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Selecting and Planting Trees and Shrubs[1]

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Success of landscape plantings depends upon an orderly process of site analysis, plant selection, site preparation, planting procedures and post-planting care. Plantings properly incorporated into an overall design create a landscape that is beautiful and functional.

SITE ANALYSIS

The long term value of a landscape plant depends on how well it performs in the planting site. Therefore, the first step in selecting plants for a landscape planting is to conduct a site analysis. Site analyses consist of studying planting site characteristics such as amount of sun or shade, salt spray, exposure, water drainage, soil type and pH. These characteristics will most likely differ between areas on the same property. For example, the area on one side of a house may have significantly different light conditions than an area on the other side.

Light characteristics of a planting site can vary from direct sun all day to dense shade. The amount of light affects rate of photosynthesis, plant water loss, growth, and ability of plants to tolerate dry soils and winds. Most plants grown in shade require less irrigation than plants grown in full sun. Ornamental plants can be selected which will grow in almost any sun or shade level around the home. Contact your County Cooperative Extension Office or a local bookstore for publications regarding the suitability of specific landscape plants for various microclimates.

Saline irrigation water and/or salt spray limits the number of plants suitable for that particular site. Plant tolerance of salt water and salt spray is of particular concern to people living in Florida's coastal areas. Plants should be selected that are well-adapted to soils and exposures of coastal areas.

There are usually several microclimates on a property, particularly where temperature is concerned. Therefore, the average minimum and maximum temperature of specific areas of the property should be measured or estimated. Generally, the minimum winter temperatures occur on the northern side of the house. Southern exposures will be the warmest during the winter but there can be dramatic temperature fluctuation during a given day on the south side of a house that may predispose plants to winter damage. Western exposures will be the hottest during summer months. The amount and type of existing vegetation and architectural features such as arbors and roof overhangs will modify these stated generalities. For example, plants protected by tree canopies are less subject to cold injury than those in exposed locations because tree canopies reduce radiant heat loss from these plants. Shade during early morning slows the rate of thaw and can reduce the amount of cold damage in some species.

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The surface and subsurface drainage of areas on the site must be determined. Poor soil drainage may cause roots of some plants to rot while other plants adapt to wet areas. However, even plants recommended for wet areas which are produced in containers or in a well-drained nursery soil may not be able to adapt quickly enough to survive on the site. If a surface drainage problem exits, possible solutions should be considered. Consider adding gutters to the house to direct water flow. Another solution is to correct the drainage problem in the landscape before planting by altering surface or subsurface drainage patterns with tiles, proper grading, or other methods. The feasibility of this solution must be determined as part of the site analysis. For example, determine the options for where runoff water should be directed if surface drainage modifications are necessary to direct water away from the foundation of a house. If this is not possible, planting plants in soil mounded above the water table has been successful in some areas.

A thorough site analysis will include determination of soil pH, type, and compaction. A landscape site may contain several different soil types with fill soils provided to various depths throughout the site. In some cases, samples of the different soil types should be taken and sent to a professional soil testing laboratory for analysis. Soil pH in the range of 5.5 to 6.5 is best for most plants, but some plants can grow on more alkaline or more acidic sites. Compacted soil is a common characteristic of a new building site. Take note of areas where heavy equipment and high traffic volume may have compacted the soil. Soil compaction reduces aeration and water penetration which present problems for plant establishment. It may be possible to loosen the soil by plowing or rototilling, but generally these practices are effective to a depth of one foot or less. Such cultivation around large trees and shrubs may damage the root system, because most of the actively absorbing roots are located in the surface one foot of soil. Amending or changing soil conditions to suit a particular type of plant may be temporary and costly.

PLANT SELECTION

Plants should be selected that are suited to the environmental conditions on the site that were determined during the site analysis. Good landscape design requires that plants be used to serve a particular function(s). Plants should reduce cooling and heating costs and improve the appearance or usefulness of the home grounds. They should be selected and positioned for specific functions such as to provide a transition between the structure and the landscape, a screen for privacy, shade for comfort, or direct traffic flow onto and within the property. Select plants that will not out-grow the allotted space. Even though smaller cultivars of landscape plants may require more time to reach the desirable size, they will not have to be pruned as frequently and are less likely to need replacing in a few years.

Landscapers and gardeners often select plants with unusual colors or growth habit. A limited number of such plants can be used effectively in the landscape, but their location must be skillfully planned. Trees should be selected for shade or used to accent an area.

Unfortunately, few plants in retail outlets are tagged according to grades and standards as established by the Florida Division of Plant Industry. A plant graded as a Florida Fancy is a healthy and vigorous plant that is well shaped, densely branched, and densely foliated. A Florida No. 1 grade is a healthy vigorous plant that is well shaped, branched and foliated. The Florida No. 2 is healthy, vigorous, and fairly well shaped, with fair branching and foliage density. Any plant not meeting the above standards is a Florida No. 3. Plants graded as No. 2 or No. 3 may not grow as well after planting as one of higher quality. However, in most cases the grades are not indicated on plants in retail nurseries and the customer must be able to discern plant quality.

