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**Guidelines for Planting Trees and Shrubs**

Beginning back in the 1990’s, researchers, like the late Dr. Bonnie Appleton and the late Dr. Alex Shigo, began questioning and updating many of the long-established cultural guidelines practiced by landscape and nursery professionals. Thanks to their work and the work done by other researchers, including Dr. Gary Watson, Dr. Carl Whitcomb, Dr. Richard Harris, and Dr. Ed Gilman, long-held landscape practices were modified or changed in order to improve overall plant health in the managed landscape setting.

Improper planting techniques, particularly planting too deep, were found to be a major cause of tree mortality in managed landscapes. In addition, research showed that the accepted practices governing the size and shape of the planting hole, nature of the backfill mixture, pruning at planting time, tree wrapping, etc. required some modification, paving the way for new planting guidelines.

**Site Evaluation**

Before choosing and planting trees and shrubs, consideration and careful attention should be given to the site itself. Each site should be evaluated for the following:

* Slope
* Hardiness Zone
* Soil Type
* Exposure
* Soil compaction
* Amount of light
* Drainage
* Space or size
* Soil pH/Nutrient availability

**Plant Selection**

After site evaluation, select plant material that will adapt well to that location. Match the needs of the plant to the site. When choosing plant material, it is also important to know: cultural requirements, growth habit and ultimate size, maintenance needs, pest (disease & insect) resistance, function and potential invasiveness.

The debate continues on the use of "native" plants over "introduced" or "exotic" species. Where appropriate, choose the best plant for a given location. This choice may or may not be a "native" plant. Many urban and suburban landscape sites have been so modified and the microclimate so changed through the placement of buildings, underground wires, pavement, driveways, traffic, soil compaction, etc., that some native plants may not perform as well as non-native plants.

Do not choose plant material based solely on the merit of its native status. Consider selecting plants that: have no significant pest problems, are not invasive, are drought tolerant, have extended seasonal appeal and that will thrive in the selected site. Match the needs of the plant to the site and choose the "right plant for the right location", but also consider existing plant communities and avoid planting monocultures.

**Site Preparation**

One of the most common errors in tree planting is that the rootball is either planted too deep or too high, both of which can cause serious problems.

When planting holes are dug deeper than the height of the rootball, the plant often settles, resulting in the trunk flare and the structural roots being planted too deep. When roots are planted too deep, plants often decline and do not thrive.

It is recommended that the planting hole depth be no deeper than the height of the root ball, as measured from the trunk flare to the bottom of the rootball. To properly plant trees and shrubs, (especially balled and burlapped (B&B) plant material, but also container stock), start by locating the point at which the trunk flare begins. In some cases, the trunk flare junction may be buried in the top of the rootball and it may be necessary to loosen the burlap or soil at the top of the ball to properly locate the junction. Measuring the height from the trunk flare to the bottom of the rootball will give the correct planting hole depth.

Alternatively, if the trunk flare is not well-developed, the rootball can be probed for structural roots using a surveyor's chaining pin or similar tool. Generally, the uppermost structural roots within the rootball should be planted within 1 - 3 inches of the soil surface, measured 3 - 4 inches from the trunk.

In many past instances, planting holes were often not only dug too deep, but were also not very wide. However, research revealed that the fibrous or absorbing roots of most woody ornamentals are usually found within the top 6 to 12 inches of soil and that root development will often extend beyond the canopy or dripline. Based on that research, recommendations were formulated that the planting area be loosened and aerated approximately 3 times the diameter of the rootball, and 3 to 5 times the rootball diameter if the site soil is compacted. The wider planting hole should also have sloping sides (See diagram below).

**Setting the Plant**

Try to maintain the integrity of the rootball until it is secure in the planting hole. In the event that some of the soil should fall away from the roots, simply proceed with the planting, taking care to ensure that the roots do not dry out from sun or wind.

Once the planting hole is ready, carefully set the rootball so that the trunk flare is 1 - 2 inches above the existing grade. Once the plant is properly placed in the hole, cut away and remove all rope, twine, burlap and any plastic or synthetic materials that will not decompose. Treated burlap is sometimes left in place, but it may not decompose very quickly and could impede root development. If a decision is made to leave treated burlap in place, remove as much as possible, or at least the top one-third covering the rootball. Synthetic burlap needs to be removed entirely. Although still subject to debate, remove as much of the wire basket as possible, or at least the top 8 to 16 inches of the wire basket, once the rootball is stable in the planting hole. Do not leave any protruding points of wire, which could possibly cause injury to people, pets etc.

**Backfilling the Planting Hole**

Backfilling with soil dug from the planting hole is often preferable to mixing the soil with large amounts of organic soil amendments such as peat moss, compost, etc. The addition of an organic soil amendment may be called for if the existing soil is of poor quality, such as excessively sandy or heavy clay soils, or those consisting of undesirable fill material. Alternatively, quality topsoil, similar in texture to the existing soil, may be brought in and used for backfill.

