G A R D E N I N G S E R I E S

Colorado
MASTER GARDENER

Structural Training of Trees with a Central Leader

no. 7.822

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Outline. . .

Young trees require little pruning. However, the training a tree receives while young determines its structural integrity for life. Many trees become prone to wind and storm damage as they mature due to the lack of training they received while trunk and branches were small. Ideally, all pruning of a tree occurs only on branches 2 inches in diameter and smaller.

The desired branching structure depends on the natural growth habit of the tree. Trees with an **excurrent** growth habit develop with a **central leader** (single trunk) to the top. Examples of excurrent trees include pine, spruce, and aspen.

Trees with a **decurrent** growth habit develop a more rounded form, as multiple **scaffold** (primary) branches originate from the trunk. Examples of decurrent trees include maple, ash, and elm. Training of trees with multi-scaffold branches (decurrent trees) is discussed in the fact sheet 7.823, *Structural Training of Trees with Multiple Scaffold Branches*.

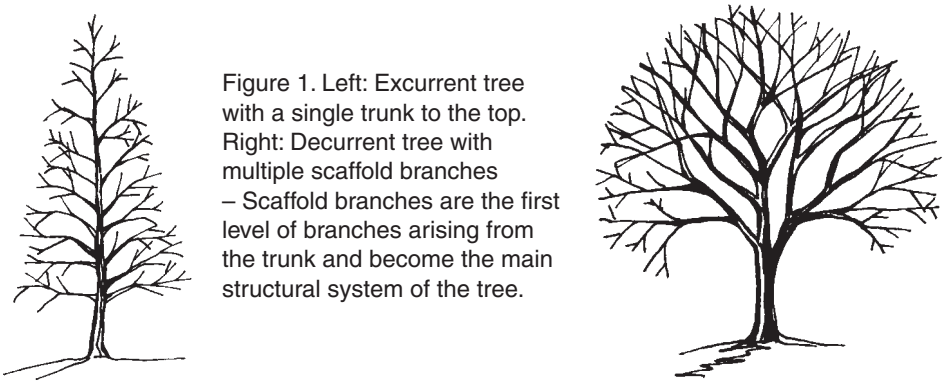

Figure 1. Left: Excurrent tree with a single trunk to the top. Right: Decurrent tree with multiple scaffold branches – Scaffold branches are the first level of branches arising from the trunk and become the main structural system of the tree.

Pruning at Planting

Any pruning of a newly planted/transplanted tree should be kept to a minimum. Only do the minimal pruning necessary to: 1) maintain a single trunk to the top of the tree, and 2) remove broken branches. The hormone *Auxin* produced in the twig's growing tips stimulates root growth. Thus heavy pruning slows root regeneration. Conversely, *Gibberellins* (hormones produced in the root growing tips) stimulate canopy growth.

Pruning (structural training) of the young tree begins for the gardener when it show significant twig growth after planting/transplanting. This indicates that the root system has adequately reestablished to support branch and leaf growth.

In hardiness zone 5 with good soil and planting techniques, it takes approximately one growing season for the roots of a 1-inch diameter tree to reestablish a root system supportive to canopy growth. Approximately two years

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Putting Knowledge to Work

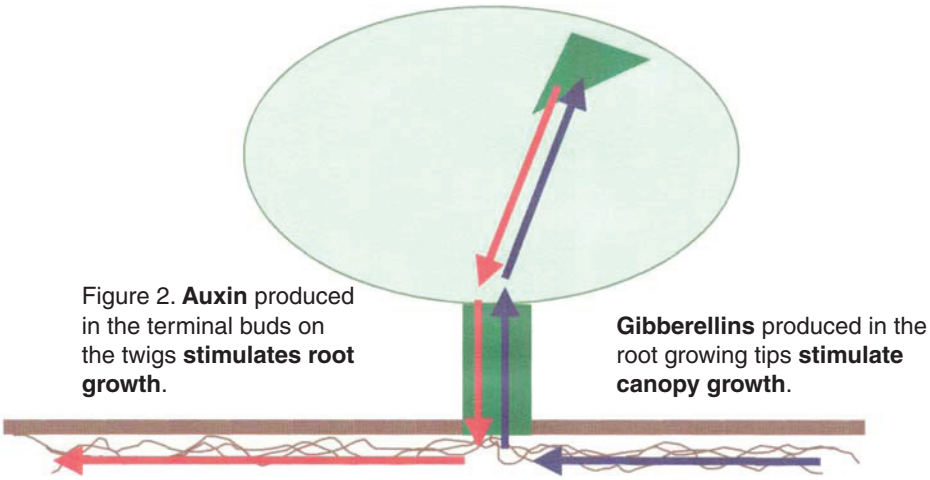

Figure 2. **Auxin** produced in the terminal buds on the twigs **stimulates root growth**.

Gibberellins produced in the root growing tips **stimulate canopy growth**.

on a 2-inch diameter tree, three years on a 3-inch diameter tree, and so forth. (Note: Trunk diameter is measured on small trees at 6 inches above soil line.) In Colorado mountain communities with shorter growing seasons and trees planted into poor soil conditions, a longer root establishment period may be required.

Structural Training of Central Leader Trees

Central leader trees (excurrent growth habit with a single trunk to the top) usually require little training. However, the training a tree receives while young determines its resilience to storm damage for life. The primary structural objective on central leader trees is a single trunk with smaller side branches. Central leader (excurrent) trees have five pruning objectives, as follows.

