PROGNOSIS FOR THE WOUNDED TREE

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ARBORICULTURE is both an art and a science. The art precedes the science by many centuries. Cavity treatment is almost 100 percent art. Treatment of wounds to prevent heart rot also has a strong art background. A manner of treatment that has been successful for generations, has standards of craftsmanship, and is practiced by the leading artisans would seem to be what we should each strive for, be it an art or a science. The USDA Farmer's Bulletin on "Treatment and care of tree wounds," published in 1934, contains 38 pages of recommendations for care of tree wounds almost exclusively based on the state of the art at the time.

During and since the 1930's many individuals have sought to explain why certain arboricultural practices are successful and other practices are unsuccessful. The methods they used to obtain the explanations have been scientific. They were based either on large numbers of observations or on experimentation. This excursion into the field of science has now created questions concerning whether or not certain heretofore accepted arboricultural practices are beneficial to trees. Lately this questioning has been especially aimed at tree wounds.

Some of the questions that scientists in the field of arboriculture has been striving to answer are: 1) how much damage do wounds cause?, 2) how does wound size and location influence tree damage?, 3) how do wounds heal?, 4) what cultural practices affect rate of healing?, 5) what wound dressings are best?, and 6) what do wound dressings accomplish?

The answers to some of these questions as determined by the scientists can be found in scientific and professional publications. Many of the answers have been accepted by arborists and fellow scientists while others are disputed.

The answers concerning wound healing are well documented and well received. Wounds heal by covering the exposed wood (or cavity filler) with callus tissue. The callus tissue originates in the living cambium at the margin of the wound. The cambium cells that normally would have produced ray cells in the wood and bark are the first to produce callus tissue. Callus production is more rapid at the sides of the wound than from the top or bottom. Callus tissue matures into wood and bark typical of the species.

Still being debated are the answers concerning the best wound dressing. An ideal wound dressing is one that will persist on the surface of the wood for an indefinite period of time, prevent entrance of wood-rotting and disease-causing organisms, and stimulate rapid callus formation and wound closure. Asphalt-based compounds are most frequently applied, although lanolin- and rubber-based materials and shellac have been tried frequently. Many chemicals have been added to wound dressings in an attempt to increase their effectiveness. These usually are fungicides or plant-growth-stimulating compounds called auxins.

Results from many tests comparing wound dressings indicate that shellac is nontoxic to callus tissues. In certain tests, wounds treated with shellac closed faster than untreated wounds. Shellac applied immediately after wounding prevents dieback around the margin of the wound. The wound is therefore somewhat smaller and heals earlier than untreated wounds. Shellac is not persistent. It will not protect the exposed wood for many months.

Asphalt-based materials are slightly toxic to the tree, but they are easily applied, and are persistent for one or more years. Many auxins have been added to wound dressings and none have been proven to be consistently beneficial.

The materials currently recommended as wound dressings are being challenged to show that they accomplish either rapid wound closure or fungus exclusion. In many tests using wound dressings with auxins, the untreated wounds have healed as rapidly and, in most cases, more rapidly than have treated wounds. The materials currently used are not shortening the time for wound closure.

Alex Shigo and Charles Wilson, with the USDA, are now questioning whether wound dressings prevent entrance of wood-decay fungi. They are sectioning trees at varying intervals of time following application of wound dressings and isolating and identifying rot-causing organisms found in the wood beneath the wound dressing. These tests should determine the effectiveness of wound dressings in preventing entrance of wood-rotting organisms.

At the Illinois Natural History Survey, our research is centered on the rate of wound healing. The data obtained in our studies do not refute the conclusions of previous researchers. Rather, they substantiate many conclusions previously not subjected or infrequently subjected to experimental evaluation.

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WOUNDED TREE *(from page 16)*

Our study had two objectives. We compared the amount of healing on one tree, of wounds with one or more of the following variables: shape, width, facing direction, height, season of wounding, stub length, and wound dressing. The second objective was to determine the relationship between tree vigor and rate of healing.

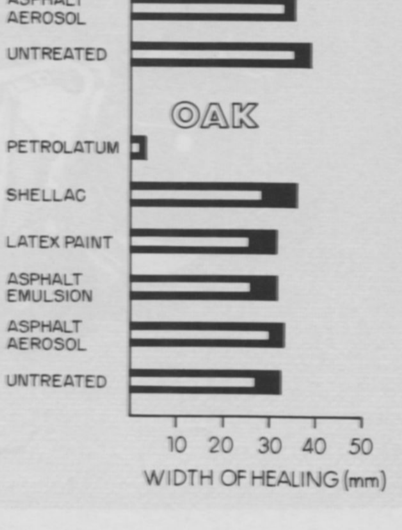
The 3-year study was conducted at the Morton Arboretum, near Lisle, Illinois, 25 miles west of Chicago.

The three species of trees used in this study were white ash, honey locust, and pin oak. The trees were growing in square 100-tree blocks with 15 or 20 feet between trees. The trees were 15-20 feet tall when the study began.

