

The Plant Doctor's LANDSCAPE TIPS

By Dr. David L. Roberts, The Plant Doctor LLC a.k.a. The Tree Doctor

EVALUATING RESEARCH ON HERBICIDE/GIRDLE METHODS FOR THE MANAGEMENT OF OAK WILT

INTRODUCTION

Oak Wilt is the most serious threat to oak trees in urban and natural forests in Michigan (Photo 1). There are various methods to manage Oak Wilt. Many of the methods used to contain and eradicate Oak Wilt are often more destructive than the disease. In Michigan, for example, the Bruhn Model has been promoted as the "Official Recommendation" through the "Oak Wilt Qualification" (OWQ) program as administered by the Michigan DNR, the Oak Wilt Coalition (OWC), and the International Society of Arboriculture Michigan Chapter (ISA-MI). The Bruhn Model, originally designed for Root Graft Disruption, has morphed into other variations such as utilization of tree injections and herbicide/girdle applications in lieu of RGD, the reason I have often referred to the Bruhn Model as the DNR/Bruhn Model.



Photo 1: Oak Wilt continues to advance in incidence in Michigan. Methods used by some "experts" to contain and eradicate the deadly disease often kill more oak trees than the fungal disease does.

On April 1, 2023 (I have no idea if April Fools' Day is significant!), a peer-reviewed research paper was published by a group in Wisconsin that looked specifically at the Garlon 4/Double Girdle Technique (my terminology) and its application to Oak Wilt sites in Wisconsin. To my knowledge, other than my own research, this paper is the only other research designed to test the Garlon 4/Double Girdle technique, referred to as the Girdle-Herbicide (GH) method by the Wisconsin researchers, in replicated field research. The reference

to this study is as follows: *Evaluating Effectiveness of Girdle-Herbicide Containment of Below-Ground Spread of Oak Wilt (Bretziella fagacearum). Forest Ecology and Management. Volume 533, 1 April 2023, 120816* (Photo 2). This publication contains valuable information regarding the ramifications of Oak Wilt management in Michigan via the Garlon 4/Double Girdle method. For anyone who would like to review this research, this publication is available on the Web or via Yours Truly. For brevity in my current article, I'll refer to the research in this publication as "The Wisconsin Study".

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Evaluating effectiveness of girdle-herbicide containment of below-ground spread of oak wilt (*Bretziella fagacearum*)

Photo 2

Photo 2: A research study published by scientists in Wisconsin in April 2023 confirmed my prior research that Triclopyr applied to double girdles on oak trees is not that effective at containing and eradicating Oak Wilt, especially when the number of healthy sacrificial oak trees are considered. This photo discloses the reference for arborists who desire to learn more about The Wisconsin Study.

MATERIALS AND METHODS OF THE WISCONSIN STUDY

The authors of The Wisconsin Study reported that the research was conducted at 42 independent Oak Wilt sites in an eight-county region in central and northern Wisconsin. The Bruhn Model was used as the template to determine which diseased and healthy trees would be treated according to the protocol in this study. Horizontal double girdles spaced approximately six inches apart were cut using chain saws and subsequently drenched with a mixture of 25% Element 4 (Triclopyr 4) and 75% Diesel Fuel by a handheld sprayer (Photo 3). The herbicide mixture was applied to both girdles immediately after the girdles were made. An average of 142 mL (= ~28 teaspoons)



Photo 3: The principal method used by Wisconsin scientists included "drench applications" of Triclopyr mixed with diesel fuel to horizontal double girdles. This method is also recommended to Michigan "Oak Wilt Qualified (OWQ) Specialists" even though my prior research and the recent Wisconsin Study demonstrated lackluster with failed results. Photo 3 is from my own research several years ago.

of the Triclopyr/Diesel Fuel mixture was applied to each tree for a total average of 5833mL of herbicide mixture used per Oak Wilt site. The Girdling Herbicide treatments were applied in 2015 and 2016 to a total of 2,270 red oaks; 248 treated trees were newly Oak Wilt-symptomatic trees while the remainder, 2,022, were apparently healthy trees surrounding diseased trees according to the Bruhn Model. For each of the succeeding four years following treatment, trees within 200 meters of the treatment/containment sites were monitored for the development of Oak Wilt. Other matters such as soil texture were also considered in this study. Extensive statistical analysis was performed on this research by the Wisconsin researchers.

