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Effects of Pruning and Staking on Landscape Trees[1]

Richard W. Harris[2]
Department of Environmental Horticulture
University of California
Davis, CA 95616

Abstract

Pruning and staking can be effectively used to develop structurally stable trees. The growth of young trees can be directed by pruning branches that are in unwanted permanent positions. Staking should be used primarily to protect and anchor young trees; support staking should be used only when plants are not able to stand upright without support.

Index words: Pruning, staking

Introduction

Young landscape trees are pruned and usually staked during training to be structurally strong and to perform their intended landscape functions. This paper focuses on some pruning and staking considerations in training young trees and cities research results and observations that provide the basis for evaluating these practices.

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[2]Professor of Landscape Horticulture.

Pruning

Two seemingly opposite effects occur when young plants and those that do not have a heavy flower and fruit load are pruned. *Invigoration* of individual shoots is the universal response, but *dwarfing* of the remaining branch and the entire plant results by the end of the growing season (1, 2). Because of these responses the growth of plants can be directed by pruning.

Pruning is the most common practice in training young trees and in maintaining mature ones. Branches that are to become the main scaffolds should be spaced vertically along and radially around the trunk. Other branches should be removed or pruned back so as not to compete with those selected.

Whenever possible it is wise to leave branches along the trunk below the lowest scaffold branch to nourish and protect the trunk. *Temporary branches* increase trunk caliper and taper, shade the trunk, and reduce the likelihood of damage. The smallest branches should be selected for temporary branches and kept pruned back so as not to compete with scaffold branches or invade pedestrian space. At each dormant pruning, the largest of the temporary branches should be removed in favor of smaller ones. After three or four years, they can be reduced in number during the next few years.

Crown configuration of a tree is critical not only to developing a strong tapered trunk, but also in distributing stress along the trunk in a wind. An ideal branch distribution would center the wind load acting on the tree at about two-thirds of the total height (7). Thus, one-half or more of the foliage should be on branches originating on the lower two-thirds of the trunk, and one-half or less should originate on the upper one-third.

Locating the pruning cut is much more important than previously thought. The location of a pruning cut in relation to the branch attachment not only determines the size of wound, but also affects the callusing of the wound, exposure to decay, and the possibility of ring shakes (circumferential separation of xylem along an annual ring) (10, 11). From the evidence to date, most pruning cuts should be close to, but beyond the branch bark ridge (shoulder rings) and the collar at the base of a branch. Branch bark ridge is synonymous with shoulder ring, but a collar may extend further, particularly on a weak or dead branch. When ridges or collar are not visible, cut slightly beyond an imaginary line joining the vertices of the upper and lower angles of the branch attachment. Shigo and coworkers (11) point out that this branch-bark-ridge zone is usually a strong physical barrier to decay between the lateral and its mother branch and can become a more effective chemical barrier should the lateral die or be injured.

Staking

Trees should be staked only as needed (3). Many young trees can stand alone, but may need *protective* stakes against lawn mowers, vehicles, and vandalism. Some may need to *anchor* the rootball until it becomes established. Others, unfortunately, may need *support* to hold them upright. For the tree's well being, it should be supported as little as possible so that it will develop a strong trunk able to better withstand storms.

Support staking commonly used is not only unsightly and often injurious but actually delays the development of a well-balanced, structurally strong top and root system. In contrast to a tree that stands alone and is free to move, a staked tree will:

- Grow taller (4, 5, 8, 9);
- Grow less in trunk caliper near the ground, but more near the top support tie (4, 5, 8);
- Produce a trunk with little or no trunk taper (3, 4, 8);
- Develop a smaller root system (4, 5);
- Offer more wind resistance than trees of equal height (because the top is not free to bend) (7);
- Be subject to more stress per cross-sectional area at the top support (the ground for an unstaked tree) (6); and
- Develop uneven xylem around the trunk if it is closely tied to one stake. The trunk will grow or bend away from the stake (8).

