The Department of

FORESTRY AND NATURAL RESOURCES

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Frequently Asked Question Series

Should Newly Planted Trees Be Staked and Tied?

William R. Chaney, Professor of Tree Physiology

In most cases, no. It is crucial that trees experience movement caused by the wind to develop properly. Supporting trees with stakes and guys can be detrimental to them and in most cases is unnecessary. However, in a few situations it is essential to hold trees upright with stakes and guys until adequate root growth has occurred to anchor them in the soil. If staking is considered necessary, it is important that the stakes and guys be installed properly to prevent damaging trees.

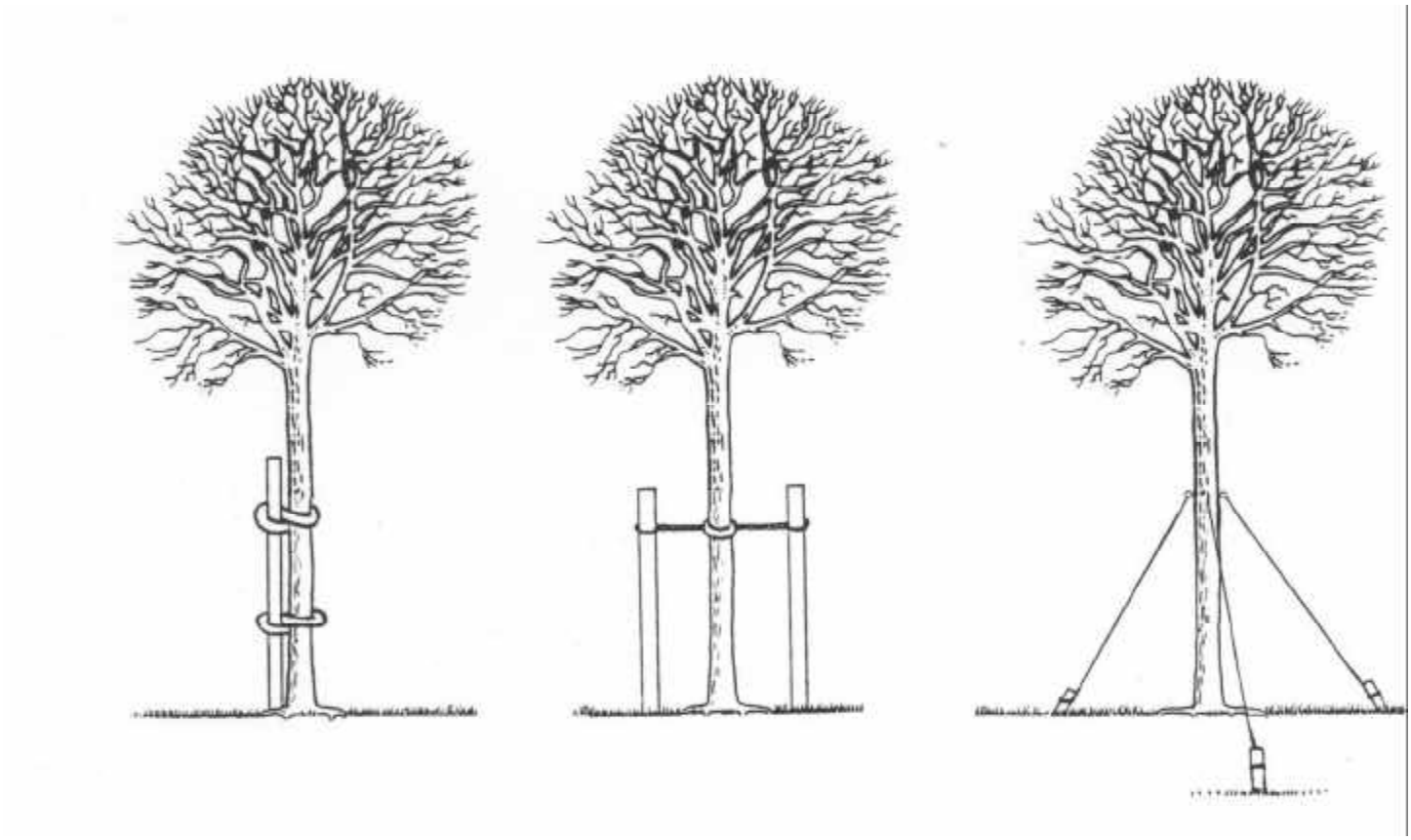
When to Stake Trees

Very open sites exposed to strong winds, such as new housing developments or sites with sandy soils, present conditions where staking newly planted trees is probably essential. Tall trees with small root balls also may need to be staked. Without support in these situations trees may become tilted and movement of the root ball in the planting hole may damage the fine, absorbing roots. If a tree is supported, the ties and guys should be removed as soon as feasible, usually no later than after one growing season. 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.

Perhaps the greatest advantage of supporting trees against the wind is that the staking materials provide barriers to physical damage of tree trunks, particularly that due to lawn mowers. Leaving the stakes as trunk 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 be avoided because of the hazards they present to people who might trip over the guys or fall onto the stakes. The pervasive threat of lawsuits today and the concern about liability for personal injury are reasons enough to avoid stakes and guys unless they are absolutely necessary.

