The Plant Doctor's
LANDSCAPE TIPS

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OAK WILT MYTHS AND MISCONCEPTIONS PART 3: "TREE INJECTIONS DON'T WORK"

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INTRODUCTION

In this continuing series on Oak Wilt Myths and Misconceptions, I wanted to delve into the subject of tree injections with the fungicide propiconazole to manage Oak Wilt (Photo 1). The Michigan Department of Natural Resources (DNR) has declared for decades that treatment of healthy trees with propiconazole injections will not protect these trees from root graft infection from nearby trees affected by Oak Wilt. Over the years, whenever I asked state department personnel in the field why they perpetuate this myth, the answer has always been- "Because that is what we were told to say". More recently, an arborist society has also divulged a similar doctrine in their collaboration with the DNR; for transparency, the arborist society is receiving funding from the DNR. After the arborist society has recognized propiconazole effectiveness for control of Oak Wilt for years, the society is now teaching in the Oak Wilt Qualifications (OWQ) program and public-wide distributions that propiconazole will not protect healthy trees from root graft infections. This change of "doctrine" has angered many arborists and suppliers, who often voice their exasperation to me. As we can now imagine, the management of Oak Wilt by fungicides has become a confusing and highly controversial issue. In this article, I wanted to discuss my research, other scientists' findings, and arborists' experiences with the management of Oak Wilt by tree injections with propiconazole.

PROPICONAZOLE LABELS

There are a variety of products on the market that contain Propiconazole and that are prescribed for the management of Oak Wilt. Some of the more commonly available products include Arborjet's "Propizole", Rainbow Treecare's "Alamo", and Arborsystems' "Shepherd". There are also generic Propiconazole products on the market. Some of these generic products are manufactured in China and are generally much less expensive in cost; some arborists and suppliers have questioned the quality of these "knockoffs". On most labels, there is a low rate and a high rate of Propiconazole for injection into trees for Oak Wilt management. The low rate of Propiconazole on many products is often recommended at 10 mL per inch dbh (diameter at breast height=4.5 feet). The high rate is usually recommended at 20 ml per inch dbh. Other rates are sometimes recommended by some companies.

RESULTS OF PROPICONAZOLE TREATMENTS

Propiconazole for the prevention of Oak Wilt has been extensively studied by university scientists who have reported success with Oak Wilt control for years. Arborists have also used Propiconazole extensively and report positive results. In general, if used correctly, Propiconazole treatments to protect healthy trees from root graft transmission of the Oak Wilt fungus between infected trees and healthy trees have been highly effective. In some instances, tree injections with Propiconazole have failed (discussed below).
I thought it might be useful to provide several examples of Propiconazole treatments with which I have been involved. These examples represent arborist's treatments to uninfected, healthy trees as a preventative measure to prevent root graft transmission from nearby diseased trees within root graft range. In some instances, these tree injections were combined with other Oak Wilt management techniques.

Photo 1: Some of the oak trees at this lake-front cottage near Kalkaska Michigan were infected by the Oak Wilt fungus after they were pruned, likely to improve visibility to the lake. Tree injections with Propiconazole were planned due to the proximity of nearby oaks, which would not readily allow Root Graft Disruption procedures without severely damaging healthy trees.

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Example #1: In 2015, a married couple near Grand Rapids, Michigan, had their trees pruned in May by an "arborist". I use the term "arborist" loosely herein because many of our customers view anyone who does trees work as an "arborist", and because any reputable "arborist" would not be pruning oak trees in May, the high-risk period for overland spread, without taking proper precautions. Injured trees at this Grand Rapids landscape showed typical symptoms of Oak Wilt within 1-2 months after the pruning event (Photo 2A). I was asked by another highly respected arborist to provide advice on remediation at this site. Two red oak trees in the center of the landscape had escaped the initial infection (Photo 2A) but were now in jeopardy from root graft transmission from nearby infected red oak trees. Because of the short distance between healthy and diseased trees, I could not recommend Root Graft Disruption (RGD=trenching) without causing serious injury to the two healthy trees by destroying a significant portion of the two trees' root systems. Hence, my most logical recommendation was to prescribe tree injections with Propiconazole at the high rate (20ml per inch dbh). Trees were injected in the fall of 2015 and again two years later in 2017. As of 2022, the two trees have shown no symptoms of Oak Wilt infections from root graft transmission (Photo 2B); with respect to time, there has been no further development of Oak Wilt in the 7-year period the some of the trees on the property became infected from overland spread to wounds created by pruning or within the last five years after the last propiconazole treatment, essentially ensuring the effectiveness of Propiconazole tree injections as an effective Oak Wilt management tool.