All of these responses work against a tree being well-formed and structurally strong. Except to protect a tree against vehicles and vandalism, the less support a tree is given the sooner it will be able to fend for itself.

The importance of the trunk of a tree being free to move has been dramatically demonstrated in research and practice (Table 1, Fig. 1) (3, 5, 9). Moderate shaking at the top of sweetgum *(Liquidamaber styraciflua)* trunks for 30 seconds daily reduced height growth to only 30 percent of that of trees not shaken (Table 2) (9). During a strong north wind following an early fall rain at Davis, CA, almost all of the plane trees *(Platanus)* that were staked in a large landscape blew down while all of those that were not staked withstood the storm (3). The diameter at breast height (dbh) of the trees was about 15 cm (6 in).

Table 1. Influence of staking and pruning trunk laterals on ten broadleaved tree species growing in #5 containers (5).

Treatment	Height	Caliper	Taper
	(%)	(%)	(%)
Laterals Headed			
Staked/Unstaked	125**	85*	76**
Staked			
Laterals Removed/Headed	99	91	94
Unstaked			
Laterals Headed/Unpruned	121**	99	84*

*Differences were significant at the 0.05 level or higher.
**Differences were significant at the 0.01 level or higher.

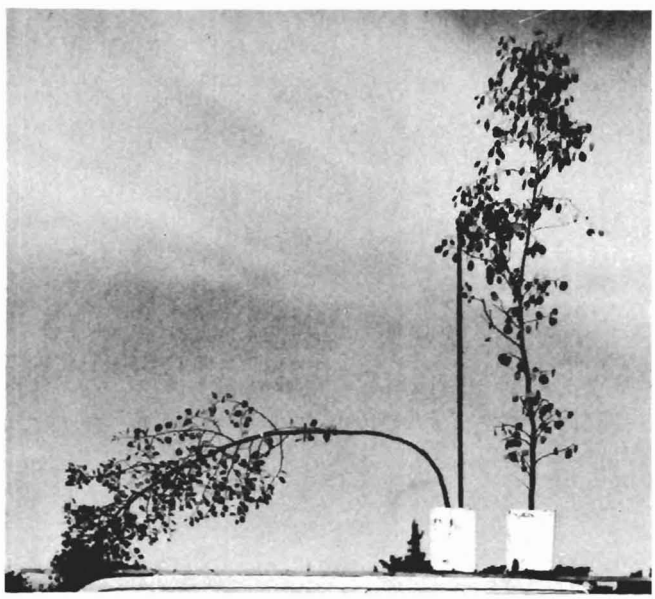

Fig. 1. Influence of staking *Eucalyptus polyanthemos* for 11 months. The tree on the right was grown without a stake and the lower laterals on the trunk were headed to about 20 cm (8 in). The tree on the right was staked and the lower laterals removed (5).

Table 2. **Influence of shaking trunks of *Liquidambar* seedlings for 30 seconds daily (9).**

Growth Parameter	Shaken/Not Shaken
	(%)
Trunk length increase	19**
Internode length	38**
Node number	52**

**Response to shaking significant at the 0.01 level or higher.

Staking stresses vary within the head of a tree, depending on distances from the terminal and on the position and size of individual branches. Leiser and Kemper (6) found on trees with tapered trunks that stress per unit of trunk area increased with increased height of staking. Tying a leader closer than within 75 cm (30 in) of the tip, particularly of previously unstaked trees, will subject the leader to maximum stress and maximum likelihood of wind deformation.

If trees are supported by stakes or guys, they should be inspected several times during the growing season to adjust the ties so that girdling and injury to the trunks are minimized.

Trees have been growing as trees for centuries and most can fend for themselves if given a chance. In fact, even though the tips of many leaders may bend of their own weight, reaction wood will bring the tip portion that was bent upright as the leader grows (1, 3).

Significance to the Nursery Industry

Even though trees will not grow as tall, they will be better able to stand in the landscape if they are grown with minimum staking and foliage is left along their trunks. The trees will need to be grown farther apart in order to take advantage of these practices.

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