RESULTS OF THE WISCONSIN STUDY

The researchers reported that with sites that had four or less Oak Wilt-infected trees (<4), the GH (=Girdle-Herbicide=Triclopyr/Double Girdle) method was 82% effective at containing Oak Wilt. With sites where five or more oak trees were infected by Oak Wilt, 29% control of Oak Wilt was achieved. Four to Five symptomatic trees appeared to be a breakover point

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for the scientists. An overall average of 55% control of Oak Wilt was reported in The Wisconsin Study, which is likely not a "weighted average" but simply an average control of 29% and 82%.

DISCUSSION

The Wisconsin Study was sorely needed research regarding the use of Triclopyr products for application to girdled oak trees, reinforcing my own research results from several years previous. Where I might disagree with the Wisconsin researchers is in their conclusions, which, in my view, are overly optimistic: *"This study shows that the Girdle and Herbicide (GH) methodology is an efficient way to contain Oak Wilt"*. I do not consider 29% control, an overall average of 55% control, or even 82% control an efficient way to contain Oak Wilt. Please consider that even with 82% control, many healthy trees (tiers?) needed to be sacrificed according to the Bruhn Model. For many tree diseases other than Oak Wilt, we can tolerate less than 100% control without serious consequences to tree health and for property owners (Photos 4A & 4B). But for a lethal disease such as Oak Wilt, we must strive for as close to 100% disease control as possible, especially when we consider that so

many healthy trees are being sacrificed (Bruhn Model) and when we consider the exorbitant cost of remediation, property value loss, and adverse environmental impacts associated with Oak Wilt. In The Wisconsin Study, approximately 10 healthy trees were sacrificed for every Oak Wilt-infected tree. In other situations, many more healthy trees have been proposed for sacrifice for each diseased Oak tree.

In my own studies as reported in my plethora of articles published in *the Landsculptor* over many years, I have achieved 100% control, or nearly that, of Oak Wilt using my Tier Tree Model in its various diverse applications (RGD, Glyphosate/Stump Cup variations, etc.), often without sacrificing any healthy oak trees. To review, I have attained 100% control using my Glyphosate/Stump Cup 'Chaser' at elevated, experimental Glyphosate rates (8 ounces concentrate per 12" dbh). In further field trials comparing Glyphosate and Triclopyr with a Half Stump Cup (=half girdle= 'Half Moon'), the Glyphosate always killed trees while Triclopyr failed to show any visible adverse impact on the health of oak trees. Even when I compared Garlon 4 at drenching doses of Triclopyr (=~ 28 teaspoons Triclopyr in The Wisconsin Study), the Garlon 4 had no discernable impacts on the health of oak trees (Photos 5A & 5B) while Glyphosate even at the ultra-low one (1) teaspoon rate per 12" dbh was sufficient to kill oak trees (6A & 6B). The reason we want to quickly kill oak



Photo 4A



Photo 4B

Photos 4A & 4B: Oak Wilt is a disease that often stimulates control methods that are expensive, destructive, and environmentally unfriendly. We desperately need better remediation methods to contain and eradicate the disease much more efficiently. My creations over the last 40 years of research offer disease management approaching 100% efficacy or nearly that level. By comparison, many diseases such as apple scab (*Venturia inaequalis*) may cause leaf loss beginning in late July or early August every year, ending with dead-appearing trees by fall. Even though these trees appear dead in the fall, they invariably flower and re-leaf just fine the following spring (Photo 4B). The tree in Photo 4B almost always appears dead every fall, to the consternation of the owner, but always comes back to life every spring despite no control inputs.