Proper Methods of Staking and Guying

One, two, three, or sometimes four stakes may be used to support a tree (Figure 1). A single stake should be placed on the windward side of the tree. The tree should be tied with a figure eight loop between the tree and the stake to minimize the stake rubbing the tree stem (Fig. 1A). The material used to attach the tree to the stake should be broad, smooth, and somewhat elastic.



Cord or wire inside a section of rubber hose or other flexible tubing can be used too. The tree should be attached to the stake at several points along the trunk. Never use bare wire or cord as a tie material because it will likely cut into the bark and damage the essential food and water conducting tissues beneath.

If two support stakes are used, they should be placed on opposite sides of the tree and outside the planting hole for maximum support and to avoid damaging the root ball (Fig. 1B). A guy attached to the tops of the stakes will be sufficient for support. The stakes should be tall enough to keep the tree upright, but not so high that the top of the tree bends above the tie point. Tautness of the guys is required, but the tree should not be totally inhibited from moving if it is to attain a natural shape at maturity. It is best to use a flexible material, like one-half inch concrete reinforcing rod, for stakes that support the top but at the same time allow some natural movement of the stem.

Three or four stakes provide more protection against lawn mowers and other mechanical damage to the trunk (Fig. 1C). The guys should slope from about halfway up the trunk to the ground at an angle of about 45 degrees. Stakes should be driven deep into the soil in line with the guy, pointing toward the tree. Stakes that are driven perpendicular to the guy tend to loosen.

Attachment of stakes to trees may be accomplished by an assortment of ties, wires, hoses, or combinations. Trees larger than four inches in diameter should be secured with three or four guys attached to the trees with eye screws. Critics immediately mention injury to the stem. However, the stem is damaged in only a very small area compared to the rubbing-girdling effect of tie material looped around the stem, which can damage 60% or more of the bark at that point. If the eye screws cannot be removed easily when the guys are removed, they should be left in place. Diameter growth of the tree will eventually bury the eye screws in the wood with no consequence to the tree.

How Wind Affects Trees

Most of the time we discount the effect of wind on trees until it rages, littering the ground with broken branches or uprooted trees. Even gentle breezes however, have profound influences on trees and stronger prevailing winds are an important factor affecting the way trees grow and their appearance in the landscape. The wind mixes the carbon dioxide and oxygen around leaves and keeps these gases at concentrations favorable for exchange with the gases inside leaves, affecting the rate of photosynthesis. Transpiration is either increased or decreased by wind, depending on the velocity at which it blows. Wind blowing over leaves removes heat radiated from their surface and affects moisture vapor gradients between tree leaves and the surrounding air. Wind also is important in the reproduction of trees, blowing pollen to female flowers and spreading the seeds that develop. It affects trees in indirect ways too by transporting the spores of disease causing organisms, spreading the larvae of some kinds of insects, and moving toxic air pollutants to the leaves.

When trees are free to sway in the wind, 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 stems, increased trunk diameter, and enhanced root development. The result is a better balance in trees between canopy size, trunk caliper, and the root system. Research with sweetgum in a greenhouse has shown that manually moving the tops of potted seedlings for as little as 30 seconds each day for 23 days reduced height growth by 30% and significantly increased stem diameter. A tree staked in the landscape will probably grow taller than an unstaked tree, but the staked tree will grow less in diameter near the ground, producing a trunk with little or no taper. A tree free to move in the wind will have more taper because of the increased growth at its base, and consequently, be better able to keep its canopy upright in the wind.

Physiological Basis for Effects of Wind on Trees

A physiological explanation for the morphological and anatomical responses of trees to bending and swaying in the wind is that the stress increases the production of the hormone ethylene, which mediates growth in the stressed region of the stem. Research has shown that bending branches markedly increases the production of ethylene from 30-300%, causing the branches to increase in diameter in the region where they are bent. On a day following a severe windstorm, ethylene concentration in the wood of branches of white pine was more than six times greater than that in branches before the storm. Further evidence that wind-stimulated ethylene production could influence diameter growth is that the application of ethylene in a paste form actually stimulated radial growth of stems in the treated regions.

That ethylene plays a role in the control of tree response to wind is clear, but the actual mechanism is unknown. Ethylene influences a large number of growth processes, sometimes as a promoter and other times as an inhibitor. Regulation of growth processes in trees and other plants almost invariably involves the interaction of hormones. Hence, ethylene and other hormones acting together probably account for tree responses to wind. Ethylene acts as an antagonist of auxin transport and decreases the extractable auxin content of tissues. Auxin accumulation, in turn, stimulates ethylene synthesis. Induction of ethylene production by auxin is recognized as one of the most pervasive plant hormone interactions. Gibberellins also have been shown to be involved in height reduction of plants due to mechanical stress.

Summary

Staking should not be considered an essential part of proper tree planting, but should be done only when soil conditions and exposure to the wind make it necessary to maintain the tree in a vertical orientation. When staking and guying a tree is deemed essential, the supports should be installed properly to prevent rubbing and cutting into the bark. The supporting material should be removed as soon as possible, usually after one growing season. Trees free to sway in the wind are usually shorter in height and greater in diameter than trees held rigidly by supports. Wind – stimulated diameter growth and depressed elongation of stems are associated with mechanical stress in woody tissues and the production of the hormone ethylene. Ethylene is known to interact with other hormones, most notably auxin, in both inhibiting or promoting growth.