Plants should be inspected closely. Do not purchase plants with an unhealthy appearance or with weak, poorly formed, scarred, or cracked trunks or branches. Do not purchase trees with main double leaders or with branches clustered together on the trunk. Poorly distributed branches on the main stem usually result in weak or leggy plants that should be avoided. Leaves of abnormal size or with excessive yellowing are an indication of a plant health problem. Plants should be examined for insects, diseases, and mechanical damage.

The root system of a container-grown plant should be well established so that the root ball stays intact when the container is removed; however, the plant should not be root-bound. Root-bound plants have a mass of roots circling near the outside surface of the container medium and may present difficulty in establishment in the landscape. Roots should be distributed throughout the container medium and not protruding outside the container or penetrating into the ground. The root ball of balled and burlapped

trees and shrubs should be moist with the soil firmly held around the roots. Root balls greater that 18 to 24 inches in diameter should be secured by a wire basket if the plant was harvested from a sand soil. A broken or cracked root ball indicates the plant received rough treatment during shipping and may result in poor establishment and growth of the plant in the landscape.

A relatively new method of producing plants in field nurseries involves planting them in a fabric bag-like container that restricts root development outside the fabric. Generally, only small fibrous roots grow outside this fabric container and large structural roots are confined to the soil within the container. Plants field-grown in fabric containers must be harvested at the proper stage of development. They should have adequate roots in the fabric container to hold the soil together during transport and planting, yet the canopy size should not be greater than can be supported by the limited root system.

The cultural and environmental conditions at the retail nursery are also important. Plants that are placed in an unshaded area for even one afternoon during summer months may have received substantial root injury due to heat stress caused by direct solar radiation on container walls. Dark brown roots can often be found on the outside of the root ball on the side receiving the direct exposure. Such injury will reduce the odds of achieving satisfactory growth and quality in the landscape. Holding plants in areas with 30 to 50 percent shade will reduce or eliminate heat stress to plant roots. Also, spacing plants close enough to provide mutual shading without injuring branches or leaves will reduce heat stress to plant roots. Plants on the outside edge of the block will not be protected from one direction and may still be injured. Stems and roots of plants unprotected from cold or freezing temperatures may be damaged. Cold injury to roots and stems may not be obvious until the plant is stressed by warmer weather in the spring. Therefore, roots and stems of plants should be inspected closely for signs of root injury or bark splitting.

SITE PREPARATION

Proper site preparation may include grading, dealing with soil compaction, and managing runoff water from the roof with gutters and connecting pipe. The first operation in preparing a planting site is to grade the soil to achieve the desired land form. Adequate surface drainage that directs water flow away from structures and into the appropriate path of water movement for the area must be achieved at this stage.

Soils may be modified somewhat by the incorporation of amendments before planting. In some special cases the soil in a small area may be replaced with a suitable top soil. However, this can be extremely costly and must be reserved for those cases where the existing soil is unsuitable for plants because of some chemical residue or excessive compaction. Soils can be amended to adjust the soil (pH), add nutrient elements, increase organic matter content, and alter soil drainage and aeration.

Soil pH has an important influence on nutrients available for plant uptake and influences soil organisms, and availability of toxic elements. Florida soils that are well outside the desired pH range of 5.0 to 6.5 may need to be amended with lime to raise the pH, or with elemental sulfur to lower the pH. A lime requirement soil test is recommended to determine the amount of lime needed for raising soil pH. When soil pH is high because of naturally-occurring lime (like limestone, marl or sea shells), there is no practical way of lowering the soil pH. There simply is too much lime present to neutralize. However, where accidental overliming has occurred (such as where concrete or mortar were spilled or dumped during construction), soil pH can usually be lowered. Use elemental sulfur (yellow color) incorporated before planting. Approximately 1 to 4 pounds of wettable sulfur per 100 sq. ft. (0.5 to 2.0 kg/10 sq. meters) is required to lower the pH one unit in the first 6 to 8 inches (15 to 20 cm) of soil. Generally, the more organic matter and/or silt and clay content of the soil, the more sulfur that is required to adjust the pH. Not more than 1 pound per 100 square feet (488 grams per 10 sq. meters) should be applied at one time. Sulfur should not be reapplied for 4 months. Sulfur oxidizes to form sulfuric acid when added to soils and should be used with caution.