Photo 5A



Photo 5B

Photos 5A & 5B: In my experiments involving Triclopyr (Garlon 4) applied to half double girdles, trees often survived as though the herbicide had no discernable impacts on oak tree health the year following treatment. Photo 5A shows Garlon 4 applied to an oak tree that received two half girdles (my 'Half Moon'). Photo 5B demonstrates no recognizable herbicide toxicity to the health of the treated tree (5A) the following year . . . not even any leaf symptoms. The use of the 'Half Moon' (=half girdle) method reveals what impact the test herbicide has on the health of the tree without killing the tree by complete girdling. Trees that are Half-Girdled appear normal and quite healthy the year after administration of the Half-Girdle.

trees, including their roots, is to prevent the survival and/or transmission of the Oak Wilt fungus in diseased trees to healthy trees. The Glyphosate treatments I administer seem to do just that. In my numerous field trials, Glyphosate is translocated between oak trees much faster than the Oak Wilt fungus is transmitted. Because of the destructiveness of Oak Wilt and the costs and destruction of remediation by human intervention with some methods, we desperately need better management tools that provide less impact on the local environment and peoples' financial wellbeing. My research has shown great potential for remediation of Oak Wilt



Photo 6A

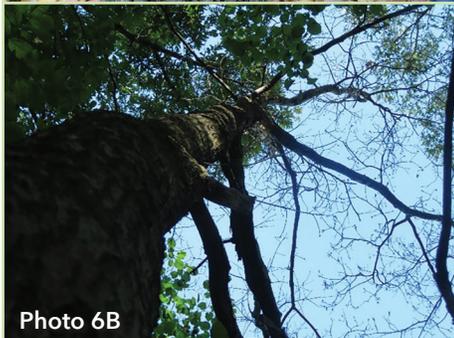


Photo 6B

Photos 6A & 6B: In comparisons with the Garlon 4/Double Girdle ('Half Moon'), oak trees were readily killed whether 8 ounces of concentrated Glyphosate (41%) or one teaspoon (label rate) of 41% Glyphosate was used. Photo 6A shows one teaspoon of Glyphosate being applied per 12" dbh to the 'Half Moon' in the fall. By next spring, the tree (Photo 6B) was "stone cold dead".

through techniques other than those used and recommended by others.

While Triclopyr is a fantastic herbicide for some applications, its use in Oak Wilt management is dubious. I do not know why so many researchers and "experts" involved with Oak Wilt in the Midwest are so enamored with Triclopyr products when it has been well documented that this herbicide does not kill roots of oak trees for several years. For example, in the University of Wisconsin Extension Publication, Lake States Woodlands: Oak Wilt management – What are the Options? (G3590, Photo 7, 2010), Jane Cummings Carlson, A. Jeff Martin, and Kyoko Scanlon reported that while some herbicides such as Garlon 3A, Garlon 4, Arsenal AC, Stalker, and Tordon RTU (and various combinations thereof) may kill the above ground portions of oak trees, they are not known to kill roots of oak trees quickly enough to prohibit spread of the Oak Wilt fungus through root grafts. At the time of printing of this peer-reviewed publication (2010), Cummings Carlson, et.al. wrote,

G3590

Lake States Woodlands

Oak wilt management— what are the options?

Jane Cummings Carlson, A. Jeff Martin and Kyoko Scanlon

Trees at risk

Thousands of oaks in woodland and urban settings die from oak wilt every year. Widespread in Wisconsin, Minnesota and Michigan, the disease is caused by the fungus *Ceratocystis fagacearum*. Figure 1 shows the extent of oak wilt in Michigan, Minnesota and Wisconsin.

Trees from the white and red oak groups, both found commonly in the Lake States, are susceptible to oak wilt. Because trees in the red oak group fall prey to the disease most often, this publication focuses on the red oak group.

Biology and spread of oak wilt

Mats of fungus, known as "pressure pads," develop under the bark of trees that have died from oak wilt (example 1a). Mats form most often in spring, approximately 9-10 months after a tree dies from oak wilt. These mats force the bark to crack open. The fungus produces a sweet odor that attracts sap-feeding beetles such as Nitidulids (example 1b). The beetles pick up fungal spores by crawling on the mats. Then they fly to healthy oaks to feed on sap flowing from fresh wounds, thus infecting new trees.

