Colorado Master Gardener[sm] Program
Colorado Gardener Certificate Training
Colorado State University Extension

GardenNotes #613

Pruning Cuts

Fact sheet outline:

A pruning cut may or may not predispose the tree to internal decay and stress depending on the type of cut used, technical precision of the cut, size of the branch removed, species, and general health of the tree. For details on tree growth and decay, refer to CMG GardenNotes #611, *Tree Growth and Decay*.

In pruning, there are three primary types of pruning cuts, ***thinning cuts, reduction cuts,*** and ***heading cuts***, each giving different results in growth and appearance.

> Note: In this publication the term "trunk" refers to the trunk or parent branch and "side branch" refers to the adjacent side branch arising from the trunk (parent branch). The same relationship exists between a side branch and secondary side branch.

Size of Branch to Remove

Ideally, all pruning cuts are two inches in diameter and smaller. ***Woundwood*** (the callus tissue that grows over pruning cuts or wounds) quickly grows over these small pruning cuts. Any cut on a branch larger than 4-inch diameter should be justified, taking into account the potential for decay.

Thinning Cuts

Thinning cuts (also known as removal cuts, collar cuts or natural target pruning cuts) remove a side branch back to the larger parent branch or trunk. If the branch union has a branch collar, thinning cuts have the advantage that they preserve the *branch defense zone*, giving a strong defense against internal decay. [Figure 1]

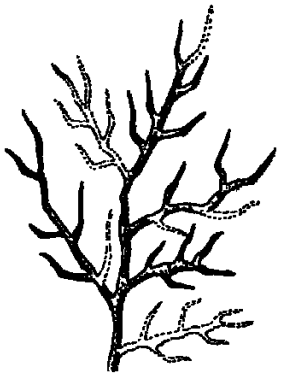

Figure 1. Thinning cuts remove a side branch back to the trunk or parent branch.

Thinning cuts reduce the canopy density but generally have little impact on height. Thinning allows better light penetration into the canopy, which encourages desired growth of interior branches. This improves trunk taper and increases the general vigor of primary branches and trunk. Thinning cuts reduce the weight on large branches, giving the tree resilience to snow loading. The primary use of thinning cuts is in structural pruning of small trees, middle-aged and older trees and on shrubs.

Two features on the branch, the *branch collar* and the *branch bark ridge*, help identify the proper cut angle. The ***branch collar*** is the area where the annual growth rings of the trunk fold in between the annual growth rings of the side branch, in a manner similar to shuffling a deck of cards. On some species, the branch collar is readily noticed while on other species the branch collar is less obvious. [Figure 2]

The ***branch bark ridge*** is where the bark from the trunk joins the bark from the side branch. It looks like a dark line or small mountain range extending out from the ***branch union*** (crotch) down both sides of the trunk/branch. It is the mirror angle of attachment for the side branch. [Figure 2]

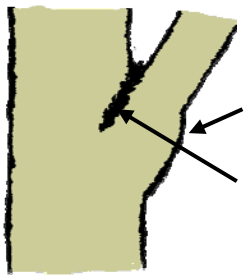

Figure 2.

Branch Collar
Trunk tissues overlap with side branch tissues

Branch Bark Ridge
Trunk bark meets side branch bark

Within the branch collar is a narrow cone of cells called the ***branch defense zone***. These cells activate the growth of ***woundwood***, the callus tissue that grows over the pruning cut. The branch defense zone also plays an important role in activating a strong reaction zone inhibiting the spread of decay organisms into the trunk. [Figure 3]

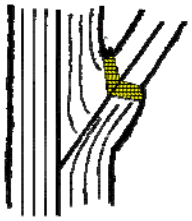

Figure 3. Branch Defense Zone – Within the branch collar is the *branch defense zone*, a narrow ring of cells that effectively initiate chemical changes that protects the trunk from decay. If the branch collar is cut or nicked in the pruning, the defense zone may fail, predisposing

If the branch collar is injured or removed during pruning, the branch defense zone fails, limiting the growth of woundwood and predisposing the cut to decay. Thus a primary objective in a correct thinning cut is to preserve the branch collar intact.

