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Tree Response to Removal Pruning Cuts on Branches that Lack Collars

by Jake Miesbauer, Ph.D.

The science and practice of arboriculture has advanced dramatically over the past 30 to 40 years. One of the most significant developments has been the recommendation of making pruning cuts at the branch collar (i.e. the swelled area at the branch base, consisting of branch wood and trunk wood) as opposed to making flush cuts. Studies showed that when pruning cuts are made at the branch collar and only branch wood is removed, the tree develops a protection zone in the interior area of the trunk at the branch-trunk union (Figure 1). This protection zone walls off the area to slow the advance of decay organisms. When flush cuts are made, some of the trunk wood around the branch is also removed, exposing the trunk tissue around the removed branch. This prevents the tree from forming an effective protection zone and allows the decay organisms to colonize the area more effectively and hastens the spread of decay. Wound closure also occurs more quickly when pruning cuts are made at the branch collar.

Figure 1. Branch protection zone (V-shaped area of darker wood) that developed after a branch was removed from the tree. The tree creates this area to protect itself against decay causing organisms.

Unfortunately, many branches have no visible branch collar, which can lead to confusion for arborists as to where to properly make their pruning cut. And although there is much evidence to support the recommendation of cutting at the branch collar when one is present, there is very little research to guide recommendations for where to make the pruning cut when there is no visible branch collar. One suggestion has been to make the pruning cut perpendicular to the branch axis so as to minimize the size of the wound. The idea is that the tree will be able to seal the wound over more quickly, thereby depriving decay causing organisms the oxygen they need. However, cambial dieback on the lower side of the cut is sometimes observed after the cut is made, thereby creating a larger area of dead tissue for the woundwood to close over. Another suggestion has been to make the pruning cut just beyond the branch bark ridge and at an angle closer to parallel with the trunk (but not cutting into trunk wood tissue). The initial wound size would be larger than if the cut was made perpendicular to the branch axis, but there might be less likelihood of cambial dieback on the bottom side of the cut (Dujesiefken and Stobbe 2002).

A better understanding of how trees respond to cut size and angle would go a long way in helping to guide recommendations to tree care professionals. To this end, we conducted an experiment measuring tree response to pruning cuts on branches that lacked collars. For this study we selected 'Highrise' live oak (*Quercus virginiana* 'Highrise') which is very good at compartmentalizing injuries, and 'Florida Flame' red maple (*Acer rubrum* 'Florida Flame'), which compartmentalizes injury moderately well. For Highrise live oak, branches had a diameter range of 3.0-12.4 cm (1.2-4.9 inches) and an aspect ratio (i.e. branch diameter to trunk diameter ratio) range of 0.21-0.95. For red maple, branches with a diameter range of 3.2-13.5 cm (1.3-5.3 inches) and an aspect ratio range 0.42-0.99 were selected.

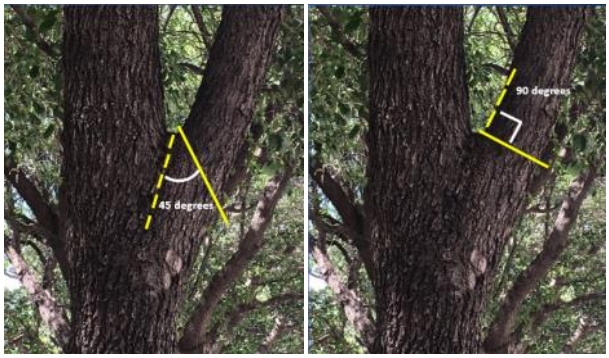

Figure 2. Pruning cuts were made either at a 45 degree angle from the branch bark ridge or perpendicular to the longitudinal axis of the branch.

Branches were pruned off the trees using one of two randomly assigned pruning cut treatments: 1) pruning cut originating beyond the branch bark ridge (BBR) and with an angle 45 degrees to the BBR (Figure 2, left), or 2) pruning cut angle that is perpendicular to the longitudinal axis of the branch, minimizing the cut surface area (Figure 2, right). After we made the pruning cuts we measured the cut surface area.

