The Plant Doctor's LANDSCAPE TIPS

By David L. Roberts, Ph.D., *Senior Academic Specialist, College of Agriculture and Natural Resources, Michigan State University*

OAK WILT PART 3: MANAGEMENT STRATEGIES

Photo 1A: The dead trees in this photo died ***the previous year*** from oak wilt after an unscrupulous "arborist" pruned them in the spring. The homeowner, not believing that simply pruning trees could result in their death, left them standing for more than a year after their death, in hopes that they might recover. Note that the neighbor's lone unpruned tree is still alive over one year after the death of the adjacent trees.

Photo 1B: The Oak Wilt-infected trees in Photo 1A are finally removed two years after they died. Note that the fungus finally transferred via root grafts to the neighbor's lone oak tree. Prompt removal of the dead trees would likely have resulted in a more rapid transfer of the fungus to the neighbor's living oak tree. The neighbor with the lone, initially unaffected tree elected not to implement Oak Wilt remedial actions to save his tree, perhaps due to cost or a belief that it would not be affected.

INTRODUCTION:

Oak Wilt (OW), caused by the fungus *Ceratocystis fagacearum*, is an increasingly important issue of concern to our industry, and the forests and landscapes in Michigan (Photos 1A & 1B). Oak Wilt is one of the costliest diseases in the landscape (Figure 1), largely due to challenging efforts to try to contain and eradicate the deadly disease once established in the landscape. It is of the utmost importance that we learn how to avoid oak wilt, and how to contain and eradicate oak wilt from landscapes when present.

THEORY OF OAK WILT MANAGEMENT:

Because much is known about the biology, infection cycle and spread of Oak Wilt (see "Oak Wilt Part 1: Symptoms and Diagnosis," *The Landsculptor*, May 2015), we can use this knowledge to hopefully address Oak Wilt issues from a variety of approaches. Of considerable importance is our understanding that the lethal oak wilt fungus can only infect oak trees by two methods: 1) sap beetle transmission of the fungus to wounds, and 2) transmission through root grafts between trees. In theory, preventing either of these two infection methods will help us avoid new oak wilt outbreaks and manage existing ones. Obviously, avoiding OW infections is the least costly of all the management options. Once a tree becomes infected by the OW fungus, however, other more invasive and costly options need to be employed.

Continued on page 24

FIGURE 1: THE COSTS OF OAK WILT

- **Property Value/Tree Value Losses:** Trees represent a significant contribution to the value of property, the reason people often prefer to buy or build homes in wooded areas. At a minimum, the tree value (and potential) loss should be assessed.
- **Tree Removal Costs:** Removing infected/dead trees, stump grinding, properly disposing of wood, and replanting etc. can be very expensive, especially in the vicinity of homes and utilities.
- **Oak Wilt Containment/Eradication:** While the above losses and costs may seem substantial, the methods needed to contain and eradicate oak wilt from a property can be even more costly. The fungus will likely move underground to infect other oaks on the affected property and neighbors' properties if not contained and eradicated.

The Plant Doctor's LANDSCAPE TIPS

OAK WILT PART 3: MANAGEMENT STRATEGIES

Continued from page 23

AVOIDANCE OF OAK WILT:

As the least costly management method, avoidance of Oak Wilt can be accomplished by pruning oak trees during periods when sap beetles and the oak wilt fungus are dormant (during cold periods), by prompt repair of trees injured by storms during the spring and summer, and by avoiding the movement of contaminated wood into communities or properties.

Avoidance through Pruning Practices: The vast majority of the new OW outbreaks the author encounters every year are due to improper pruning and other tree care procedures. Hence, probably the most important aspect of OW management is avoidance, which necessitates pruning trees, if needed, at the proper time. In Figure 2, the risks of oak wilt from tree injury (pruning or storm damage, etc.) during certain time periods of year are summarized. "When to prune" is one of the more controversial aspects of OW management. The spring months are especially high risk; some "experts" recommend pruning after July 15. While OW transmission to wounds by sap beetles decreases during mid-late summer and fall, the risk does not diminish to zero. Two factors influence the desire for zero risk: the author has documented that pressure pads sometimes form during the fall following tree death, and several cases of fall pruning have resulted in OW tree death the following spring. Given the value of oak trees and the costs to contain and eradicate OW in residential landscapes, the author advises that we be able to recommend "zero risk," which is more of a matter of temperature than calendar dates.

