

## Worried about oak wilt?

Remember the no prune dates of April 15 – July 15 to reduce the chance of oak wilt infection and spread.

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### Species name

*Bretziella fagacearum*, formerly known as *Ceratocystis fagacearum*, is a fungal pathogen that causes oak wilt, a disease that is fatal to red oaks.

## How did oak wilt come to the United States and how long has it been here?

Oak wilt was first recognized as an important disease in 1944 in Wisconsin, where in localized areas, over half the oaks had been killed. The fungal pathogen was thought to be native to the eastern United States. Difficulties in identifying the fungus delayed scientists' ability to recognize the extent of its impact until the 1980s. Recent evidence suggests oak wilt is an exotic disease that arrived in the United States in the early 1900s. The fungus has not been reported in any other country other than the United States, however, so its origin remains unknown. In Michigan, oak wilt was first reported in the 1970s.



*Photo 1. Oak wilt symptoms. A) Dying red oak showing foliar wilt symptoms. B) Crack in the bark indicating mycelial mat presence. C) Nitidulid beetle visiting a mycelial mat. D) Gray spore containing mycelial mat and pressure pad. Photos: Monique Sakalidis*

## Extent of range

In the United States, oak wilt has been confirmed in 24 states. The [Michigan Department of Natural Resources](#) has confirmed oak wilt in 61 Michigan counties. Oaks comprise about 10% of the forest in Michigan and oak wilt has the potential to impact 149 million red oak trees across the 20 million acres of forest land that occurs in Michigan.

## **Why is oak wilt a problem?**

Oak wilt is a serious disease that can cause relatively rapid mortality of trees in the red oak group (oaks with pointed leaf margins). Trees in the white oak group (oaks with rounded leaf margins) can also be affected but the disease progresses much more slowly in white oaks than in red oaks. White oaks are somewhat more resistant than red oaks because they can compartmentalize the fungus while maintaining a functioning water transport system. Activities that wound trees, such as pruning, climbing spikes, nailing signs on trees, hanging lanterns on trees or storm damage during the warmer months of the year can result in more new tree infections. Mortality of red oaks in landscapes can lead to substantial costs for removal and high mortality in forested areas can affect entire ecosystems.

## **Michigan specific research updates**

Over the last two years, we have conducted research to identify the relatively high-risk period of overland spread of oak wilt in Michigan. Overland spread occurs when tiny picnic beetles pick up fungal spores from an infected tree then serve as vectors of the fungus by introducing the spores into a fresh wound on an otherwise healthy tree. We monitored activity of picnic beetles, pathogen spore production and host tree susceptibility from March to November. We found that red oak was susceptible to infection from late March through September. However, contaminated beetle activity (beetles carrying viable fungal spores) and production of viable fungal spores (spores that are still alive and capable of causing infection) peaked in May and June.

A portion of the 20 species of picnic beetles that were trapped in sites with active oak wilt infections carried viable fungal spores. Mycelial mats with viable spores were produced on red oaks from the end of April through mid-November, but we found no viable spores in July indicating that hot, dry weather limits mat production. We also captured three contaminated beetles in August 2019, but these accounted for less than 5% of all contaminated beetles and less than 1% of all the picnic beetles captured during the growing season. Also, the number of viable spores produced on mycelial mats is much lower from late summer through the fall than in the spring and early summer.

Results from our two-year study show that May and June represent a high-risk period for oak wilt infection resulting from insect vectors. We recommend restricting activities that are likely to cause wounds in red oaks during the April 15 to July 15 period.

Outside of this time frame, the risk of infection is lower. Few beetles are active in spring when temperatures are cool and the number and proportion of beetles bearing viable fungal spores drops after mid-July. However, in areas where many red oaks are already infected, we recommend applying wound paint or latex paint to the new wound as soon as possible. In addition, consider removing diseased trees to reduce the number of fungal spores in the area. Information about management options are described below.

## **Oak wilt symptoms**

An infected tree is often first noticed when leaves take on a bronzed or partially brown color or drop in summer (Photo 1A). Often, leaf tips and margins will be bronze or brown while the leaf base will remain green (Photo 2). Other pest, pathogen and environmental problems may cause similar symptoms; however, it is important that suspected oak wilt infected trees are verified in a laboratory. Michigan State University's [Plant & Pest Diagnostics](#) accepts samples year-round.



*Photo 2. Typical fallen leaves associated with oak wilt. Photo by Monique Sakalidis | MSU.*

## **How it kills the tree**

Once the fungus enters the tree either via a spore coming into contact with a tree wound or via interconnecting root grafts, it grows throughout the xylem vessels, which are the water conducting channels of the tree. These vessels are eventually blocked, partly by the fungus as well as by structures produced by the tree trying to respond to the fungus and block its spread. Eventually, water transport slows and stops, leading to the wilting effects.

Tree death in red oak is rapid and can occur within three to four weeks after symptoms first appear. Six to 12 months after the tree has died, the fungus will complete its life cycle by producing spores on mycelial mats (Photo 1D). These mats form under the bark and as the mats mature, specialized structures called pressure pads are produced in the center of the fungal mat. These exert pressure outward causing the bark to split (Photo 1B).