With a *thinning cut,* the final cut should be just beyond the branch collar. Since the woundwood that grows over the pruning cut originates in the branch defense zone, it is imperative that the branch collar is not cut or otherwise injured in pruning. To eliminate error, cut a little beyond the collar region (i.e., 1/8 inch for small diameter twigs, and 1/4 inch for larger branches). [Figure 4]

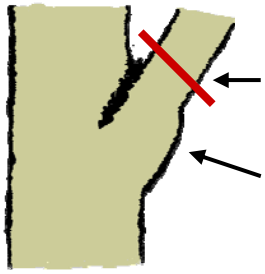

Figure 4. Thinning Cut

Final Cut made just outside the branch collar, taking care not to nick the branch collar.

Branch Collar
Trunk tissues overlap with side branch tissues

In species where the branch collar is not clearly identifiable, look for the branch bark ridge. Make the final cut at the angle that mirrors (opposite) the angle of *branch bark ridge*. [Figure 5]

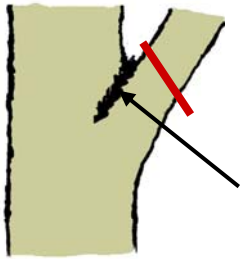

Figure 5. When the branch collar is not clearly identifiable, make the final *thinning cut* at the angle that mirrors the angle of the *branch bark ridge*.

Branch Bark Ridge

As discussed in CMG GardenNotes #611, *Tree Growth and Decay*, for a branch collar to develop, the side branch must be less than half the diameter of the trunk. In situations where a *thinning cut* is being made at a branch union without a branch collar, make the final cut at an angle to minimize the size of the cut. Be aware that in this situation, there is no branch defense zone to activate rapid woundwood growth and activate a strong reaction zone to suppress the potential for decay.

With a proper cut, the woundwood grows out from all sides in a donut-shape over the wound. If the branch collar is nicked, the woundwood does not grow from that point. It is common to see a pruning cut where the woundwood fills in only from two sides, indicating that the top and bottom of the branch collar were injured. [Figure 6]

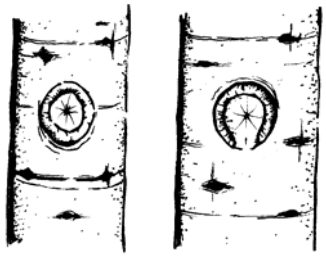

Figure 6. Woundwood – On the left, a proper pruning cut was made. *Woundwood* grows over the cut in a donut-like fashion. On the right, the pruning cut nicked the branch collar on the bottom. See how the woundwood fails to grow where the collar was nicked.

When removing a dead branch, the final cut should be just outside the branch collar of live bark tissue. If the branch collar has begun to grow out along the branch, remove only the dead stub, leaving the collar intact. Do not cut into living tissues. [Figure 7]

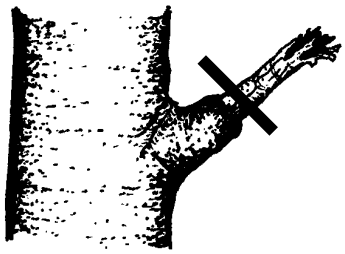

Figure 7. When removing a dead branch, do not cut into or otherwise damage the branch collar or woundwood growing around the dead branch.

Reduction Cuts

Reduction cuts remove a <u>larger</u> branch or trunk back to a smaller-diameter side branch. Reduction cuts are commonly used in training young trees. They are also the only type of cut that will significantly lower a tree's height.

However, reduction cuts do not have a *branch defense zone*, leaving the branch with a weak defense against decay. This is not a major concern on young activity growing branches. However, reduction cuts are discouraged on mature trees and on limbs larger than two-inch diameter. On trees under stress or in decline, avoid reduction cuts as it can accelerate the decline.