Avoidance through Prompt Storm Repair: Similar to pruning, the OW fungus can be transmitted by sap beetles to wounds created on trees during storms. Emergency storm repair can be accomplished by *promptly* (within hours to a couple days) cutting out the injured branch or branches, and immediately painting the new wound with a sealant to prevent visitations by sap beetles. Recall that because fresh wounds are attractive to sap beetles for about 5–7 days, we are not generally worried about storm damage during the winter months when sap beetles are dormant.

FIGURE 2:

A general summary of the risk of contracting oak wilt from pruning or storm injury during certain times of year. Note: Pests and diseases do not recognize artificial human calendars (nor property boundaries). When the climatic temperatures are cold, pests and diseases are dormant and pose little risk to trees that are injured.

Note: Sap Beetles that transmit Oak Wilt can become active when temperatures reach 45-50 F and above.

April 1-July 15	➡	High Risk!!!
July 15-October	➡	Lower Risk
Dec-February	➡	No Risk

ROOT GRAFT DISRUPTION:

As with Dutch Elm Disease, severing root grafts can help prevent the spread of the Oak Wilt fungus through roots to other nearby oak trees. Root grafts may be severed with vibratory plows, trenchers, backhoes, mini-excavators, etc. Once a trench is made, the soil can be backfilled immediately. Two principles may influence the efficacy of root graft disruption: time and space. By "time" it is assumed that the longer the period of delay in implementing the severing of roots between potential root-grafted trees, the greater the chance that the fungus has moved beyond the root graft junction into the healthy tree's roots. It is also important to understand that injuring and exposing roots can also attract sap beetles, similar to branches. By "space," it is assumed that the greater the distance between trees, the less likely that root grafts have occurred and/or, the more time it will take the fungus to move between trees. We must keep in mind that tree roots may extend laterally 1.5 to 2X the height of the tree. Recommended depth of trenching is usually at least 4 feet in heavy clay soils and 5–6 feet in sandy soils. Following are brief discussions of two major models used for root graft disruption; they are used for different situations but may, at times, be combined for specific situations.

The Forest Management Model (FMM) for Forests and Woodlands: This approach to root graft disruption is often used in woodland or forest situations where tree value is comparatively low, budgets to contain and eradicate OW are low, and efficacy demands are high to preclude the need for revisits to correct further OW issues. Briefly, the FMM, based on Johann Bruhn's 1990s research in Menominee, Michigan, attempts to define risks of spread through root grafts and where trench lines need to be installed to minimize the risk of root transmission (Table 1, Sketch #1). Primary and secondary trench lines may be installed to maximize OW containment and eradication. Once the trench lines have been installed, all trees (including healthy trees) within the trenched areas need to be destroyed (Sketch #2 and Photo 2). This destruction includes treating stumps with herbicide to prevent re-sprouting and, hence, possible survival of the Oak Wilt fungus. Once all trees have been destroyed within the trenched area, the OW fungus will theoretically die out. While the FMM has been demonstrated to be highly effective and relatively low in cost in forest situations, it is, however, highly destructive because many healthy trees are usually sacrificed to contain and eradicate OW from the site.