Normally, calcitic limestone or dolomitic limestone that contains calcium carbonate as well as magnesium carbonate is used to increase soil pH. This change may be slow and short-lived in highly buffered soils. Ground limestone is recommended over hydrated lime because it is less likely to "burn" plants. The greater the organic matter or clay content of a soil, the more lime that is required to change the pH. Generally, 3 to 4 pounds of limestone per 100 sq. ft. (1.5 to 2.0 kg/10 sq. meters) is required to raise the pH of a sand soil to a depth of 6 to 8 inches (15

to 20 cm) one unit. A sandy soil with moderate to high organic matter content (2 to 4%) may require as much as 7 to 8 pounds per 100 sq. ft. (2.4 to 2.9 kg/10 sq. meters).

The level of nutrients and carbohydrate reserve in a woody landscape plant is important to that plant's ability to extend roots into the landscape soil. A low nutrient status in plants generally can not be overcome by application of fertilizers at planting. Therefore, purchasing vigorous, healthy plants is the way to ensure rapid root extension into the landscape soil.

Several of the essential nutrients, especially nitrogen and potassium, readily leach from Florida's sandy soils. Therefore, a general broadcast application of fertilizer at transplanting is not recommended because it will be several weeks to months before roots will grow into the landscape soils to absorb applied nutrients. Proper irrigation is much more important to plant establishment than applications of fertilizers at the time of planting. Soluble fertilizers incorporated or surface applied are leached from the soil in a few weeks. Therefore, soluble fertilizers applied to the general area at transplanting is an inefficient means of increasing the nutrient status of plants. If a fertilizer is added at the time of planting, make it a light application of a slow-release fertilizer to deliver nutrients over an extended period. Optimally, fertilizer application would begin a few months after planting.

Micronutrients are essential nutrients that are required in relatively small quantities and do not readily leach from soils. Most Florida soils are not deficient of micronutrients. Micronutrient deficiencies are generally related to lack of chemical availability of these nutrients in the soil or the inability of plants to absorb the nutrients. Soil micronutrient content can be determined by special soil test procedures but this is seldom necessary. Materials containing these elements individually can be purchased but formulations containing many micronutrients are more convenient. Fertilizers containing macronutrients as well as micronutrients are probably the most convenient method for home gardeners to apply micronutrients, but repeated use of fertilizers containing micronutrients could result in a build-up of some elements to toxic levels over time. Read and follow fertilizer label recommendations.

Most Florida soils are extremely low in organic matter content. The notable exception is muck soils in central Florida. It is extremely difficult to increase the organic matter of sand soils because of the high rate of organic matter decomposition due to the consistently high soil temperatures. A one-time application of organic matter such as peat, composed leaves, or pine bark will have little lasting effect on soil organic matter content. A short-lived increase in waterholding capacity of sand soils can be achieved by incorporation of organic matter, but the relative size of this increase would seldom warrant the practice.

Many Florida soils have sufficient drainage and aeration that incorporation of organic matter or other materials of relative large particle size in the planting zone is usually not justified. Most drainage problems in Florida soils can not be appreciably modified by amending the surface layer of soil. Drainage tiles, deep excavation, or land form changes are the primary methods of alleviating subsurface drainage problems caused by soil conditions such as an impermeable hard pan or layer of soil.

PLANTING PROCEDURES

Container-Grown Plants

Container-grown plants are readily available in Florida and can be planted anytime of the year provided proper soil moisture levels are maintained. Plants grown in containers too long become root bound and should be avoided. This condition is difficult to overcome. Although cutting or breaking up the root mass during planting has been recommended in the past, there is no strong scientific evidence to support the benefit of this practice. The best recommendation is not to invest your money and effort in a root-bound plant.

A common procedure for transplanting container-grown plants involves amending the backfill around the root ball with an organic material such as peat. However, a significant amount of research over a range of irrigation schedules, plant materials, and soil types provides no evidence that this practice is beneficial. In fact, incidences where roots remain in the amended backfill soil and do not grow into the undisturbed field soil have been reported. The argument for amending backfill soils centers around the fact that peat increases the waterholding capacity of a sand soil. What actually happens is the water in the adjacent landscape soil is held at greater tensions than the water in the amended backfill. The result is

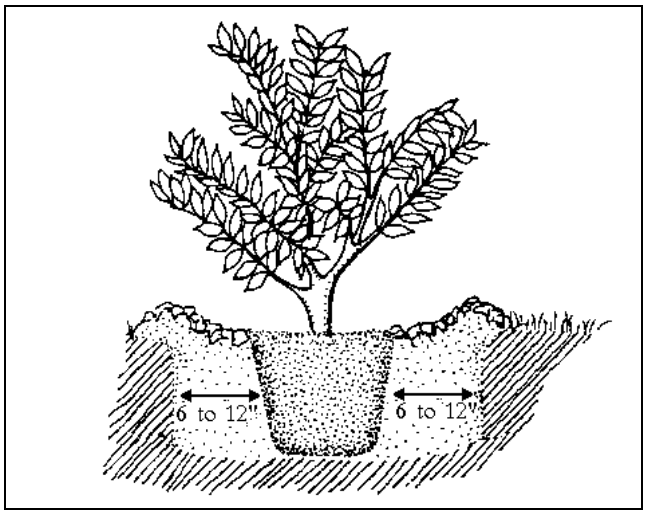

Figure 1. Planting container grown plants.

a drying container root ball as water moves from the container medium and the amended soil into the adjacent landscape soil as it dries.

