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Tree Support Systems

*Should I stake or guy my newly planted trees?
Should the tree be wrapped to protect the trunk?*

“No,” is the likely answer to these common questions about post-planting tree care. Trees establish themselves quite well in normal situations. Support systems such as staking and guying are, in most cases, unnecessary and can even be detrimental. Movement caused by the wind is crucial in helping saplings develop into strong, structurally balanced trees.

However, in special situations, staking, guying, or a similar system may be needed to hold trees upright until adequate root growth anchors them firmly in the soil. When necessary, the support system must be installed properly and removed at the appropriate time to prevent damage.

When to Stake Trees

When stakes are needed, timing depends on the environment and the type of tree.

- *Bare-root trees* and *container-grown trees* with small, lightweight root balls may require support until lateral anchor roots develop.
- *Large evergreen trees* with high wind resistance may need to be supported to prevent tipping.
- *Open sites exposed to strong winds*, such as new housing development sites, sites with sandy soils, or elevated settings present conditions where support of newly planted trees is essential.
- *Taller trees with undersized root balls* may need to be staked as well. Without support, trees may become tilted and movement of the root ball in the planting hole may damage the fine, absorbing roots trying to establish themselves in the new soil.



- Also, trees in areas with high rates of vandalism should be considered candidates for support systems. Staking or guying has helped deter theft and damage in many instances.



Trees in exposed areas and lightweight root balls are easily displaced, disrupting root growth and establishment.

An additional advantage of tree supports is that the staking materials provide physical barriers against mechanical damage of tree trunks, particularly damage due to lawn mowers and other lawn equipment (see FNR-492-W, *Mechanical Damage to Trees*). They act as a visual cue to stay away from the tree, because equipment may be damaged. Leaving the stakes as tree guards after the supporting guys are removed from a tree may be useful as long as they don't pose a hazard. Staking and guying trees in areas of heavy public use such as city parks and playgrounds should include mulch rings outside the support system area and high-visibility tape as an extra precaution to prevent tripping or other accidents.

There can be distinct disadvantages. Improperly staked trees suffer from poor development such as decreased trunk diameters and smaller root systems—and may be unable to stay upright after you take the supports away. Often trunk tissue suffers from rubbing and may even be girdled by support materials. Also, due to poor development and taper, previously supported trunks are more likely to break off in high winds or blow over after stakes are removed.



Cambial tissue can be damaged by improperly installed support materials. Note the wounds where the hose was resting.



Support wires left too long can girdle the tree, either killing the tree or making it more likely to break off. Stakes left in the ground create a hazard and damage tree structure.

How Wind Affects Trees

Most of the time we don't think too much about the effect of wind on trees until it rages, littering the ground with broken branches or uprooted trees. However, wind, under normal conditions, is critical to tree development. Gentle breezes have profound influences on trees, and stronger prevailing winds affect the way trees develop strength and shape.

Trees that freely sway in the wind are actually “working out”!

Wind sway has been shown to promote additional growth of wood fibers in the lower trunk. Internal responses in the tree cause this movement. Ethylene and other plant-growth hormones together affect tree growth in response to motion from wind. A simple explanation of a tree response to swaying in the wind is that the bending stress increases the production of the hormone ethylene, which increases growth in the stressed region of the stem. Research has shown that when branches bend, production of ethylene increases markedly from 30% to 300%, causing the trunk to increase in diameter in the region where they are bending.

Bending stress stimulates localized ethylene production and is associated with growth of *reaction wood* (wood that forms in plants as a reaction to gravity). The mechanical bending and pulling of the branches, main stem, and roots affect their growth in both length and diameter. Movement by wind causes shortened, stronger stems, increased trunk diameter, and enhanced root development. The result is a better balance between canopy, trunk caliper, and the root system. This increased reaction wood helps resist against failure in more severe wind conditions.

A tree supported by stakes or guys grows taller than an unstaked tree, but the staked tree has a smaller diameter near the ground, producing a trunk with little or no taper. This tall, thin tree is more likely to fail after the support materials are removed or have been left on too long. A tree free to move in the wind has increased taper because of the increased growth at its base and, consequently, is better able to keep its canopy upright in the wind.

