TREE CARE: A NEW LOOK, 1979[1]

by Walter C. Shortle

Abstract. This paper provides an update of new ideas in tree care that have been developed as a result of research on discoloration and decay in living trees. Highlights of the CODIT model system, which shows how trees compartmentalize after being wounded, are presented along with specific recommendations about how to prevent, diagnose, and treat decay in trees. A list of useful publications about new ideas in tree care, the expanded concept of decay in trees, information packages and models, diagnosis of the internal condition of trees, wound dressings, tree injections, the use of bolts and rods, and new research is provided.

Trees have been around longer than mankind. Trees have strong survival systems that allow trees to live longer and grow larger than any other living creature on earth. The best way to better tree care is to learn how to work with the tree's own natural defense systems.

Decay is a major cause of damage to trees. Decay makes trees hazardous to people and property. Decay begins with a wound to the branches, trunk, or roots, and is caused by decay fungi acting in a succession of microorganisms. This disease goes on for many years inside the tree and unseen. Strength is lost as wood is decomposed by microorganisms for food. Finally, the results are seen as a big, old tree with a hollow core comes crashing down in a storm. How can such incidents be prevented?

Over the past 20 years, an expanded concept of decay has been developed. Old ideas about heartrot and wound healing must be set aside. New ideas, based on hundreds of research papers which are based in turn on thousands of dissected trees and hundreds of thousands of careful observations, have been brought together in a model system called CODIT — **C**ompartmentalization **O**f **D**ecay **I**n **T**rees. New methods of treating trees to reduce the impact of decay are being developed from new knowledge. The tree-care professional needs to learn how to make the defense system of a tree work at peak efficiency.

Highlights of CODIT

Color booklets, slide/tape presentations, posters, journal articles, and meetings are all available to help professionals learn about compartmentalization. Some study is necessary. But here are a few highlights before we discuss some specific recommendations for tree care.

Trees do not really heal wounds, because to heal means to replace, repair, or restore to a healthy state. What trees do is to wall-off, confine, or compartmentalize injured and infected wood.

Whenever a tree is wounded, three processes begin: wound closure, compartmentalization, and succession of microorganisms in injured and infected wood. A wound is a break in the bark that exposes injured wood. The amount of damage resulting from any given wound will depend in part on the kind of wound, how large it is, where it occurred on the stem, and the season of wounding; in part on the genes of the tree which regulate compartmentalizing; and in part on the microorganisms that begin to grow on the exposed, injured wood.

Wound closure, the external part of the defense system, is accomplished by callus formation. The rate of callus formation depends on how fast the tree is growing.

Compartmentalization, the internal part of the defense system, is accomplished by anatomical and chemical changes in new wood formed after wounding, and in the wood already present at wounding. The first wood formed by the cambium after wounding has a different anatomy from normal wood as well as a different chemical composition. This tissue is called a barrier zone and varies in size depending on the severity of the wound. The barrier zone prevents the spread of discoloration, decay, and microorganisms into normal wood formed after the barrier zone.

In wood present at wounding, the small, live

[1]Presented at the annual meeting of the Penn-Del Chapter, ISA in King of Prussia, Pennsylvania in February 1979.

parenchyma cells convert food reserves into plugging and wood preserving materials. These materials are most effective where the woody tissue is most dense. These zones of plugged, preserved, and dense tissues are called compartment "walls"; they retard the spread of discoloration, decay, and microorganisms.

In summary, when a tree is wounded, closure begins to seal off injured and infected wood on the outside by callus formation. Compartmentalization begins to wall off injured and infected wood on the inside by forming a barrier zone and compartment walls. The spread of discoloration, decay, and microorganisms is limited to as small a volume as possible.

Prevention

As in medicine, prevention is better than cure. Many wounds to trees can be prevented by careful planning. People need to be aware that wounds start the decay process.

Diagnosis

Not all wounds can be prevented. Damage in wounded trees can vary from slight discoloration to a hollow stem. How can you tell how much damage has occurred? Looking for external indicators of internal decay helps. Fruit bodies of fungi indicate the presence of decay. The size, shape, position, and depth of wounds on trees give indications of the severity of the decay. A lot of experience and judgment are needed to diagnose the internal condition of a tree from such indicators. A knowledge of the CODIT system helps the mind's eye predict what might be inside. But, often there are no obvious external indicators of serious problems.

A new electronic tool is now available to help determine the internal condition of trees. It is called a Shigometer® [1]. Used properly as a part of a three-part process, it will indicate whether a tree is sound, decayed, or beginning to decay. The first part of the method is to know the patterns of discoloration and decay in trees described by the CODIT system.