The mycelial mats have a distinctive odor that makes them attractive to more than 20 species of picnic beetles (Photo 1C). Picnic beetles are small enough to crawl through the split bark to reach the mycelial mats. Beetles will feed on the mat then fly to other mats or to fresh wounds on live trees. If beetles are carrying viable fungal spores when they feed on a fresh wound, the fungus enters the tree and starts the infection process.

## How it is spread

Spread of the disease can be rapid and result from multiple causes.

- **Belowground by root-to-root transmission.** Local spread of oak wilt occurs when the fungus travels through root grafts, i.e., the interconnected roots of infected and healthy trees. This can account for up to 90% of newly infected trees each year. This type of spread results in outwardly expanding pockets of dead trees (infection epicenters) in landscapes or in forests (up to 39 feet per year). Breaking and disrupting these root grafts via trenching or vibratory plows can limit oak wilt spread, but is not always practical, especially in urban or residential areas.
- **Overland by insect transmission.** Picnic beetles (small beetles in the family Nitidulidae) are attracted to mycelial mats produced on trees that were killed by oak wilt. Beetles visit the mats, which have an odor similar to fermenting apple cider vinegar or bubblegum, and pick up fungal spores on their bodies. These beetles are also attracted to sap produced by fresh wounds on live oak trees. If beetles are contaminated with fungal spores when they visit a fresh wound to feed on sap, the fungus is introduced into the tree, which becomes infected. Overland (long range) transmission by insect vectors can result in new infection centers. Removing the entire infected tree (including the stump) in late fall or winter when underground spread is reduced and limiting activities that result in tree wounding when beetles are active are essential to reduce the risk of overland infection.
- **Overland by firewood.** Since mycelial mats develop on dead oak trees, they can also form on firewood or logs from infected oaks. Sporadic long-distance infections can result when people transport firewood from an infected tree to a new area. Options to minimize the risk of moving oak wilt in firewood are summarized below.

## Management options

Because red oaks have no natural resistance to this disease, management goals focus on preventing spread of the fungus to healthy trees and reducing the fungal presence and spore production in areas where trees are already infected. Tactics include reducing activities that could wound trees, disrupting root grafts that form between healthy and infected trees and removing trees that have confirmed oak wilt infections.

Once oak wilt is confirmed at a site either by the presence of mycelial mats or following evaluation of samples by trained pathologists, a management strategy can be developed. Action is usually taken in late fall or during the winter when the ground is frozen to avoid compacting soil or injuring roots. Risk of overland spread by picnic beetles is minimal during winter when temperatures are cold. Risk of the oak wilt fungus moving through root grafts is also lower in winter than during the growing season.

Management options will vary depending on site-specific factors including accessibility and the number of affected trees. Strategies that are appropriate for a forested site may not be practical in a residential or landscape setting. In most situations, activities will focus on first disrupting root grafts to prevent infection from spreading to healthy trees and then removing and destroying branches, trunks and stumps of infected trees.

A great resource for specific management options can be found on the Minnesota Department of Natural Resources [Oak Wilt Management](#) web page or their downloadable [flyer](#), and from [Michigan State University Extension's Oak Wilt in Michigan's Forest Resource](#).

## What you can do to help prevent the spread of oak wilt

- **Do not prune oak trees during the high-risk period from April 15 to July 15. This will help prevent overland spread.** If possible, limit other activities that could cause wounds during the warm months of the year.
- **If wounds do occur during the summer (e.g., from storms), paint the wounds with tree wound paint or latex-based paint as soon as possible.** Beetles have been known to find their way onto wounds within ten minutes of pruning.
- **Do not move firewood from trees killed by oak wilt.** If you cut a dead oak for firewood, stack the wood then cover the pile a plastic sheet (minimum 4 millimeter thickness) and bury the edges of the plastic underground. Leave the plastic over the woodpile for six to 12 months until the wood is dry and the bark sloughs off. At that point, the fungus can no longer survive in the wood.
- **Report suspect trees** to the [Department of Natural Resources Forest Health Division](#) by emailing [DNR-FRD-Forest-Health@michigan.gov](mailto:DNR-FRD-Forest-Health@michigan.gov), calling 517-284-5895 or through their [online reporting tool](#) by selecting the “View and Report Oak Wilt Locations” bar.
- **Get a lab verification of oak wilt via [MSU Plant & Pest Diagnostics](#).** Unless a mycelial mat is observed on a dead tree, the presence of oak wilt must be verified by plant pathologists before any management actions begin. See [MSU \(Michigan State University\) Plant & Pest Diagnostics' specific sampling instructions](#).

# Additional resources

- [How to Identify, Prevent and Control Oak Wilt, USDA \(United States Department of Agriculture\) and U.S. Forest Service](#)
- [Battling oak wilt disease](#), Michigan Department of Natural Resources
- [Smart Gardening to prevent oak wilt](#), MSU Extension

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