Objective 1 – Remove Broken, Damaged and Competing Branches

As in any pruning job, the first training objective is to remove broken, damaged, or competing branches. Competing branches are branches growing in the same space with the potential to rub and damage others.

Objective 2 – Maintain Single Trunk to Top of Tree

On excurrent (central leader) trees, maintain a single trunk to the top of the tree. Do not prune or "head back" the central leader (trunk).

If multiple trunks start to develop, remove all but one. If the leader is killed back, select a side branch to become the new central leader, removing competition. It may be helpful to loosely tie the new leader to a stick to bend it to an upward orientation.

Co-Dominant Trunks

In training trees, arborists have zero tolerance for co-dominant trunks (trunks of similar diameter). Co-dominant trunks account for the majority of tree failures in Colorado storms.

With co-dominant trunks, no branch collar develops knitting the two trunks together. The branch union (crotch) is structurally weak and prone to breakage as the trunks reach a size greater than 3 to 4-inch diameter.

In training a young tree, always eliminate co-dominant trunks. By technical definition, the diameter of any side branch is less than half the diameter of the trunk.

Note: In selecting a tree, it is advisable to avoid purchasing any tree with co-dominant trunks.

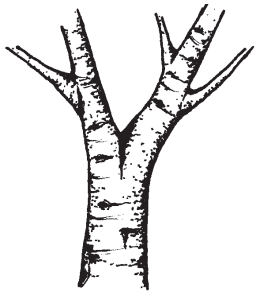

Figure 3. **Co-dominant trunks** – A branch union with two trunks (or branches) of similar size is structurally weak and prone to storm damage. Included (or hidden) bark between the trunks prevents the wood from growing together. Without a branch collar, wood of the two trunks does not knit together. In structural pruning, there is zero tolerance for co-dominant trunks!

Objective 3 – Select Lowest Permanent Branch

It's often desirable to "limb up" (remove) lower limbs so they are out of the way of people and lawn mowers. For shade trees in lawns, patios, and along sidewalks, the lowest permanent branch generally starts 7 to 10 feet above

ground level. Along streets, lowest branches start at 14 feet. On smaller specimen trees in a planting bed, however, lower branching may be preferred. As a fire management technique in a wooded setting, it's advisable to limb up trees to at least 10 feet.

In establishing the lowest permanent branch, don't limb-up a young tree too early in its growth. To develop a trunk taper resilient to wind, one-half of the leafing area should be found in the lower 2/3 of the tree. Branches below the lowest permanent branch are called **temporary branches** and should be removed only as the tree expands in height, but before they reach a two inch diameter.

Objective 4 – Maintain Diameter of all Branches Less Than 1/2 the Trunk Diameter

For structural integrity, side branches must be less than one-half (less than one-third preferably) the diameter of the adjacent trunk as measured just above the branch union (crotch). Without the important size ratio, the branch collar fails to develop, creating a weak branch union.

If the diameter of a branch is growing too fast compared to the trunk, prune the branch back to slow its growth rate or remove the branch entirely.

Objective 5 – Manage Temporary Branches, Removing Them Over Time

Temporary branches on the lower trunk are important to the tree's early growth. The carbohydrates produced by photosynthesis in the lower leaves help develop

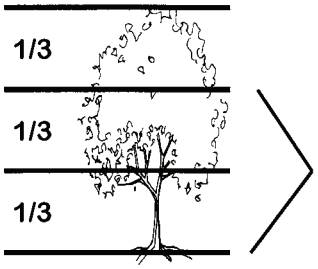

Figure 4. To develop a strong trunk taper at least one-half of the foliage must be in the lower two-thirds of the tree. Temporary branches below the lowest permanent branches will be removed over time.

natural trunk taper giving wind resilience. Shading by lower foliage helps reduce sunscald of the tender bark.

Manage growth on temporary branches by keeping these branches short. On small trees, prune temporary branches back to a few buds. On temporary branches that have been allowed to grow significantly, start by cutting them back approximately 50 percent, removing more over time.

Figure 5. General shape of a young tree: temporary branches on the lower trunk (below the lowest permanent branch) create a narrow cylinder of short branches. Keeping the temporary branches short promotes desired growth in the upper canopy.

Keeping temporary branches short suppresses their rapid growth in diameter while encouraging the desired growth up in the permanent branches. During the early training process, a young tree will have a cylinder of short temporary branches along the lower trunk (below the lowest permanent branch), with the tree's significant growth above in the permanent branch structure.

Remove temporary branches over time as the tree grows in height, but before they reach a 2-inch diameter.

On young vigorous growing trees without stress factors up to 25% of the total foliage may be removed per season. Significantly less should be removed on trees with reduce growth rates. Do not remove live foliage on trees showing stress.

Additional Information

Fact Sheets on Pruning

- 7.820, *Tree Growth and Decay*
- 7.821, *Pruning Cuts*
- 7.822, *Structural Training of Trees with a Central Leader*
- 7.823, *Structural Training of Trees with Multiple Scaffold Branches*
- 7.824, *Structural Training of Trees – Pruning Flow Chart*
- 7.825, *Pruning Mature Shade Trees*
- 7.826, *Pruning Flowering Shrubs*
- 7.827, *Pruning Evergreens*

Books

Edward F Gilman. *An Illustrated Guide to Pruning*, Second Edition. Delmar. 2002.

Web

http://hort.ifas.ufl.edu/woody/pruning/

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