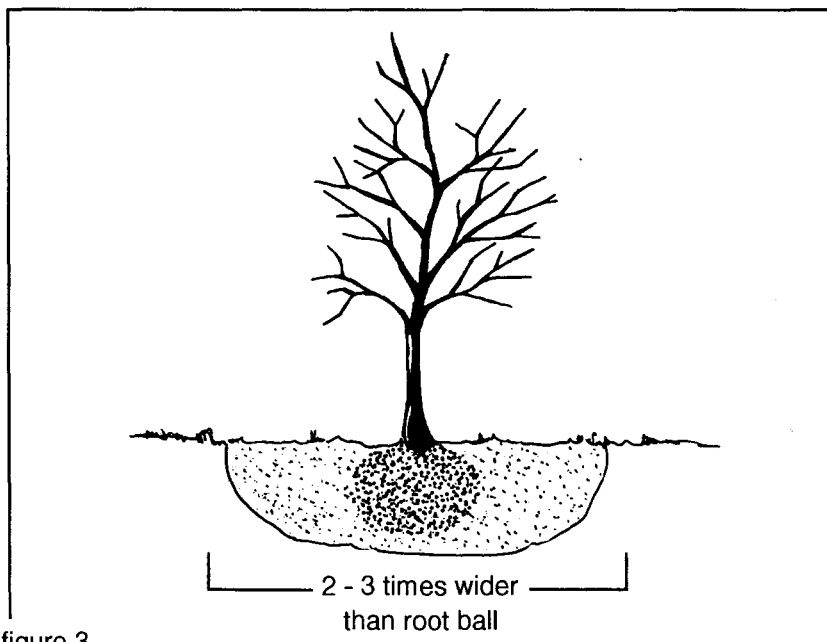


figure 3

## Postplanting Care

**Watering.** Too much or too little water after transplanting is a major cause of tree or shrub loss. The site should be thoroughly watered immediately after planting. Thereafter, the soil must be regularly monitored to prevent drying out. If rainfall is inadequate, the soil around the plant's roots should be deeply watered approximately every 10-14 days. If you are not sure if the soil is drying, dig down 3 to 4 inches next to the plant. Wet soil at that depth verifies watering is not needed at that time.

**Mulch.** Mulches help conserve moisture, moderate soil temperature and control weeds around trees and shrubs. They are placed on the soil surface over the tree or shrub root system. Either organic or inorganic mulches may be used. Organic mulches may be composed of bark or wood chips, straw, partially decomposed leaves or other materials. They should be applied 3 to 4 inches deep. Maintain a 4 to 6 inch mulch-free area adjacent to the woody stems. Inorganic mulches include plastic, crushed rock, woven fabric, and other materials. Solid plastic mulches may impede or prevent root development because they do not allow air or moisture to move into or out of the soil from above. Occasionally, when soil is poorly drained, mulch should not be used.

**Fertilizer.** For the first few years, woody plants rarely need nutrients beyond those naturally occurring in the soil. No fertilizers or manure should be mixed with the fill soil, as this could cause root damage. If transplants appear to need fertilizer during the first few years, a totally soluble complete fertilizer should be applied. For additional information on fertilizing trees and shrubs, see NDSU Extension Service Circular H-1035, Fertilizing Trees.

**Pruning.** Pruning may be required when transplanting trees or shrubs. The amount of pruning depends on the size of the root ball and plant canopy, health of the plant, and the species transplanted. Insect infested stems or those infected with disease should be removed during transplanting. Any broken stems should be removed as well. Additional pruning of shrubs may be required to balance the leaf area with the reduced size of the root system, but further pruning of deciduous trees should be postponed for at least one year after transplanting. Pruning of conifers should be limited to diseased, insect infested, and broken limbs. If additional pruning of conifers is necessary, it should be limited to one-year-old wood whenever possible. Late season plantings may require additional pruning since the plants have less time to become established before winter than those planted earlier in the season. For additional information on pruning see NDSU Extension Service Circular H-1036, Pruning Trees and Shrubs.

**Mechanical Support.** Mechanical support for trees may be necessary when the tree is tall, slow to recover, heavily foliated, or planted in a sandy site. Most small trees and shrubs do not require staking or other support and will develop strong trunks faster if allowed to move freely with the wind. For trees that do require mechanical support, staking may be used. Two stakes can be placed opposite of each other and the tree anchored to the stakes with a nonabrasive material, such as a soft, broad, fabric strap (Figure 4). Any support provided to a tree should be removed as soon as the tree can stand alone, usually after the first growing season. The sooner the support is removed, the faster the tree will become stronger.