The second part is to locate "voids" (hollows or zones of punky wood) with a battery-operated drill and a fine drill bit. Finally, an electrode is inserted into the drill holes without voids, and changes in electrical resistance indicate the position of sound, discolored, and decaying wood. This method can help a tree-care professional decide whether a tree is a hazard, requiring removal, or a tree needing treatment. The meter will not make a decision for you.

Another use for the meter is determining the relative vitality of trees, by taking readings in the inner bark and outer wood. Better growing trees often have a lower electrical resistance than poorer growing trees. Although there is too much variation in readings among trees to say much about individual trees, groups of relatively high vitality trees can be separated from low vitality trees.

Treating the wound

Two kinds of wounds require treatment: *stub wounds,* in which dead wood protrudes beyond the callus and prevents wound closure, and *trunk wounds,* in which injured wood is exposed by areas of broken bark. To treat a stub wound, prune the dead wood protruding beyond the callus collar, but NEVER cut off the callus. This not only disrupts wound closure externally, but breaks the barrier zone and compartment walls internally.

To treat a trunk wound, cut away the dead and dying bark to form a healthy bark-wood interface. Be sure to round the top and bottom ends when scribing and cleaning a trunk wound. This reduces splitting of the bark above and below the wound. As with stub wounds, NEVER cut away callus if it has already begun to form. Do not paint the surface of the treated wound with a wound dressing, unless painting is required to show the job has been done, or for cosmetic reasons. Commonly used wound dressings do not stop decay. If a dressing is required for cosmetics, apply only a thin coat.

As in medicine, treating only the wound but not the patient can have serious consequences. To promote tree vitality, prune dead and dying

[1] The use of trade, firm, or corporation names in this publication is for the convenience of the reader. Such use does not constitute endorsement or approval by the U.S. Department of Agriculture or the Forest Service.

branches, water and fertilize, remove less valuable trees that are competing with the treated tree, and practice sanitation by removing dead trees and wood debris that harbor wood-degrading microorganisms. Establish a tree maintenance program.

When pruning branches, do not cut through the branch collar where the branch meets the stem. Flush cutting in this manner, which has become common practice with the use of chain saws, makes a larger wound than necessary and retards wound closure. Proper pruning requires that no stub should be left, and that the branch collar should not be cut to optimize wound closure and compartmentalization.

Treatments that cause wounds

Pruning branches has already been discussed, but there are several other practices in which wounds are made as part of a treatment to help the tree.

Boring holes to let water out of cavities is poor practice because it breaks compartment walls and causes decay to spread. It is only because the hollow is walled off from healthy wood that water remains trapped.

The use of drain pipes to help with a wetwood and fluxing problem is not the same as boring a hole to release trapped water. Conditions that favor wetwood where bleeding occurs do not favor decay fungi, thus less damage is likely to occur.

The various kinds of bolts and rods for cabling and bracing must be used with care. A bolt placed properly into sound, healthy wood does little damage. However, bolts that are "dead-ended" in decayed wood can cause the decay to spread outward and the bolt may not hold. When decay is detected, a rod placed through the stem is recommended. Washers should be put on both ends of the rod.

Injection of fungicides, insecticides, fertilizers, and other substances into trees is becoming popular. Such injections cause wounds which may or may not lead to serious problems. Repeated wounds, even small wounds, can have cumulative effects that increase the likelihood of decay-related problems. Some materials can have adverse effects on compartmentalization. Consequences of injections to the tree's natural defense systems need to be evaluated.

Drill wounds made to use the Shigometer are quickly compartmentalized because of their small size. However, even such small wounds, if repeated many times could have adverse effects.

Arborists need to be conscious of what wounds can do to trees. Think CODIT. When cleaning out a cavity before filling, be sure not to break through compartment walls and allow decay to spread. When thinning sprouts, do it early and select the best, low on stump, vigorous stems. If decay occurs, it will be limited to the diameter of the sprout when cut.

What's new

Recent work has shown that compartmentalization is under genetic control. By proper selection and breeding, it seems possible to have decay-resistant planting stock in the future.

Recent work has also shown that microorganisms that develop in injured wood can be manipulated to reduce damage. One method is bio-regulation, in which a harmless fungus, such as the mold *Trichoderma harzianum* can be used to stall establishment of decay fungi. Another method is using black plastic to alter the processes initiated by wounding. New methods are continually being tested so that better therapeutic treatments will someday be available to the arborist.

Keep informed

Keep in contact with researchers studying tree problems. Read their publications. Encourage them to write for magazines and journals read by arborists.

Useful references on tree care

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