The following are guidelines for installing container-grown plants (Figure 1).

1. In loose soils, dig the planting hole 1 foot (30.4 cm) wider and as deep as the container is tall. In some cases where the soil is hard or compacted, it may be advisable to dig a planting hole 3 times wider than the container and half as deep. Then mound the soil to cover the sides of the root ball. A plant installed in this manner might require more frequent irrigation during dry periods, but is not likely to suffer from subsurface drainage problems. Another possible solution for subsurface drainage problems is to dig a small diameter hole in the bottom of the planting hole to penetrate the compacted layer and allow water percolation. Most shrubs and trees normally develop shallow root systems and the wider planting hole can make a significant difference in the rate of establishment in hard or compacted soils.

2. Gently place the plant straight in the hole and be sure the top of the root ball is no deeper that the existing landscape soil surface. In areas of compacted or poorly drained soils, the top of the root ball may be positioned slightly above the soil surface to provide an adequate volume of well-drained soil for root development. Fill around the ball with soil and gently firm the soil. Do not pack the soil. Water thoroughly while planting to remove air pockets.

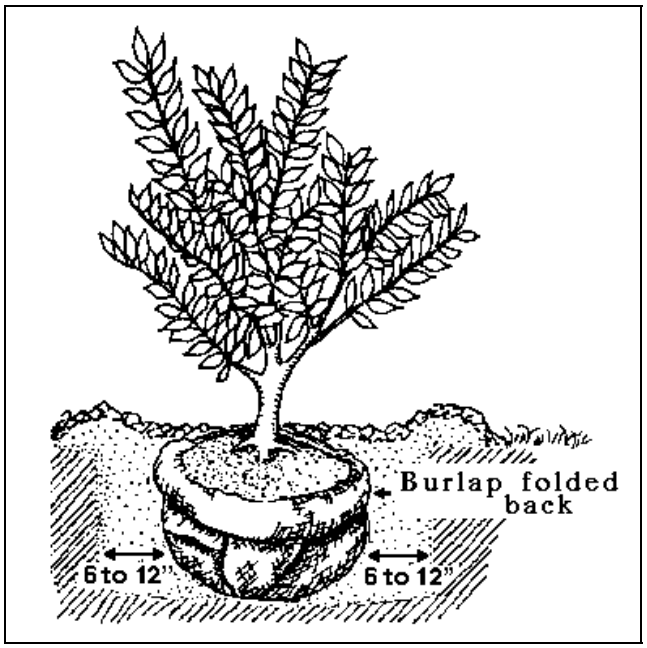

Figure 2. Planting balled and burlapped plants.

3. Do not mound soil over the roots but form a saucer-like catchment basin around the edge of the root ball with a soil ridge 3 to 6 inches (10.2 to 15.2 cm) high to facilitate watering.

4. Mulch with 3- to 4-inch (7.6 to 10.2 cm) layer of organic material to buffer soil temperature, reduce weed competition, and conserve moisture. Be sure to keep the mulch layer approximately 3 inches (10.2 cm) away from the plant stem.

Balled and Burlapped Plants

Planting procedures for balled and burlapped plants are similar to those for planting container-grown plants (Figure 2). Always move balled and burlapped plants by the root ball only. Never use the trunk as a handle to pick up or move these plants. Care should be taken not to disturb the root ball, as this would severely damage the root system. Removal of all the burlap before planting is not necessary, although the top one-third of the burlap should be pulled back from the stem as shown in Figure 2. Removal of woven plastic wraps completely after setting the plant in the hole is recommended. Nondegradable, woven plastic fabrics can girdle roots as they expand through the material. However, this practice may not be feasible when moving large trees that have been sleeved in woven plastic materials before being placed in wire baskets. Slice the material through the wire basket to facilitate healthy root growth into the landscape soil. Always remove nylon twine tied around the plant stem. Nylon twine