In a reduction cut, make the final cut to bisect (split the difference) between the *branch bark ridge* angle and an imaginary line perpendicular to the stem being removed. [Figure 8]

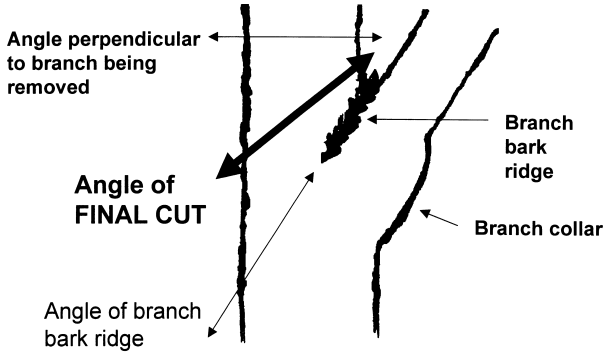

Figure 8. Reduction Cut – When pruning back a larger branch to a smaller branch, the angle of the final cut should split the difference between the angle of the *branch bark ridge* and the angle perpendicular to the branch being removed.

To prevent undesired suckering at this point, the diameter of the smaller side branch should be at least one-third (one-half preferable) the diameter of the larger branch being removed. If the diameter of the smaller branch is less than one-third the diameter of the larger branch being removed, the cut is considered a heading cut, and is generally unacceptable in pruning standards. [Figures 9 and 10]

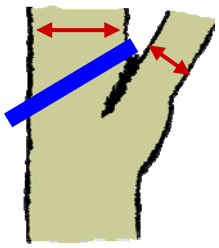

Figure 9. To prevent excessive suckering, the smaller branch should be at least 1/3 the diameter of the larger branch.

Figure 10. This adventitious sucker growth from a reduction cut is structurally unsound and prone to storm damage as it grows.

Heading Cuts

Heading cuts remove the growing tip of a branch. This releases the side buds to grow resulting in a more dense growth at the point of pruning. [Figure 11]

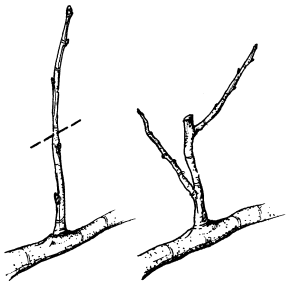

Figure 11. Heading cuts remove the growing tip of a branch releasing side buds to grow.

Another type of undesirable heading cut is the removal of a large trunk/branch back to a smaller side branch when the side branch is less than one-third the size of the larger trunk being removed. Structurally unsound water sprouts often emerge along the branch and the tree may become more unsound than before the pruning. [Figure 12]

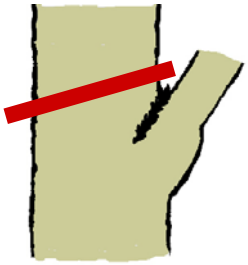

Figure 12. Removing a larger trunk or branch back to a small side branch when the side branch is less than 1/3 the diameter of the adjacent trunk is also considered a heading cut. This leads to structurally unsound growth of water sprouts and in not considered an acceptable pruning cut.

Heading cuts are undesirable for most pruning objectives on shade trees. Topping a tree with heading cuts give a surge of new branch growth at the tree's top. The new growth is often structurally unsound and prone to storm damage. Growth in the tree's interior thins out from increased shading, decreasing the tree's overall health and vigor.

On shrubs, heading cuts or "shearing" creates a very dense upper/outer canopy that shades out the lower/inner portion, creating a woody base.

Three-Cut Method for Larger Branches

When removing any branch larger than 1 inch diameter, use a three cut method to protect the bark from tearing. [Figure 13]

Cut 1. Coming out 12 to 15 inches from the branch union (crotch), make an undercut approximately one-third to half way through the branch.

Cut 2. Moving a couple of inches out past the 1st cut, make the second cut from above, removing the branch. This double cut method prevents the weight of the branch from tearing the bark below the collar.

Cut 3. Make the third and final cut at the correct pruning point. For example, on a *thinning cut*, just outside the branch collar. For *woundwood* growth, take extra caution not to cut into or otherwise injure the branch collar.

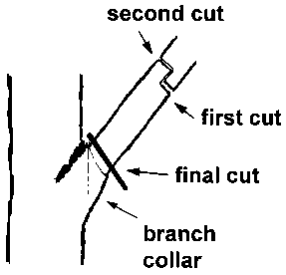

Figure 13.
Three-cut method for any branch larger than 1-inch.