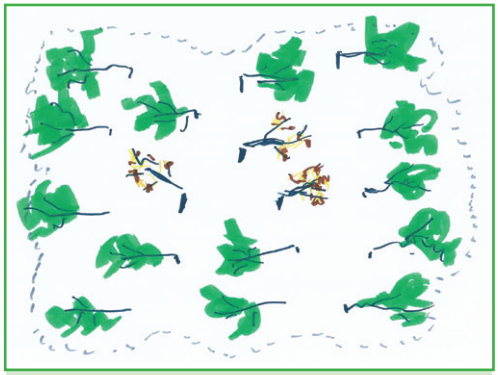
The Tier Tree Model (TTM) for Residential Landscapes: The TTM is employed where trees are of significant value and where as many trees as possible are desired to be saved from destruction by OW. With the TTM, trench lines are installed much closer to infected trees (Sketch #3 & Photo 3) than in the FMM. Often primary lines are installed between OW-infected trees and adjacent, apparently

TABLE 1: Forest Management Model: The placement of trench lines in relation to Oak Wilt-affected trees and apparently healthy trees. Combine the diameters (dbh= diameter at breast height) of diseased and nearby healthy trees. Distances for the trench line are in feet from the diseased tree(s) and are listed below the soil type.

Combined dbh of diseased & healthy trees (inches)	95 % Trench Sandy Soil	98 % Trench Sandy Soil	95 % Trench Loamy Soil	98 % Trench Loamy Soil
20	39	51	31	41
22	43	56	34	45
24	47	61	37	49
26	50	66	40	53
28	54	72	43	57
30	58	77	46	61
32	62	82	49	65
34	66	87	53	69
36	70	92	56	73
38	74	97	59	77
40	78	102	62	81
42	82	107	65	85
44	85	112	68	89
46	89	117	71	94
48	93	123	74	98

Note: The 95% Trench and 98% Trench (Root Graft Disruption) represent *Confidence* that the trench line will actually contain Oak Wilt to within the trenched area; they may be considered as primary and secondary trench lines. (This is an abbreviated Table.)

Sketch #1: This "Artist Rendering" of the Forest Management Model shows that trench lines (dotted) are installed quite a distance from oak wilt-infected trees to provide the greatest possibility of containing the oak wilt fungus within the trenched area.



Sketch #2: This "Artist Rendering" of the Forest Management Model reveals that all trees within the trench lines must be cut down and sacrificed to prevent further spread of the oak wilt fungus. Stumps are treated with herbicide to prevent resprouting. Presumably, if all goes according to plan, the Oak Wilt fungus will die out.

healthy trees; obviously, the risks of OW transmission increase with lengthy delays in trench line installation and with closer distances to infected trees. Secondary trench lines are typically installed between the first and second "tier" of trees out, between apparently healthy trees. Tertiary trench lines may also be installed. The efficacy of the TTM can be enhanced with supplemental trunk injections of propiconazole (see below) in high value landscapes. The author has developed and fine-tuned the TTM for more than 25 years ... with great success.

Continued on page 26

Photo #2: View of the destructiveness of the Forest Management Model (FMM) utilized in one of Michigan's State Parks to contain and hopefully eradicate Oak Wilt from the site. The trees in the photo were live, healthy trees that need to be sacrificed according to the FMM. This extensive destruction is usually unacceptable for residential landscapes and communities.

Sketch #3: This "Artist Rendering" of the Tier Tree Model (TTM) demonstrates that in situations where tree values are high, such as in landscapes, it is undesirable to sacrifice many healthy trees. Hence, the trench lines (dotted) are installed much closer to infected trees. Note that residential foundations/basements, serving as "natural barriers," may augment the trenching efforts. The TTM has been used with great success by the author over the last 25+ years. Trunk injections with propiconazole may enhance trenching procedures or may be implemented in lieu of trenching ... depending on the situation. Each Oak Wilt site is unique and requires consideration of best management practices by an experienced professional.

Photo 3: Primary and secondary trench lines are being installed in this residential landscape with a mini-excavator. In using the Tier Tree Model, note how close the trench lines are being installed between infected trees (left, just out of photo) and healthy trees compared to the FMM. Backed up with trunk injections of propiconazole, no further Oak Wilt outbreaks occurred on any of the trees on this property during the subsequent four years.