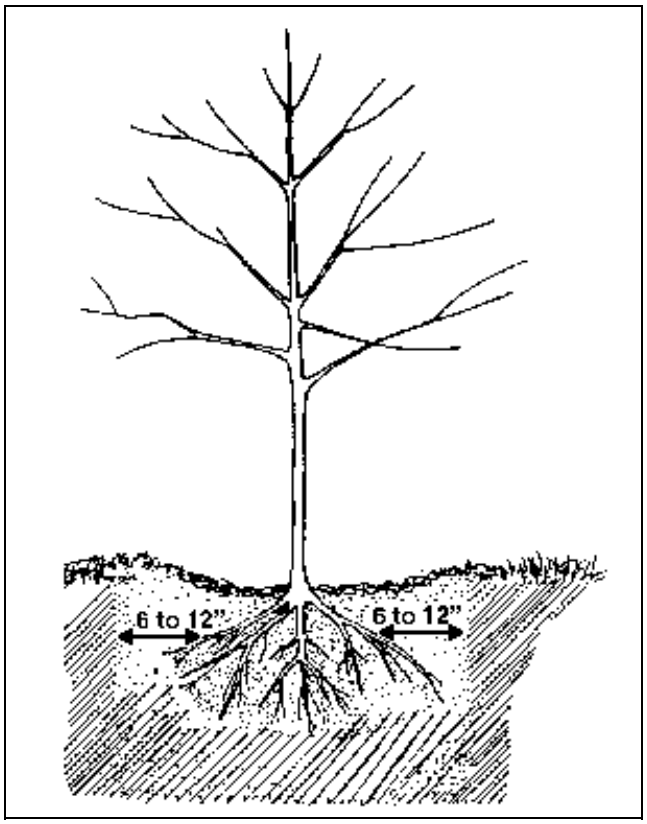

Figure 3. Planting bare root plants.

does not rot and will eventually girdle the stem if left in place.

Most balled and burlapped trees and shrubs are best harvested and transplanted during the cooler months. Plants harvested at other times must be given extra care and acclimated in a holding area before transporting to the retail nursery or landscape site. Trees and shrubs may be harvested during the cooler months and held for planting during the hotter, more stressful periods of the year.

Generally, procedures for planting balled and burlapped shrubs and trees are suitable for palms. Palms should be harvested with a root ball appropriate for the size and species of palm. Although a 2 foot (61 cm) diameter root ball would be adequate for a palm 3 to 6 feet (91 to 182 cm) in height, a root ball of 4 to 5 feet (122 to 152 cm) in diameter is recommended for larger palms. In the past, it has generally been thought that if you damage or cut a palm root, the remaining attached portion of the root would die back to the trunk where new roots would be initiated.

Research has revealed that this characteristic varies with the palm species. This root dieback is apparently true in the cabbage palm (*Sabal palmetto*); however, coconut palm (*Cocos nucifera* 'Malayan Dwarf') cut roots do not die back, but regenerate new roots near the cuts. Queen palms (*Arecastrum romanzoffianum*) and royal palms (*Roystonia regia*) often regenerate new root tips if the roots are cut 2 to 3 feet (61 to 91 cm) from the trunk. The majority of roots die back to the trunk on smaller root balls. Coconut, queen and royal palms are transplanted most successfully when a large root ball is harvested. Although cabbage palms can be transplanted successfully with relatively small root balls, root pruning 6 to 8 weeks before transplanting decreases transplant shock and increases survival. Root pruning allows time for new root initials to develop near the trunk. Palms transplanted with small root balls require a higher irrigation frequency after planting than those moved with a larger root ball.

It is important that root balls should not be allowed to dry during transport and holding. Palms should be planted during the warm rainy months for optimum success because root growth is stimulated by moist warm soils. They should be planted at the same depth as they grew in the nursery and watered frequently when planted in well-drained soils. Planting palms deeper than they were grown in the nursery reduces survival and subsequent growth.

Bare-root Plants

Few bare-root plants are installed in Florida landscapes. Bare-root materials are generally available only during late fall, winter, and early spring and should only be planted at these times (Figure 3).

Follow these steps when planting bare-root plants:

1. Protect plant roots from drying. Keep roots moist and plants in shade prior to planting.

2. Dig a hole 1 foot (30.4 cm) wider than the root spread and about the same depth as the root system. As with container-grown plants, disturbing the soil to a greater depth than the root system may be advisable if the compacted soil layer can be penetrated. Generally, a wide hole that provides ample room to spread the roots out in the hole is more important than digging a deep hole. Roots crowded into a small hole will restrict plant growth.

3. Inspect the root system and cut off roots broken or damaged.

4. Make a shallow, rounded mound of soil in the bottom of the planting hole. Place the plant on the mound and spread the roots to their natural, nearly horizontal position. Set the plant upright and at the same depth it was grown in the nursery.

5. Hold the plant upright and fill the hole half to two-thirds full of soil. Work the soil around the roots to eliminate air pockets.

6. Settle the soil around the roots with water before filling the remainder of the hole. Compacting the soil around the roots with your foot could damage the root system.