All trunk wounds were made by placing a metal template on the trunk and scoring the bark with a nail. The scored bark was cut to the cambium with wood chisels. Bark was removed and the wood scraped. Each tree had three or four trunk wounds. The wounds faced different directions and ranged from 2 feet to 6 feet above the ground.

Both trunk and branch pruning wounds were made early in May. The width of each wound was measured and recorded the day the

Petrolatum hindered wound healing on ash and oak. Branch removal and trunk wounds treated with other wound dressings healed no faster than untreated wounds.



Trunk injuries of uniform size were made by using a metal template. Square, circular, and elliptical wounds were each 2 inches wide. Elliptical wounds were 4 inches long.

wound was made. The annual amount of healing was determined from measurements of width of wood still exposed in the fall after one, two, and three growing seasons. The annual growth of each tree was measured at the height of a nail driven into the trunk approximately 3 feet above the ground.

Based on the data collected, we can make the following conclusions about tree wound healing:

1. Tree wounds heal when radial growth occurs. Since radial growth of trees occurs chiefly during May, June, and July, wounds made prior to May will heal extensively the first calendar year. Wounds made in July or later will heal little the first growing season. Dieback around wounds made during the autumn frequently occurs during the winter and creates a larger than necessary wound.

2. In vigorous trees with low crowns there is little difference in the amount of radial trunk growth in relation to height. On such trees there is also little difference in amount of healing in wounds of different height.

Radial growth begins at the top of the tree and progresses downward. Growth at the base of the large tree may begin weeks after twig growth. In nonvigorous trees the amount of radial growth in the tree top may be much greater than radial growth on the trunk. Wounds higher up the tree in this instance would heal faster than trunk wounds.

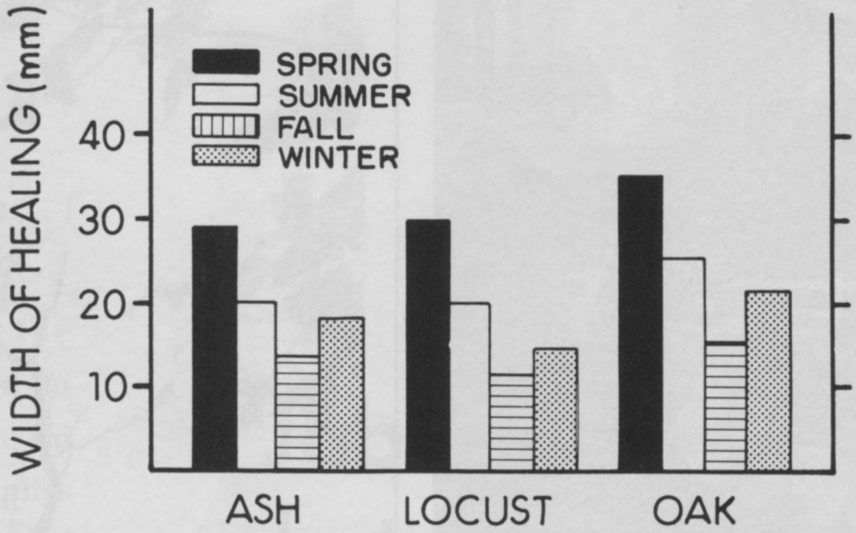
3. Radial growth around the circumference of a tree trunk is not uniform. Soil, water, air, root location, and competition factors around the tree affect radial growth much more than direction. Since facing direction affects radial growth slightly, if at all, the facing direction of

wounds also affects healing of wound margins slightly, if at all.

4. Environmental conditions during the year influence the width of the annual growth ring. Any cultural practice which increases the rate of growth of the tree decreases the time required for wound healing. Feeding and watering wounded trees is therefore recommended.

5. In our present study there was little or no difference in rate of healing due to tree species. Identical wounds on pin oak, white ash, and honey locust all healed the same amount *per unit of radial growth*. All tree species, however, do not grow the same amount each year. The wounds on rapidly growing trees will heal in a shorter period of time.

6. Width is the single most important dimension of the wound that affects rate of healing. For this reason it is sometimes possible to remove bark above and below wounds (to shape wounds) without increasing the length of time required for healing. The area of the wound is increased but the width is not. It is not a good practice to increase wound width merely to have a beautifully shaped wound.



Wounds made in the spring prior to leaf emergence healed in a shorter period of time than did wounds made during other seasons. On ash, locust, and oak, dieback occurred around wounds made in the fall and they healed less rapidly than did wounds made later in winter.

7. Healing rates of pruning wounds are strongly influenced by the length of branch stub remaining after branch pruning. Even though larger wounds result, pruning cuts should be made through the branch collar. Branch stubs even 1 inch long greatly retard wound closure.

Much additional research is needed before we can fully explain tree wound healing. The hypothesis that all tree species and sizes of trees heal at equal rates based on units of radial growth certainly needs to be confirmed or refuted.