

Tree Diseases: Oak Wilt in Indiana

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Introduction

Oak wilt is a fatal disease of red and black oak trees in Indiana and other Midwest states. While there is no cure for infected trees, you can keep oak wilt from spreading by taking appropriate preventive measures. This publication describes the symptoms of oak wilt disease, its cause, and management options that are available.

Symptoms

Indiana has at least 17 oak species, which are commonly classified into two groups: the red and black oak group, and the white oak group.

Red and Black Oak Group

The red and black oak group includes red, black, pin, shingle, and other oak species. Trees in this group are much more susceptible to oak wilt than white or bur oaks. Red and black oaks are infected with the disease in early summer, which will generally result in rapid wilt and tree death by late summer.

The first symptoms of oak wilt occur in the top portions of trees. Initial symptoms usually occur in June, but can appear earlier in southern Indiana. Leaves on infected trees develop bronze or dull tan tissue that begins at the leaf tips and edges and progresses toward the leaf base, which often remains green. The separation between bronze and green tissue may be abrupt. (Figure 1).

Infected trees may drop leaves, which may be either totally green or bronze and green. The sapwood will begin to show dark streaks in branches of about 1 inch in diameter — a typical symptom of wilt diseases (Figure 2). To find the streaks, remove the bark



Photo by Gail Ruhl

Figure 1. These branches and leaves show symptoms of oak wilt.



Photo by Gail Ruhl

Figure 2. The dark streaks in the sapwood of this red oak branch indicate an oak wilt infection.

and examine the sapwood surface. Examine several actively wilting and defoliating branches, because the brown streaks will not be present in some branches.

Infected trees may start losing leaves any time after symptoms first appear. By late summer an infected tree may be bare of leaves (Figure 3). Infected trees in the red oak group often produce a fungal mat beneath the bark the following spring (Figure 4). Pressure from the growing fungal mat (known as a pressure pad) may eventually split the bark vertically. (Figure 5)

White and Bur Oaks

The white and bur oak group contains species that are much more resistant to oak wilt, so oak wilt symptoms appear more gradually. Oaks in this group may have only a single limb or scattered limbs with disease symptoms, and the disease will progress down the tree only a short distance in one growing season.

Premature leaf drop is generally not pronounced, and an infected tree may survive several years before it dies. However, infection will result in dead limbs throughout the crown of the tree and will become more noticeable each year as the infection spreads. It is easy to mistake this gradual dieback for other oak problems.

Cause

Oak wilt is caused by the fungus *Ceratocystis fagacearum*. Once inside the tree, the fungus permeates the vascular system and plugs the tree's water-conducting vessels. This disrupts the flow of water and nutrients, which causes the oak to wilt, drop leaves, and die back. Root grafts and sap-feeding beetles move the oak wilt fungus from diseased to healthy trees. Contaminated pruning tools have never been demonstrated to spread the disease.

Root grafts occur when the roots of nearby trees of the same type fuse, which forms a connecting bridge between the two trees (Figure 6). Root grafts often unite red and black oaks growing within 50 feet of one another. Root grafts are much less common between trees within the white oak and bur oak groups, and also infrequent between oak groups.

Sap-feeding beetles can pick up spores of the fungus on their bodies or mouthparts during feeding, then carry the spores to fresh wounds on nearby healthy trees. Infested beetles may occasionally spread the disease over longer distances, but they generally remain near active disease centers. The disease may spread long distances by moving infected oak logs or firewood.



Photo by Gail Ruhl

Figure 3. The canopy of this pin oak dying from oak wilt shows considerable thinning.



Photo by Janna Beckerman

Figure 4. Pressure pads develop under the bark of infected red oaks.



Photo by Janna Beckerman

Figure 5. The vertical crack in this red oak trunk was caused by a pressure pad developing below the bark.

Other Oak Problems

Oak wilt may be confused with other disorders. For example, oak trees are prone to injury that results from soil compaction, grade changes, root restrictions, and other site-related root stresses. It is easy to mistake these symptoms of decline with oak wilt symptoms. Mature oaks also may exhibit decline symptoms due to a complex of factors that involve drought, insect borers (especially the two-lined chestnut borer), and root decay.

An incorrect diagnosis can cause unnecessary concern and even result in using improper control measures. Laboratory testing is required to confirm an oak wilt infection. The foliar symptoms of bacterial leaf scorch may also resemble those caused by oak wilt.