The Plant Doctor's LANDSCAPE TIPS

OAK WILT PART 3: MANAGEMENT STRATEGIES

Continued from page 25

PROPICONAZOLE TRUNK INJECTIONS:

Propiconazole is a fungicide that has been proven to be an effective treatment for Oak Wilt. At high rates, the fungicide has been shown to "cure" members of the white oak family. At high rates, the fungicide has also prevented the transmission of the OW fungus through root grafts (Photo 4, including red oaks). Because it is believed that the OW fungus can survive for 3-4 years in the roots of infected trees, nearby healthy trees that are likely root grafted to the diseased trees need to be trunk-injected with high rates of propiconazole for at least six years. Due to potential damage from injection procedures and other ancillary issues, the author does not recommend routine, preventative treatments of oak trees in landscapes where OW does not exist.

OAK WILT WOOD MANAGEMENT:

The OW fungus is not a good survivor in oak trees killed by the disease. As with many diseases and pests, the movement of OW-infected wood can spread the disease to new locations, predominantly during the first year after death of the tree. Methods to minimize the survival and transport of the OW fungus in wood can be accomplished in several ways. Chipping or debarking the wood hastens rapid destruction of the OW fungus; the chips and/or bark are acceptable as landscape mulch. Trees that have been killed by OW are perfectly fine for milling into lumber. Wood from OW-trees is also fine for firewood (Photo 5); however, firewood should be covered (tarped) during the spring and summer months to prevent visitations by sap beetles, which may subsequently transmit the fungus from pressure pads in the firewood to newly wounded trees. The wood only needs to be covered during the fall following tree death and then the following spring and summer of the following year (about a year) because the OW fungus is rather quickly displaced by other organisms. Immediate burning, burying, etc. are other options.

Photo 4: At the same location as in Photo 3, no trench lines were placed between Oak Wilt-infected trees (foreground, stump ground areas) and the trees in the distance. High rates of propiconazole alone applied as trunk injections have saved these red oaks (background) from root graft infection.

ORDER OF IMPLEMENTATION OF OW MANAGEMENT STRATEGIES:

Even though OW may kill trees quickly, the fungus apparently does not move through root grafts very quickly-only approximately one tier of trees per year (hence, the Tier Tree Model) see Photos 1A & 1B. It has also been observed that removing infected trees (except for immediate removal of infected trees ***and stumps*** at the ***very first symptom expression*** of OW infection) ***before*** implementation of other procedures can actually hasten the spread of OW to nearby trees. Following is the protocol the author has used for great results:

1. Install Trench Lines to Sever Root Grafts…and/or
2. Trunk-Inject Trees with Propiconazole (allow time for dissemination of the fungicide throughout tree)
3. …….
4. Go On Vacation: See the wonders of this Great Lakes State. Yes, Michigan!!
5. ……
6. Take family to several of Michigan's wonderful County Fairs and Festivals.
7. ……
8. Remove Oak Wilt-Infected Trees in Late Fall or Winter

Oak Wilt Management Summary: The sudden appearance of Oak Wilt in a landscape is usually the result of improper pruning practices and/or storm injury during the months conducive to spread of the lethal fungus by sap beetles. Avoidance of OW is the most cost-effective strategy for managing OW. Hence, it is very prudent for Counties, Townships, Neighborhoods and various Associations to advance the word about Oak Wilt and to adopt policies to prevent its introduction and spread within these communities. Once oak wilt is established in a residential landscape or neighborhood, efforts to contain and eradicate the disease can be daunting and costly. The proper installation of trenches to sever potential root grafts and/or the utilization of propiconazole trunk injections takes extensive experience. Please feel free to contact the author for assistance at 248.320.7124 or robertsd@msu.edu.

The author, MSU and MGIA do not endorse any particular products. If using pesticides, be sure to read and follow label directions.

Photo 5: This property owner decided to burn his Oak Wilt-infected firewood ("green," undried) in his outdoor wood burner the winter after his trees were killed by Oak Wilt—this is a very acceptable practice.