7. Form a saucer-like catchment basin around the edge of the planting hole to aid in watering.

Plants Field-Grown in Fabric Containers

Plants that have been grown in field soils using a fabric container or bag as described previously should be handled similarly to balled and burlapped plants. **The fabric container *must be removed* before planting.** The most common means of removing the fabric is by making approximately 4 equally-spaced cuts down the side of the container. The fabric may then be gently pulled away from roots that have grown into the fabric or in some cases the root may have to be cut on the inside of the fabric. Do not shake soil from the root mass while removing the fabric. Trees and large shrubs harvested from this production system almost always have to be staked when planted in the landscape.

Transplanting Established Plants

Nursery-grown plants are preferred over plants collected from the wild. Nursery plants have a more compact and well-distributed root systems due to routine root pruning, spacing, and cultivation. However, it is sometimes necessary to move plants that are established in the landscape because of construction, landscape renovation, or lack of plant availability.

The success of moving established plants can be improved by root pruning. Proper root pruning encourages development of a compact, fibrous root system and may reduce shock and increase the portion of root system harvested when the plant is moved.- Schedule root pruning and subsequent transplanting when shoots are not elongating. Plants moved from their native environment or within the home landscape can be root pruned 10 to 12 weeks prior to moving, provided irrigation can be supplied after pruning. Do not root prune if irrigation can not be provided since root regeneration after pruning is largely governed by available soil moisture. Early spring is often the best time to root prune because roots generally grow best during this season. Only half the root system should be pruned if the plant is in an exposed location in danger of blowing over in a strong wind. Plants should be root pruned with a sharp spade to minimize injury behind the cut. Roots should be cut in a circular pattern around the plant stem. Generally, cut the roots 3 inches (7.5 cm) inside the area to be the root ball when moved.

Heavy pruning of shoots of transplanted trees and shrubs to compensate for loss of a portion of the root system has proven to be unnecessary and in some cases detrimental. Prune only to obtain the desired shape. Loss of foliage through pruning decreases the ability of the plant to synthesize the carbohydrates necessary to support root regeneration.

Antitranspirants are available for spraying broad and narrow leaf evergreens and actively growing deciduous plants before digging. Antitranspirants are chemicals which reduce water loss from leaves. These antitranspirants have mixed reviews in scientific literature. They appear to work sometimes, but no one product has been shown to be beneficial in a range of environmental conditions. Generally, any effect is short-lived.

Mulching

Provide a 2- to 3-inch (5.1- to 7.6-cm) layer of mulch at the base of newly installed plants. Mulches reduce soil temperature fluctuations, prevent packing and crusting, conserve moisture, help control weeds, add organic matter to the soil, and improve the appearance of the landscape. Generally, a 2 foot (61 cm) circle of mulch per inch of tree trunk caliper will give adequate mulch area for newly planted trees. Entire beds of mass-planted shrubs should be mulched.

Common mulch materials include leaves, pine needles, compost, bark, wood chips, sawdust, and bagasse (sugar cane by-product). Peats should not be used since once dry they are very difficult to wet and may restrict water movement into the soil. Inorganic materials such as glass wool, gravel, and crushed stone can also be used. Avoid using black plastic

sheets around plants. They are undesirable barriers for water and gas exchange. A woven plastic fabric or other types of porous ground cloths can be used to help stabilize the soil, reduce weed penetration, and conserve moisture. These materials should be covered with a mulch to prevent degradation of the material by sunlight and to increase the landscape's aesthetic quality.

Some organic mulches, such as fresh sawdust, are decomposed rapidly by soil microorganisms and must be replenished periodically. Microorganisms decomposing organic mulches can remove nitrogen from the soil. Application of additional nitrogen fertilizer to the mulched area may be justified if the organic mulch has not been composted.

Keep a 2- to 3-inch (5.1- to 7.6-cm) circular area around the stem of plants free of mulch. Mulches against the stem of plants may increase the chance of stem rots.

Staking and Guying

Most shrubs and many trees installed in landscapes do not require support from stakes or guy wires following planting. Their trunks are strong enough to hold them upright and they are relatively small so wind will not blow them over. There are 3 reasons to stake or install guy wires on plants: 1) to protect the tree from mechanical injury; 2) to support the trunk in an upright position and 3) to anchor the tree to stabilize it against wind. Determine why staking or guying is necessary before choosing materials.

Protective stakes are meant to signal equipment operators to stay clear of trees or shrubs planted in a lawn. Three or more are required to provide adequate protection. Half of a 36-inch (90-cm) long stake is driven into the ground at the edge of the mulch around the trunk. Protective stakes are not attached to the tree and can stay in the ground for an unlimited period of time. They should be made of a rot resistant material if they will remain in the ground for more than 2 years. They are usually unnecessary in a residential landscape since the home gardener knows to prevent lawnmowers and other equipment from damaging the trunk. They are more commonly installed in commercial landscapes where larger equipment operates and trunk injury is more common.