Wound Dressings

Wound dressings do not prevent decay organisms from moving in. In fact the older tar-type dressings actually interfere with the natural *woundwood* growth and may create conditions favorable for decay organisms. Generally, leave pruning cuts dry and untreated.

Occasionally a thin layer of water-based dressing or paint may be applied solely for aesthetic purposes. Never use an oil-based paint, tar or other materials that contain petroleum solvents. A dark colored material over a wound may predispose the wound site to winter injury. In some disease management situations, like fire blight, a fungicide/bactericide may be used as a wound dressing.

The key to good wound closure is proper pruning, making a smooth cut just beyond th*e branch collar,* and making all cuts on branches less than two inches in diameter. Trees under stress (soil compaction, drought, overly-wet soils, insect or disease problems, lawnmower damage to the trunk, etc.) are less capable of fighting the invasion of decay organisms.

Time of Year to Prune

Dead, diseased and damaged wood can be removed anytime of year, as needed.

When it comes to removing live wood, there are better times of year for pruning. Light pruning—up to 10% of the foliage—may generally be done anytime of year on healthy trees without stress factors.

Late winter—Pruning in the late dormant season (before buds swells) is considered the routine pruning time on many tree species. It may be the

best time to prune young trees where growth is desirable. However, some species (including Birch, Black Locust, Elms, Goldenchain tree, Hackberry, Japanese Pagodatree, Kentucky Coffeetree, Maple, Mulberry, Poplar, Walnut, and Willows) are prone to bleeding if pruned in the spring. While this is more of a cosmetic issue than a health issues, most arborist avoid pruning bleeders late dormant season.

Spring, during growth flush is generally considered an undesirable time to prune trees. The bark and cambium tissues are easily damaged. It may stimulate excessive watersprout growth, or may reduce tree overall vigor.

Mid-summer following growth flush (as leaves reach full size, harden and turn dark summer green) is considered an excellent time to prune. It's the preferred time for spring bleeders. It may give a slight temporary slowing of growth that may be desirable on some trees and undesirable on others. It may be the best time of year to suppress decay potential.

Late summer to fall is generally considered an undesirable time to prune. It may stimulate canopy growth and interfere with winter hardiness.

Late fall to early winter is generally considered an undesirable time to prune. Extreme cold (below zero) may cause cambium damage near the pruning cut.

Drought – Do not remove live wood from trees in drought stress. This removes stored photosynthates that the tree is living on during the stress.

Pest management consideration – In some insect management programs, pruning may need to be timed before insect flight periods or avoided during insect flight periods.

Amount of Wood to Remove

Dead and broken branches can be removed anytime.

Removal of live wood is generally limited to 10-15% of the foliage per season. Under special need, young trees in the "growth phase" of the life cycle without stress and growth limiting factors may have up to 25% of the foliage removed per season. Trees in the "mature phase" of the life cycle without stress or growth limiting factors may have up to 20% of the foliage removed per season. Live wood with foliage should not be removed on trees under stress or on older trees in decline.

When heavier pruning is needed, it should be done over a period of years. Removal of too much foliage in a season puts the root system under stress and may lead to structurally unsound watersprout growth.

Hiring a Qualified Tree Care Professional

Pruning large trees is a safety issue, beyond the training and experience of most home gardeners. Look for arborists or tree pruning professionals with ***International Society of Arboriculture, ISA*** certification. Many are listed in the phone book yellow pages or may be found on the ISA web site at www.isa-arbor.com. Also ask about liability insurance coverage.

Additional Information

CMG GardenNotes on pruning

#611 Tree Growth and Decay
#612 Developing Strong Branch Unions
#613 Pruning Cuts
#614 Structural Training of Young Shade Trees
#615 Structural Training of Young Shade Trees—Pruning Flow Chart
#616 Pruning Mature Shade Trees
#617 Dealing with Structural Issues on Shade Trees
#618 Pruning Evergreens
#619 Pruning Flowering Shrubs
#620 Structural Pruning Summary – 2 pages

Books – Edward F Gilman. *An Illustrated Guide to Pruning, Second Edition.* Delmar. 2002
Web – http://hort.ifas.ufl.edu/woody/pruning/

Authors: David Whiting, Robert Cox, and Carol O'Meara; Colorado State University Cooperative Extension.

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