Identification

If you suspect oak wilt, the Purdue Plant and Pest Diagnostic Lab (PPDL) can test samples for the presence of the fungus. You may want to consult a certified arborist to help you collect wilting branches from the crown of the tree. You can find an arborist at www.treesaregood.org/findanarborist.

To submit a plant sample to the PPDL, complete a sample submission form. You can get a form from your Purdue Extension county office or online at www.ppd.l.purdue.edu.

The back of the form includes detailed instructions for submitting most types of samples, but oak wilt samples require special handling. Be aware that isolations require seven to 14 days for the fungus to produce spores and allow a positive identification.

For oak wilt samples:

- Collect at least six branches. Each branch should be about 8 to 15 inches long and 1/2 to 1 1/2 inches in diameter.
- Place branches in an ice chest with disposable ice packs immediately after collecting.
- Be sure to take samples from living trees showing dieback.
- **Be certain that samples contain discoloration in the sapwood** (see Figure 2).
- Keep samples cool and dry and ship or deliver them the same day you collect them.
- Ship samples early in the week, so they are not in transit over a weekend.
- Send several photos of the affected tree to ppdl-samples@purdue.edu or upload on the PPDL website. Photos should include a view of the whole



Photo provided by James O'Brien, USDA Forest Service Bugwood.org.

Figure 6. Root grafts between oak trees.

tree and close-ups of the dieback, the trunk from several sides, and views of the base of the tree at the soil line.

Ship samples to:

Plant & Pest Diagnostic Laboratory
Purdue University
915 W. State St.
LSPS Room 116
West Lafayette, IN 47907-1155
765-494-7071

Management

Prevention is the key to successfully managing oak wilt, because once a tree is infected, there is no cure. It's possible to suppress disease development in the white and bur oak group for many years with treatment; but for trees in the red and black oak group, preventing infection is the only option for long-term tree health.

1. **Prevent wounds and treat wounds that occur.** Fresh wounds attract beetles that carry the oak wilt fungus. The highest risk is from March 1 through the end of November. There is little risk that insects will spread the disease from December 1 through the end of February. For this reason, you should (if possible) do any pruning of your oaks during this low risk period. If you can't avoid doing the work, or if your tree is wounded anywhere during the high-risk period, immediately treat the wound with an appropriate tree wound dressing to reduce insect being attracted. This is one of the few instances where pruning wound treatments are appropriate. Never use tree climbing spikes on oak trees.
2. **Practice sanitary pruning.** For trees in the relatively resistant white and bur oak group, sanitary pruning of infected limbs might save the tree. At the first indication of oak wilt, remove the infected branch.

Make proper pruning cuts as close to the main trunk as possible to avoid leaving infected wood behind. Treat the wounds promptly.

3. **Prevent and disrupt root grafts.** Most oak wilt transmission occurs underground. When oak trees grow near each other, their roots can grow together (fuse) and form a graft (Figure 6). If one tree is infected, the fungus can spread rapidly to the roots and infect any other oaks that are part of the root graft system. If trees are within 50 feet of each other, you should disrupt all possible root grafts between healthy and infected trees (or trees suspected of being infected). Root grafts can be disrupted mechanically (for example, by vibratory plow, Figure 7). Always hire an arborist or forest pest specialist trained in oak wilt management. However, if there are obstructions that interfere with digging or cutting (such as pipes, power lines, cables, etc.), professional applicators may use chemicals to disrupt root grafts.
4. **Consider applying preventative fungicides.** Disease management focuses on preventing infections. Professional applicators can inject all oak species with a propiconazole-based fungicide (such as Alamo®) to protect healthy trees from oak wilt. Do not consider fungicide injection a substitute for severing connected root systems to stop belowground spread. You may inject red oaks every other year to prevent infection, but once they show symptoms it is usually too late to save them. You may treat white and bur oaks after infection if the treatment begins before 30 percent of the canopy is lost. When used properly, propiconazole can provide effective protection from oak wilt for approximately two to five years for white oaks. Propiconazole by itself cannot prevent the spread of oak wilt through root grafts, but it can suppress aboveground symptoms.
5. **Remove infected trees.** You should promptly remove infected red oaks and grind out the stumps to prevent the trees from forming pressure pads that will be a source of fungal spores (and new infections). Alternatively, you may completely girdle diseased red oaks and black oaks through the outer sapwood as soon as a diagnosis is confirmed to prevent pressure pads from forming that attract beetles and spread disease. It is best not to remove an infected tree until winter to minimize the risk of wounding surrounding trees during the removal process. Fungal mats are produced only rarely on white oaks; therefore, girdling is not necessary. You may use diseased trees for firewood or lumber but



Photo provided by James Solomon, USDA Forest Service, Bugwood.org.