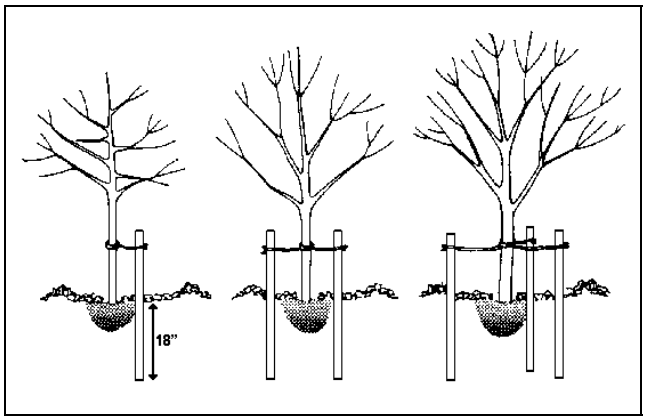

Figure 4. Tree size dictates the required number of stakes.

Support and anchor stakes and guy wires must be connected to the tree to fulfill their function. Support stakes secure trees in the upright position until the trunk is strong enough to hold the tree erect (Figure 4). These are only necessary if the trunk is too thin or weak to support the top. Bamboo or similar support stakes are often taped to young tree trunks in the nursery to help develop straight trunks. If a tree stands upright, it does not require support staking.

Support stakes should be secured to the trunk at the lowest position which will hold the tree erect. This is accomplished by holding the top of the trunk with your hand so the tree stands upright, and sliding down the trunk to a point where the top of the tree bends over. Move up 6 inches (15.2 cm) and attach the stake. Cut the stake above the point of attachment to prevent trunk damage. It is important to remove the stake from the tree as soon as possible because supportive trunk tissue develops slowly on staked trees. Unfasten the stake from the trunk 6 months after staking. Do this immediately following a rain shower since the weight of the water can cause the trunk to bend over if the tree is still too weak. If the plant stands erect, remove the stake. If not, repeat the process approximately every 2 months until sufficient strength develops in the trunk. If the tree requires staking for more than one year, it may never develop the strength needed to support itself. Leaving small branches along the lower trunk will also help the trunk increase in diameter and strength. These branches can be removed once the tree can support itself.

Trees or shrubs with a large canopy can be injured by winds before their roots become established. Winds push against the canopy as it does against a sail and can blow the tree over or move it in the soil. Anchor stakes function to stabilize the tree

until regenerated roots grow into the landscape soil far enough and in great enough numbers to hold the tree firmly in the soil (Figure 4). Even slight root ball movement can break new roots and slow plant establishment. Trees in areas open to the wind such as commercial parking lots and parks are more likely to require anchor staking than those planted in protected areas. All trees field-grown in fabric containers require anchor staking.

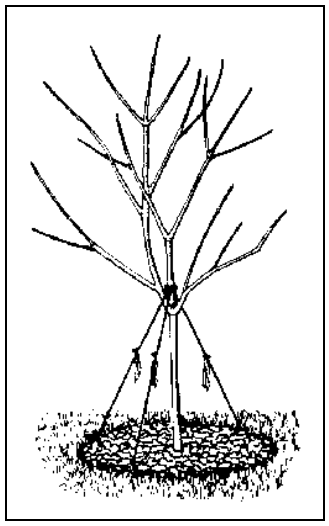

Figure 5. Staking a tree with guy wires.

Trees with trunk diameters less than 2 inches (5.1 cm) can usually be anchored by a single 36 inch (90 cm), 2 x 2 inch (5.1 x 5.1 cm) wood stake. Trees 2 to 3 inches (5.1 to 7.6 cm) in diameter require 2 to 3 stakes (Figure 4). The stakes should be placed next to the root ball and inserted 18 inches (45.7 cm) into the soil. Secure the stake to the trunk with ties made from wide, smooth material or hose-covered cable or wire. Check ties periodically during the year for tree injury and adjust accordingly.

Larger trees, 4 inches (10.2 cm) or larger in diameter at chest height, should be guyed with 3 or 4 wires or cables. The guy wires are secured to deeply driven short stakes evenly spaced 6 to 8 feet (1.8 to 2.4 m) from the base of the tree. Guy wires should be run through rubber hose and secured to the trunk at only one level (Figure 5). Guy wires can be kept tight by twisting the wires or by using turnbuckles. Mark the support wires with bright materials to prevent accidents. In all but exceptional cases, anchor stakes or guys should be removed within one year after planting since most trees should have developed enough new roots to anchor the tree. Unfortunately, this does not always happen and trees have died due to the trunk girdling effects of attached wires and other supports.

Trunk movement is necessary for the development of a strong and well proportioned trunk. Rigid anchor-staking and guying restrict trunk movement and reduce development of proper supportive tissue.