Proper Methods and Materials of Guying and Staking

Staking and guying a trunk to keep it upright can be a necessary, temporary support system, but does not compensate for poor root development and establishment long-term.

Guying is temporary and typically used on larger trees that are transplanted balled-and-burlapped. Three points of attachment provide the best support for these large-tree installations. Often this is done by attaching a wire to an anchor and slipping it through hose material around the tree. However, the hose material and wire can cause damage from abrasion at the attachment point. It is best practice to use wide, smooth, flexible tie-materials such as soft webbing weave, that can help dissipate pressure exerted on the tree where it attaches. This minimizes abrasion and damage to the cambial tissue just beneath the bark on the trunk and stems.



Tree guyed with three points of attachment, less than 2/3 the height of the tree.



This newly transplanted tree is guyed with flexible webbing materials.

When guying, attach the guy-wires on the lower half of the trunk, always less than $\frac{2}{3}$ the height of the tree to reduce the chance of the tree breaking at the attachment point. Proper tension is important for support, but some movement should be allowed to stimulate trunk taper and root anchorage. Excessive tension in the guying material can cause the trunk to break where it attaches as the tree bends in the wind. Poor tension, or too loose provides no support for the tree.



Loose ties and inadequate supports allow tilting in the planting hole, loosening roots from the soil.

Three anchors with guys provide better support and even more protection against lawn mowers and other mechanical damage. Wood or metal stakes should be driven into the existing soil for best anchorage. Specialized anchors are available to attach the guy-wires. These small, metal augers can be reused and easily adjusted for depth. Space stakes evenly around the tree in the ground so that there is equal space between each anchor point. Drive stakes into the soil to a depth where they are firmly held in place. Guys should be attached between the anchor point and the attachment point at a 45-degree angle.

Staking connects the trunk to a nearby steel or wooden post. This is a common approach on smaller trees or containerized tree stock. These posts are usually from 2 to 6 feet long and are driven vertically into the soil near the trunk. One to four stakes may be used to support a tree. Typically, two to three stakes with separate flexible ties are recommended. Proper tension is important in staking; allow some movement for trunk and root development. If a single post is used, it should be placed on the windward side of the tree and typically used with a fabricated, specialized device.



A properly staked and guyed tree.



A specialized staking device is used with single stakes. Photo by Safeguard Nursery Products

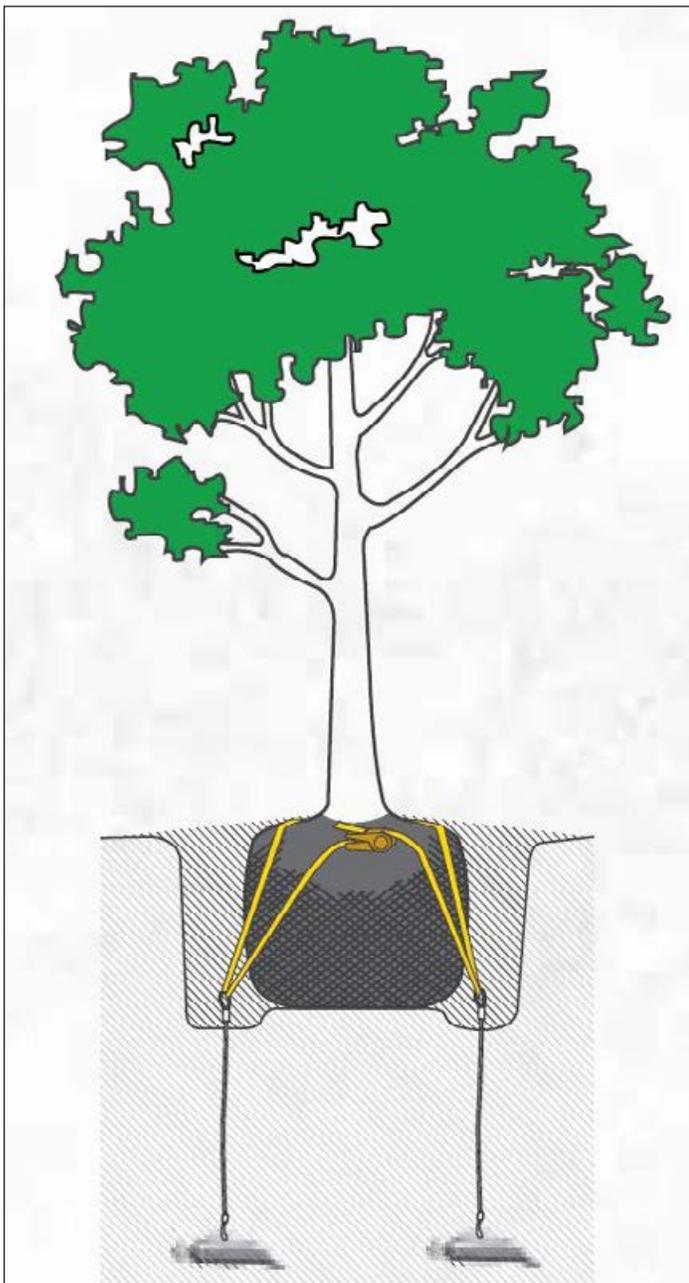
Underground stabilizing systems are also effective and economical for stabilizing the root balls on larger balled-and-burlapped trees. There are several commercial anchor systems available. However, a simple untreated wood frame held in place with wooden stakes can provide an aesthetic option which degrades naturally over time. Vertical stakes are attached to the ends of horizontal boards over the ball. Stakes should be driven up to 4 feet deep, or as deep as possible in the existing soil to keep them from getting loose or pulling out. The system can be easily covered with mulch after installation.