Figure 7. This trenching operation is designed to cut root grafts between trees.

only in areas where oak wilt is already widespread. To reduce the spread of the fungus, you should debark diseased trees. You should split firewood and stack it in open grids off the ground in a dry, open area. Protect the stacked wood from moisture to hasten drying and reduce the risk of fungal mat formation.

6. **Replant.** When you replant, remember to choose a site at least six feet away from the removed tree, and to select a tree other than oak to reduce disease pressure and diversify the landscape or forest.

What You Need to Know

- Oak wilt is found sporadically in Indiana each year and has been confirmed in more than 60 counties since 1979 (Figure 8).
- To manage oak wilt:
 - Prune during the dormant season to minimize the risk of spread by insects
 - Minimize the possibility of root grafts and underground spread
 - Prevent the spread by insects by preventing oak wilt mats from forming on trees in the red and black oak group.

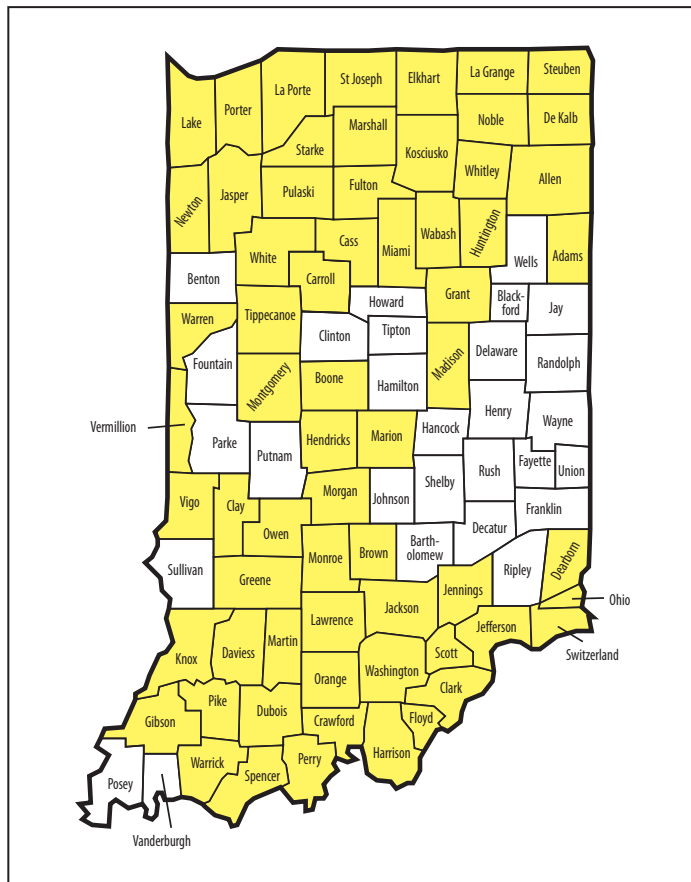


Figure 8. The counties in yellow have had at least one case of oak wilt confirmed by the Purdue PDDL and/or U.S. Forest Service since 1979.

References

Jennifer Juzwik, Appel, D., MacDonald, W., Burks, S. 2011. Challenges and Successes in Managing Oak Wilt in the United States. *Plant Disease* 95 (8): 888-900. doi:10.1094/PDIS-12-10-0944

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Collecting Samples for Oak Wilt Testing

Sampling for oak wilt is best done during the summer months when trees are actively exhibiting wilt symptoms.

Stem Samples (preferred):

Collect 4-6 stems that are about 8 to 10 inches long, about 0.5 to 1.5-inch diameter, alive but showing dieback (wilt) symptoms. The sapwood must contain vascular discoloration as shown in the photos below. Don't confuse the normal reddish color of red oak wood with the dark brown to black streaks caused by the oak wilt fungus.



If you don't see streaking in the sapwood we are unlikely to recover the oak wilt pathogen.

It takes at least 7 days for the fungus to develop in the lab to the point that a positive confirmation can be made. Often, a 2-week incubation is needed. Samples must be submitted with disposable ice packs. Temperatures in mail trucks in summer are high enough to kill this fungus in wood samples, resulting in false negative tests. Only mail samples early in the week using an overnight delivery option so they are not in transit over a weekend.