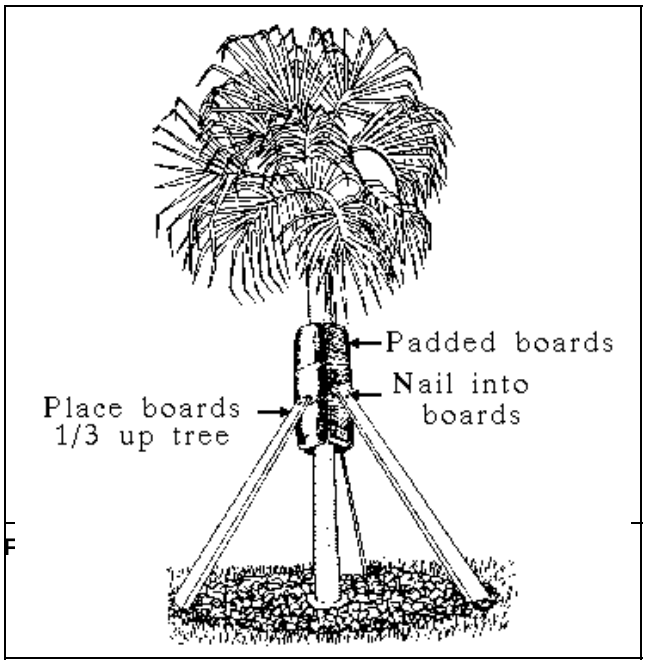

Figure 7. Padded supports necessary when staking large palms.

Staking should allow some trunk movement, however, the stakes should be rigid. Ties should be somewhat flexible and attached to the stem at one level (Figure 6).

Large transplanted palms must be anchored (as shown in Figure 7). They can be anchored with guy wires or wood supports. Wood supports should not be nailed to the palm. Instead, wrap 3 boards about 4 feet (1.2 m) long in 20 layers of burlap and fasten these to the trunk of the palm with wire or metal strap. Then nail support posts to the padded boards being careful that the nails do not penetrate into the trunk of the palm.

Trunk Wraps

Burlap and paper trunk wraps have been recommended for years to protect trunks and large branches of newly planted trees from excessive moisture loss and sun scald. However, there is little scientific evidence that this procedure is beneficial or cost effective. It has been suggested that trunk wraps can hold too much moisture against the trunk and may cause disease in some instances. If a tree wrap is used, begin wrapping at the ground and spiral the tree wrapping material around the trunk up to and including the first major branches. Overlap each layer by a half width. Tie the wrap at the top and bottom, and at two-foot intervals in between with

twine or heavy cord. Inspect the cord or twine often because many trees have died due to cords girdling the trunk. Tree wraps should be removed after the first season.

Watering

Plants should be watered thoroughly after planting and during the establishment period. Adjust the watering schedule to provide moist but not saturated conditions until the plant is well established. The establishment period varies from a few months for some one-gallon size plants to several years for trees 6 inches (15.2 cm) or greater in trunk diameter. Water the plants "as needed" after establishment. Water should be applied directly to the root ball by filling the catchment basin constructed around each plant. Small trees and shrubs transplanted into sand soils should be watered daily for the first week by filling the catchment basin around the tree. Fill the basin every two days for the next 4 to 6 weeks and one day per week for weeks 7 to 12. Continue once-a-week watering for 1 to 2 years for transplanted trees with trunks larger that 4 inches (20 cm) in diameter. Soils that retain more moisture than deep sands may require less frequent irrigation. Judgement must be used to maintain the proper moisture level, i.e. moist but not consistently wet.

Recently transplanted field-grown trees require frequent and generous irrigations because less than 20% of the root system is harvested with the plant. Although roots begin to regenerate within a week or two after severing, the water demand of the top requires that the remaining roots not dry out, not even for a short period of time. In most landscape sites the existing irrigation system can not meet the demand of the recent transplant without over watering the rest of the landscape. Large trees will usually require hand watering or installation of a temporary irrigation system which can supply a measured and controllable amount of water to each tree. The amount and frequency will depend on the tree species and size, site water table depth, soil type, slope, and the amount of irrigation the existing system can supply to the recent transplant. Across the board recommendations are not practical; however, except on a poorly drained site, it is probably safe to error on the wet side for several months to a year following planting.

Container-grown plants require frequent irrigation when planted in well-drained soils. Water will not move from the landscape soil into container media until the landscape soil is almost saturated with water. Water should be directed on the root ball surface at least until the root system is established.

Established plants in the landscape require watering to wet the soil to the bottom of the root system at each irrigation. This depth varies but averages 12 to 18 inches (30 to 45 cm) in a well-drained soil. Roots will be shallower in hard, compacted soils. Applying a greater volume of water than it takes to wet this root zone is a waste of water and energy. Frequent, light watering of established plants is undesirable as it may encourage development of a shallow root system. Apply water only as fast as the soil can absorb it to prevent runoff.