While backfilling the hole, it has been customary to tamp the soil heavily to avoid leaving large air pockets. However, this practice often results in the soil being packed so firmly as to drive out all the fine air spaces needed for a well-aerated soil. Roots require oxygen to thrive and will usually decline in a compacted, anaerobic soil. An alternative to tamping the soil would be to water the soil halfway through the backfill process and allow it to drain. When the water has drained away, resume backfilling and water again thoroughly. If the practice of tamping the soil is chosen, it should be done lightly so as to not compact the soil in the planting hole.

To complete the backfilling, smooth the surface soil and check to ensure that the trunk flare is completely exposed. (The structural roots should be within the top 3 inches of soil as measured 4 inches from the trunk.) Water the rootball and planting area immediately after backfilling.

**Watering**

Water is a critical factor in the successful establishment of landscape plants. Excessive or insufficient water will impede the formation and/or elongation of new roots. Immediately after planting, water the planting area and water the rootball deeply; 2-3 gallons of water per inch trunk diameter has been recommended. Depending on soil type, rootball size, weather, location etc., the rootballs of newly planted trees may need water every day, 2-3 times per week or once a week; more frequent irrigation may be needed during the summer season or in times of extended drought. A watering schedule needs to be established, as the important thing to remember is that the rootball and planting area need water on a regular basis for the tree to become established. Newly planted trees, with their newly developing roots, must receive adequate water during the entire first growing season, right up until dormancy in the late fall, to become established. Rainfall alone may not provide the adequate, consistent moisture necessary for establishment.

On larger caliper trees (2-inch caliper and greater), consistent and frequent watering is necessary beyond the first growing season. According to research, "in the Northern part of the U.S., the establishment period, for recently transplanted trees, is approximately one year for each one-inch of trunk caliper" (Dr. Gary Watson, Morton Arboretum). For example, a 2-inch caliper tree would require approximately 2 years for re-establishment, meaning that the tree would need to be watered weekly (or more depending on weather, etc.) for two years or two growing seasons.

**Fertilizing**

According to research, "fertilization is not likely to be effective during the first growing season, as long as there is no nutrient deficiency" (Dr. Gary Watson). The addition of fertilizer and limestone should be made according to recommendations based on a soil test. Avoid placing water-soluble (quick-release) nitrogen fertilizer directly in the planting hole as this may cause injury to roots. If needed, a slow-release or organic form of nitrogen could be mixed into the planting area or be applied on the soil surface around the tree basin.

**Staking**

While there are many opinions on the method and value of staking trees at planting time, staking may not be necessary for all trees. Trunk strength, size of the canopy, wind direction and site traffic problems should all be considered before staking a tree. Research has shown that rigidly staked trees may develop a smaller root system and decreased trunk taper. If the rootball is stable in the soil, then it may not need to be staked. However, if the rootball is unstable and staking is required, try to attach stakes low on the trunk and allow some sway. In most instances, stakes should be removed after one growing season.

**Mulching**

Mulching is a cultural practice that can be of benefit in the landscape when done correctly. Mulching helps reduce weeds, moderate soil temperatures, conserve soil moisture in the root zone and add an aesthetic quality to the landscape. However, improper mulching can impair plant health and may lead to the decline of the plant material.

Organic mulch should be placed over the planting area, no more than 2 - 3 inches deep, in a wide band approximately 3 times the diameter of the rootball, tapering to 1- 2 inches over the rootball, and not be touching or placed against the trunk. Mulch piled up against the trunk may cause bark decay and may create entry points for insects or disease organisms. Mulch piled against the trunk may also provide a refuge for rodents, such as voles, which may then feed on and girdle the bark. **Avoid "volcano mulching"** where mulch is placed high around the base of the tree trunk and resembles a volcano.

**Pruning**

After transplanting, prune only broken or damaged branches, or to correct and improve structure. Extensive top pruning to compensate for root loss is no longer recommended. It is important to leave as much foliage on the tree as possible because carbohydrates and other products produced by photosynthesis in the leaves are necessary for root system regeneration and development.

**Tree Wrapping**

The bark on a tree or shrub is as important as skin to an animal. Bark acts as a barrier to exclude insects and disease organisms from the vascular system, which lies directly under the bark. Some bark injuries may occur because of damage from the sun (sunscald) or temperature extremes (frost cracks). For many years, it was a common practice to automatically use tree wrap on newly planted or thin-barked trees in an effort to reduce sun or temperature damage to the bark.

Research has found that some tree wraps may not provide the protection that was originally intended. In experiments using plastic tree guards on dogwoods, large numbers of dogwood borers were found under the guards while few were found in trees without guards. In addition, some tree wraps were found to retain excess moisture beneath the wrap. This may encourage tree decay and fungal or bacterial growth, especially if there are pre-existing wounds in the trunk.

If tree wrap is to be used, it is recommended that the appropriate material be selected, checked frequently, and the wrap be removed during periods of active growth.

It is hoped that these guidelines, together with the selection of appropriate and healthy plant material, will be of help in promoting improved plant health in the landscape.

**Figure 1. Diagram illustrating proper planting procedure for a tree or shrub**

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