A wooden frame can provide support for balled-and-burlapped trees and can be easily covered with mulch to hide the support system. Photo by Ed Gilman, University of Florida

If possible, make allowances to place all support equipment inside the mulch ring. This prevents damage from lawn equipment and helps eliminate trip hazards. Mulching out to the anchor points is a good, safe practice.

Staking trees too high, too tightly, and for too long are the most common causes of tree damage. Improper staking can cause stem abrasions and trunk girdling. Review the anchor, attachment point, and tension on a regular basis, adjusting as needed to make certain the supports are effective and not damaging the tree. If a tree is supported, the ties and guys should be removed as soon as feasible, usually no later than after one growing season or one year. Trees prevented from moving for longer periods usually grow taller than trees free to move in the wind, but they grow less in diameter, have a smaller root system, and are often unable to support themselves or break easily in the wind after the supports are removed.



Specialized underground stabilizing systems provide less visible support and can be reused. Illustration by Maclean Civil Products and DUCKBILL®.



A tree guyed too long will girdle the tree at the attachment point, resulting in failure.



Poorly chosen staking materials and improper tension cause damage and do little for support.

Trunk Protection

Use of tree wraps is often a contentious point among researchers and practitioners. Studies of common tree wraps have shown that they do not prevent extreme fluctuations in temperature on the bark which cause sunscald. In some cases, the temperature extremes are worse. Tree wraps are also quite ineffective in preventing insect entry. In fact, some insects like to burrow under them. A tree wrap can also kill a tree, if not remove before it begins girdling the tree.



Paper wraps are ineffective in providing protection; they harbor insects and diseases.



Flexible, expanding light-colored wraps provide protection for smooth-bark trees.



Tree wraps can girdle the trunk, causing damage and even death.

How can wraps help? Flexible, light-colored, plastic wraps appear to be the safest for providing protection for the trunk. These loosely-fitting wraps allow air circulation to buffer temperature extremes and prevent excess moisture from accumulating between the wrap and the trunk tissue. Wrapping also may protect your trees from physical injury from animals gnawing or rubbing against them. At the very least, protective trunk wraps do help prevent mechanical damage after a support system is removed and continues to guard against mechanical damage. These wraps are often recommended on juvenile, smooth-bark trees to help reduce frost cracking.

Summary

Tree support systems such as staking and guying should only be considered when conditions and exposure to the wind make it necessary to keep a tree upright. When staking and guying is deemed essential, install all supports properly to prevent damage to the tree and remove them as soon as possible—usually after one growing season. Review the system regularly and adjust it as needed to ensure the equipment is functioning properly.



Flexible wraps expand as the tree grows, which prevents the chance of girdling the trunk.

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