Addendum to Example #1: While it is significant that healthy trees very close to infected trees could be saved from root grafts infection with the aid of Propiconazole, an equally important tool involved the installation of a RGD procedure on the property to preserve the health of other trees in the vicinity, especially neighbors' trees. The standard procedure for Oak Wilt remediation at this site by the DNR and an arborist society's OWQ program would have been to implement the Bruhn Model for RGD; the Bruhn Model would not only have specified the destruction of the two healthy trees in Photo 2A & 2B, but many other trees on surrounding neighbors' properties as well. Because the property owner's oak trees that became infected with Oak Wilt butted up to their neighbors' properties, many more trees were at risk. Having created my Tier Tree Model (TTM) beginning in 1984, I recommended that a single RGD (trench) be established between the infected trees and the neighbors' trees, some of which were 10-20 feet distance from diseased oaks. As of 2022, seven years after the initial infection in 2015, all neighbors' trees have remained healthy and free of Oak Wilt infection. If the Bruhn Model had been implemented in 2015, according to DNR and OWQ criteria, dozens of the neighbors' trees would have been sacrificed. The application of the Propiconazole tree injection procedure in conjunction with the TTM resulted in no sacrifice of any healthy trees and a 100% success in Oak Wilt eradication from the neighborhood.

Photo 2A: Trees at this landscape site near Grand Rapids were pruned in the spring of 2015. Symptoms of Oak Wilt developed by mid-summer. Note that infected trees are turning brown and dropping foliage. Two trees in the center of the photo initially escaped infection. Because the healthy trees were so close to diseased trees, Root Graft Disruption (RGD) could not be performed without severe injury to the healthy trees. Instead, the two trees received Propiconazole injections at the high rate of 20mL per inch dbh in 2015 and 2017. Note proximity of property owner's diseased oak trees to their neighbor's healthy oak trees.

Photo 2B: As of 2022, the two trees in the center of the landscape have survived just fine thanks to the previous tree injections with Propiconazole. In 2015, a single Tier Tree Model RGD trench line had been placed between healthy and diseased trees, which were near the property boundary, often only separated by 10 feet distance. From 2015 through 2022, no further Oak Wilt has developed on any of the properties due to intelligent applications of Propiconazole injections and the Tier Tree Model for RGD. If the Bruhn Model had been used at this site, so frequently recommended by the DNR and the OWQ program, mass sacrifice and destruction of many trees in the neighborhood would have ensued. Note the neighbors' healthy oaks on the property boundaries (right and left) that were protected due to application of the author's Tier Tree Model for RGD.

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Example #2: In northern Michigan, an affluent individual owns a nice property running between Lake Michigan and an inland lake, with a canal connecting the two lakes and delineating his northern border. Several oak trees on his property became infected with the Oak Wilt fungus when an "arborist" pruned some low hanging branches from them in the spring of 2013 (Photo 3A). Typical Oak wilt symptoms developed by mid-summer. As with Example #1 (above), the Tier Tree Model for RGD was utilized in conjunction with Propiconazole Tree Injections. Two RGD trench lines were installed between tiers of trees to isolate most of the oaks on the property from the infection center (Photo 3B). Some trees, however, could not readily be isolated by RGD trenching due to potential for severe root injury; these trees were injected with Propiconazole (Photo 3C & 3D). The site has been monitored every year since implementation of the Oak Wilt remediation efforts in August 2013. Results were highly successful; trees isolated from the Oak Wilt infection center by RGD trench lines have remained healthy. Trees that could not be isolated by RGD but which received Propiconazole injections are also doing very well (Photo 3D), proving that tree injections with propiconazole alone can prevent Oak Wilt transmission through root grafts (Photo 3D).

While there are naysayers who will quickly dismiss the above two examples as "anecdotal" and, hence, unscientific, these same results were replicated at many locations all over Michigan by me, other scientists, and many arborists. These results are scientific proof of the effectiveness of Propiconazole for protecting oak trees from root graft infections by the Oak Wilt fungus.

Photo 3A: At this landscape wedged between Lake Michigan and an inland lake in northern Michigan, trees became infected in the spring of 2013 when an arborist trimmed some low hanging branches to allow the property owner better access to his boat house (at end of dock in foreground). Note that all trimmed trees developed Oak Wilt symptoms amongst many non-infected healthy trees. The challenge: How do we save so many nearby healthy oak trees from contracting Oak Wilt?