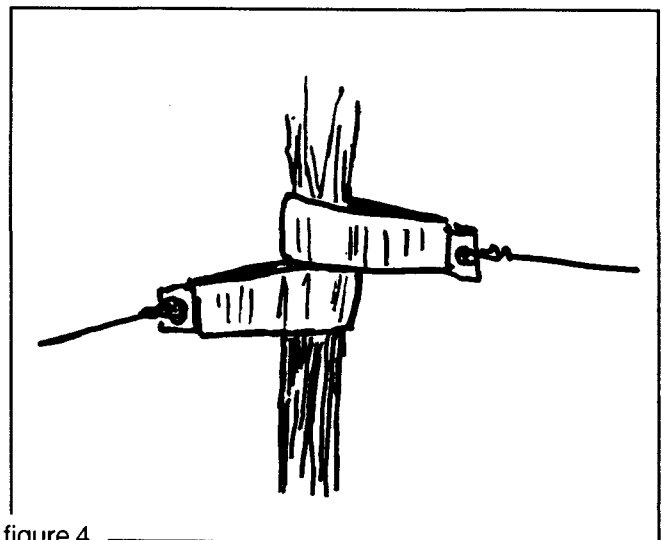
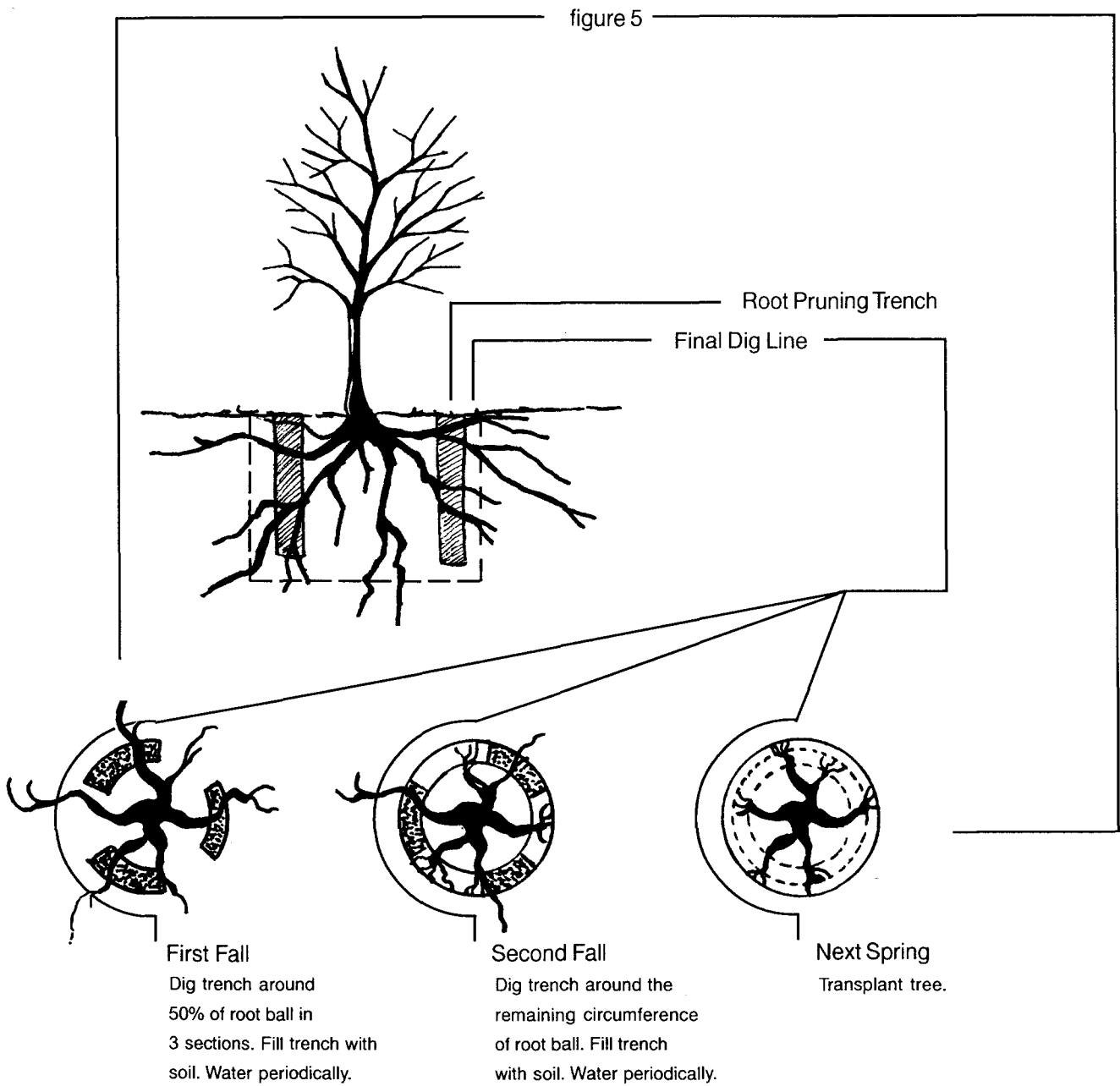