As fungus invades a tree's water conducting system, the leaves turn dull green, bronze or tan, and wilt from the top of the tree downward (example 1c). Leaves fall rapidly after wilting. Infected trees are bare in 4-6 weeks. Underground spread of oak wilt from infected to healthy trees occurs through root grafts. Most root grafts form between oaks of the same species; red oak roots graft more commonly than do white oak roots, and grafts between red and white oaks are very rare.

Figure 1. This map shows the county distribution of oak wilt in Michigan, Minnesota and Wisconsin in 2010. Map produced by the USDA Forest Service, Northeastern Area—Forest Health Monitoring GIS Group.

Example 1a. In April, May and June, fungal mats ("pressure pads") grow under the bark of trees that wilted the previous summer. Mats are sometimes present in late summer or fall.

Example 1b. Fungal mats force the bark to crack open. The mats' odor attracts sap-feeding beetles which spread the disease to healthy trees.

Example 1c. The fungus invades the tree's water-carrying system, causing leaves to wilt and fall. Wilting occurs most often in July and

Photo 7

Photo 7: In this University of Wisconsin Extension Bulletin (#G3590), the authors forewarned us in 2010 that due to the chemistry/mode of action of Garlon 3A, Garlon 4, Arsenal AC, Stalker, and Tordon RTU, these herbicides are not likely to kill roots of trees sufficiently fast to prevent root graft transmission of the deadly Oak Wilt fungus between diseased and healthy trees. Despite these warnings, my own published research, and the recently published Wisconsin Study, people are still recommending the use of Triclopyr for Oak Wilt management as though it's the best thing since sliced bread.

"...herbicides should not be presented as a proven means of creating root graft barriers". Except for my research with Glyphosate, nothing has changed in all these years.

The Wisconsin Study was a huge undertaking with over 2000 trees receiving the Double Girdle and Herbicide (GH) treatment. And I am grateful to our Wisconsin colleagues for this investment in time, work and resources. However, I might offer a couple of suggestions. Oak Wilt research is notoriously slow

and tenuous because of the extended survival of the fungal pathogen in oak trees, especially their roots. In my own research, I collect data every year for a minimum of 5-6 years (sometimes as long as or longer than 10 years) to ensure that my observed treatment results are valid; although there is some variation in Oak Wilt fungal survival witnessed by scientists, it is commonly accepted that the Oak Wilt fungus may survive in oak roots for at least 4-6 years. Hence, the four-year time

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limit to collect data in The Wisconsin Study might have been a bit truncated. Also, while the magnitude of The Wisconsin Study is impressive, similar results would likely have been attained with far fewer test sites and sacrifice of healthy trees. What if, for example, more herbicides had been tested in addition to Triclopyr products? And why have no researchers (other than me) ever separated out the impact of the herbicide (Triclopyr) versus the impact of double girdling on oak tree health? Could girdling alone provide as much impact on tree health and Oak Wilt management as girdling plus triclopyr? In my studies, triclopyr demonstrated no discernable impact . . . perhaps at most inhibiting stump sprouting, but that is not even assured. When I began research into herbicide remediation of Oak Wilt in 2008, I automatically excluded carboxylic acid herbicides such as Triclopyr and Imazapyr because of their mode of action - these herbicides kill trees slowly over a period of several years . . . and in some cases with sublethal doses, trees have been observed

to recover even though they appeared dead for a year or two. I knew that Glyphosate had far more potential for stopping Oak Wilt, and it has been very effective in my research ever since.

In Michigan, the Garlon 4/Double Girdle (=GH) was promoted through the Oak Wilt Qualifications (OWQ) program as an effective alternative to the Bruhn RGD method without research or vetting years before the 2023 Wisconsin Study was released. Hence, I would urge Michigan Arborists and the public to exercise restraint when recommending applications of Triclopyr products to girdled oak trees for the containment and eradication of Oak Wilt.

Note: *There is much more information and discussion in the Wisconsin Study than I was able to present herein. I urge arborists to examine the actual publication if they'd like further information.* 🌱

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