Photo 3B: Two Tier Tree Model trench lines were installed between the Oak Wilt infection center and most healthy trees to prevent root graft transmission. In this photo, a primary trench line is placed between the diseased trees (left, out of view) and most other trees on the property including the 48 inch dbh red oak (right).

Photo 3C: For other trees, which could not easily be isolated from diseased trees by RGD, Propiconazole tree injections were employed.

Photo 3D: This photo reveals trees (beyond the sidewalk) protected by Propiconazole treatments several years after the initial infection. No RGD trenches were installed between diseased and healthy trees. The turfless soil mounds in the foreground represent the sites where the original diseased trees had been removed.

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WHY PROPICONAZOLE TREATMENTS FAIL:

I would be remiss if I didn't discuss the occasional failure of propiconazole treatments to prevent the spread of Oak Wilt through underground transmission via root grafts. Generally, there are plausible explanations for these failures. Following are several reasons for potential Propiconazole tree injection failures.

1. **Improper Injection Technique:** In some instances, injection sites are too far apart on the injected trees, and insufficient numbers of injection sites are administered. Inadequate sites may not protect all roots from infection. In some cases, improper technique results in leakage of propiconazole from injection sites. Dull drill bits (or plugged needles) and a raft of other reasons may contribute to improper injection technique. Years of excessive tree injections can lead to severe injury and disruption of the vascular system in oak trees, which may decline over time (Photo 4)
2. **Low Fungicide Rates:** Through almost 40 years of experience with Oak Wilt, I have found that Propiconazole injection rates that are too low (i.e. 10ml/inch dbh) will not protect healthy trees from root graft infections. One company in western Michigan recommends the 10ml rate of propiconazole for its clients, and I have witnessed failure after failure. This 10ml rate is probably one of the reasons why the DNR believes propiconazole trees injections are ineffective at controlling Oak Wilt (Photo 5).
3. **Dilution of Propiconazole:** What many "experts" may not realize is that when oak trees are injected with fungicides, nearby trees that have not been injected may pull fungicide from the injected ones, thus diluting the propiconazole fungicide in injected trees. It is not uncommon for arborist to inject the first tier of trees surrounding infected trees and no other tiers. Dr. David Appel, Texas A&M University, showed in the 1990s that the first tier of trees next to diseased oaks could be protected with Propiconazole but that the Oak Wilt fungus could pass through the injected trees and kill oaks in the 2nd and 3rd tier of trees.
4. **Already Infected trees:** We may not always know if trees are infected, especially if they show no symptoms of Oak Wilt. Trees that are already infected will likely not be saved by trees injections. I have worked with arborists using high rates of propiconazole on known infected trees; we have prolonged the viability of these trees for several years. Invariably, infected and injected trees will usually succumb to Oak Wilt infections.
5. **Propiconazole Phytotoxicity:** Depending on the time of injection and perhaps other matters, propiconazole may cause toxicity to oak trees. Toxicity is more likely to occur during the hot, dry, and stressful periods of summer. Propiconazole toxicity is often mistaken for Oak Wilt because leaf drop is symptomatic of both issues (Photo 6). Trees with propiconazole toxicity usually recover.
6. **Propiconazole Quality:** As mentioned earlier in this article, there are concerns regarding the quality of Propiconazole originating from sources that may not have quality standards. Tree injections could fail if the Propiconazole isn't up to the standards achieved by many professional suppliers of these products.

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Photo 4: Some arborists inject trees with Propiconazole yearly. Such treatments are not advised due to excess wounding from drilling, that may ultimately lead to tree decline. Furthermore, the author does not recommend Propiconazole tree injections as a routine prophylactic practice where not Oak Wilt exists.

Photo 5: At Hoffmaster State Park, these trees succumbed from root graft transmission of Oak Wilt after the low rate (10mL/inch dbh) of Propiconazole applications failed to protect them. These failures may be part of the reason why the DNR and a Michigan arborist society believe Propiconazole tree injections are not efficacious in protecting trees from root graft infections by the Oak Wilt fungus. The higher rate (20mL/inch dbh) recommended by me and used by many arborists would have likely demonstrated much better results.

Photo 6: Oak trees at this residence began dropping leaves (Inset) when an arborist injected them with Propiconazole in late July. Note the precipitous leaf drop on the lawn. Phytotoxicity from Propiconazole injections are more likely to occur during periods of stressful weather (heat and drought). The symptoms of Propiconazole phytotoxicity often mimic those caused by Oak Wilt. When our clients experience phytotoxicity from Propiconazole, they may become quite alarmed and need to be calmed. Trees afflicted by Propiconazole phytotoxicity usually recover just fine.

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