Three years after the pruning cuts were made we destructively harvested the trees and extracted the trunk sections that contained the

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(continued from front)

pruning cuts. We measured the area of the remaining wound opening to calculate the percentage of wound closure, and then cut the trunk section lengthwise through the center of the connection between the trunk and branch to expose the trunk-branch union and the extent of discoloration from the pruning cut (Figure 3). To measure the extent of discoloration we took digital photos of each trunk section. We downloaded the photos and used ImageJ software to measure the depth and area of discoloration from each pruning cut.

Figure 3. Trunk sections were dissected along the midpoint of the trunk-branch union to measure the extent of discolored wood within the branch protection zone. Arrow shows the depth of discoloration. Area of discoloration was also measured.

Our preliminary results show that as aspect ratio along with cut size increased, percent of wound closure was less in red maple, and there was a greater extent of discoloration within the branch protection zone (BPZ) in both species. For red maples, the increase in discoloration and decrease in wound closure percentage occurred to a greater extent when cuts were made perpendicular to the branch axis. Live oak showed no differences in any of the measured parameters based on cut angle. (Manuscript in preparation)

So what do these results tell us? It appears that even on species with different compartmentalization ability, the tree will be better able to defend against decay organisms if removal pruning cuts are small relative to the size of the trunk. For red maples, we can help to increase the amount of wound closure and slow the spread of discoloration by making removal cuts closer to 45 degrees from the branch bark ridge than perpendicular to the branch axis, especially on bigger branches with a larger aspect ratio.

Of course, these are only 2 species, and there is plenty of follow up research to be conducted on a multitude of species in different climates. But this research is an important step to providing data to help improve our industry best management practices. We would like to thank TREE Fund for their generous support of this project. The funding we received made a tremendous impact in being able to conduct this research.

Reference

Dujesiefken, D. and H. Stobbe. 2002. The Hamburg Tree Pruning System – A framework for pruning individual trees. Urban Forestry & Urban Greening 1:75-82

Behind the Research: Meet Dr. Jake Miesbauer

What does a lifetime of tree engagement look like? It looks like Dr. Jake Miesbauer, Arboriculture Scientist at The Morton Arboretum in Lisle, IL. Every late winter Jake would help his grandfather tend to his small fruit orchard in their backyard, pruning off water sprouts and branches to get them ready to successfully carry their produce through to harvest time. He didn't know it then, but scrambling up and down trees in the yard and exploring the woods in the rural area surrounding town coded arboriculture into his system. This time of year likely brings a special kind of nostalgia to Jake. His first paid job as a teenager was working on a Christmas tree farm, trimming all the different fir trees into the conical shapes people love.

After receiving two BS degrees from the University of Wisconsin, Stevens Point, one in Urban Forestry and the other in Business Administration (more on that later), Jake went on to receive his PhD in Environmental Horticulture at the University of Florida. He spent five years soaking in the southern warmth and landscape, with its majestic cypress swamps and live oaks, and went on to work in utility arboriculture before deciding to try spending time away from trees for two years as a financial advisor. However, the lure of all the unanswered questions surrounding the care of trees in our urban forests, and a lifetime spent out among trees, proved too much to resist. Jake returned to a career in arboriculture and has spent the last six years studying and working with the trees at The Morton Arboretum. Since his research keeps him indoors more than he prefers, he likes to spend his free time on outdoor activities like fishing, golfing and hiking. And when time is short and the paperwork, writing, statistical analysis and project planning conspire to keep him in his office, he is fortunate once again to have an amazing collection of trees right in his employer's backyard to remind him every day of why he does what he loves. This is what a lifetime of tree engagement looks like, and we look forward to what Dr. Miesbauer teaches us as he continues his life's work.

Read more about Dr. Jake Miesbauer's TREE Fund supported research at **www.treefund.org**.