figure 4

# Techniques for Transplanting Large Trees

Special considerations are necessary when moving large trees. If trees are over 3 inches in diameter, special equipment is often required to transport the tree. Depending on the size of the tree and the technique used, the equipment may include hand carts, winches, tree spades, or cranes. If trees will be transported on a truck, precautions must be taken to ensure

that they will clear power lines, bridges, and other obstacles. Permits may be required to transport large trees on some public roads. For trees not grown with the benefits of nursery production, root pruning the trees for two or more years prior to transplanting may prove beneficial in reestablishment (Figure 5).



When hand digging, the techniques are the same as for smaller trees. Hand dug large trees may be balled and burlapped (B&B) or boxed. Larger B&B trees should have additional support provided by rope or wire. Chicken wire is a convenient material that can be wrapped outside of the burlap to support root balls. If a crane is used to pull the B&B or boxed tree from the hole, lift from the bottom of the root ball. Ensure that the trunk is heavily padded if a cable must be secured around it to balance the tree during removal. Since there is potential for severe bark injury, cables should be secured around the trunk only when they are absolutely necessary to stabilize the tree for lifting and transporting.

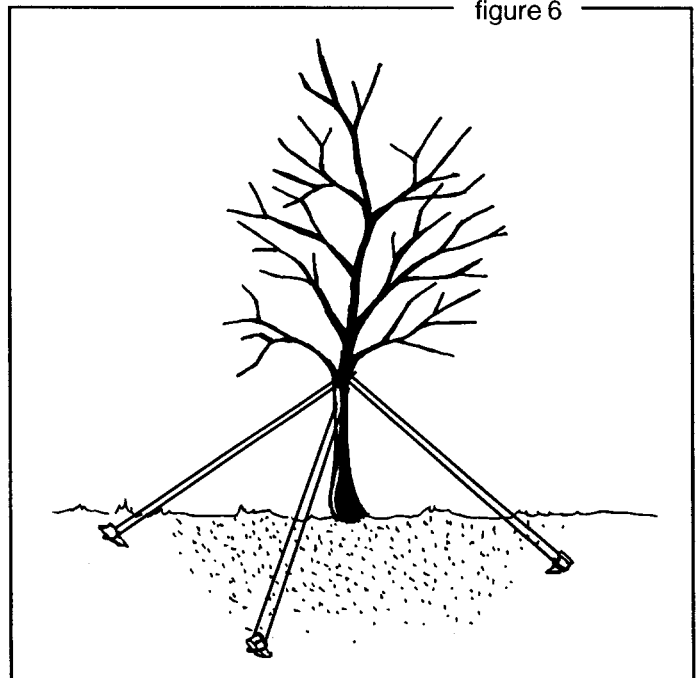
Boxing trees is sometimes preferable to B&B. Boxes will hold the root ball more securely than burlap. This is helpful in sandy soil or when trees are held for extended periods of time. Trees are dug in the same way as B&B, only the root ball is formed to fit snugly into a box. After the lateral roots are severed, the sides of the box are secured in place. Then the descending roots are severed and the bottom of the box is secured before lifting from the hole. Large boxes require heavy metal bands or other support to hold them together. Boxes may also be used to transplant trees which are larger than mechanical spades can successfully transplant. These trees should be side-boxed with the root ball diligently monitored to prevent drying out for at least three months prior to severing the descending roots and securing the bottom of the box.

Tree spades have become increasingly popular and are commonly used by professionals to move trees quickly and inexpensively. Only individuals properly trained in the maintenance and operation of tree spades should use them. Sharp blades reduce damage to roots during transplanting. Crushed or shredded roots caused by dull blades will develop more dieback than clean cut roots.

Large trees should not be transplanted with root balls smaller than 12 inches in diameter for each 1 inch in trunk caliper. If multiple trees are being transplanted, all of the trees may be dug and stored B&B or boxed before transporting them to the new site. Increased transplant success may be achieved by tilling an 18 to 24 inch wide band adjacent to the outer edge of the root ball. This allows easier penetration of roots from the transplant ball into the adjacent soil area. If planting into clay soils, the sides of the hole should be roughened with a rake or shovel. When tree stability is questionable, guy at three locations, using non-abrasive materials, only until the tree has adequately reestablished anchorage through new root development (Figure 6).

Before moving a large tree, keep in mind that smaller trees of a particular species typically transplant better and catch up in growth to larger trees of the same species. A general rule is for each inch in caliper, a year is required for transplant recovery; therefore, a 4 inch caliper tree may require four years to recover from the transplant procedure before normal, active growth resumes.

figure 6





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