

When White Pines Turn Brown...

Common Problems of White Pines in Kentucky

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INTRODUCTION

Eastern white pine (*Pinus strobus*) is a popular conifer in many Kentucky landscapes, although its use may be limited to loose, well-drained, pathogen-free soil. Often, needle browning is the primary symptom that alerts homeowners and nursery growers of health problems. In Kentucky, brown needles on white pine are often caused by one of the following three conditions: white pine decline, white pine root decline (Procerum root rot), or *Phytophthora* root rot. The following descriptions and comparison table (Table 1) may be helpful in determining reasons for tree failure.

WHITE PINE DECLINE

Symptoms and Cause

White pine decline is a slow plant death caused by a complex of abiotic (environmental and site-related) factors. The decline is not caused by fungi or other infectious microorganisms. Trees may appear healthy for a decade or more but then start to turn lighter green or slightly yellow compared to healthy trees. Annual shoot growth is reduced and bark of individual branches appears shriveled (Figure 1). Needles are shorter than normal, needle tips turn brown, and the overall tree canopy becomes sparse. Tree browning and death follow.

Several factors related to growing conditions are involved in white pine decline. Declining trees tend



FIGURE 1. WHITE PINE DECLINE SYMPTOMS INCLUDE SHRIVELING BARK (ARROW) AND BROWN NEEDLES.

to be in sites with several or all of the following characteristics:

- High soil pH.
- Soil with high clay content.
- Compacted soil.
- Limited space for root growth.
- History of mechanical disturbances that injured roots.

Although white pines in the same landscape might be expected to respond similarly to adverse soil/site conditions, it is not uncommon for some trees to decline while nearby trees remain healthy.

Management

The best way to manage white pine decline is through prevention. Once trees begin to decline, stopping or reversing the problem is usually not possible. For more information on the following practices, refer to the publications and video, listed in Additional Resources.

Before planting

Good sites for white pine have the following characteristics:

- Sandy or loamy (rather than clay) soils.
- Loose soils (non-compacted).
- Sufficient space for root development of the mature tree. White pines can reach a height of 50 to 80 feet with a 20- to 40-foot spread.
- Site that lessens risk of root injuries (e.g. digging, construction).
- Soil pH between 5.5 and 6.5. Amending the soil (e.g., with granular sulfur) to reduce pH is rarely effective or sustainable over the life of a tree.

After planting

Proper maintenance of white pines after planting includes the following:

- Maintain adequate soil moisture.
- Manage insect pests.
- Fertilize trees as needed.
- Maintain mulch at least to the dripline, especially for young trees.
- Allow fallen needles to accumulate under the tree, which can provide many of the benefits of mulch, as well as lowering soil pH over time.

WHITE PINE ROOT DECLINE

Symptoms and Cause

White pine root decline has a similar name to white pine decline (above); however, the two conditions are different. White pine root decline, also called Procerum root disease, is an infectious disease caused by a fungus (*Leptographium procerum*) that attacks tree roots. It has been reported in Christmas tree plantations and landscapes in Kentucky. Other types of pine (e.g., Scots and Austrian pines) may be affected by the disease, but it is most common and most serious on white pine.



FIGURE 2. ADVANCED ROOT DECAY CAUSED BY WHITE PINE ROOT DECLINE LEADS TO BROWNING OF NEEDLES AND NEEDLE DROP.

FIGURE 3. CANKERS CAUSED BY WHITE PINE ROOT DECLINE BEGIN AT THE TREE BASE, PROGRESS UPWARD, AND USUALLY “OOZE” A STICKY RESIN.



Both young and established trees (from 3 to 15 years old) may be affected by white pine root decline. Trees may be infected for several years before symptoms develop. Early symptoms include delayed bud break and reduced candle elongation in spring; however, these subtle symptoms are often overlooked. As root rot progresses, mature foliage begins to fade, droop, and turn brown in stark contrast to healthy trees nearby (Figure 2). Once needle browning is clearly visible, needle browning advances and tree death occurs quickly. Resin is visible on bark at the tree base where a flattened canker develops. Wood beneath bark becomes discolored (Figure 3).

The causal fungus penetrates inner bark and sapwood of roots and lower trunk of white pine. Fungal spores may build up in soil around infected roots and spread from tree to tree via soil water or runoff. Thus, trees planted in wet sites may seem to be more susceptible to white pine root decline. However, disease can also occur in moderately dry or well-drained soil. The white pine root decline fungus survives in dead/declining trees or stumps, as well as in soil.

Bark-infesting insects and other fungi such as those causing “sapstain” or “bluestain” (internal discoloration) are also commonly present in declining trees. Spread may occur as contaminated insects emerge from diseased trees and feed on healthy trees nearby.

Management

Infected trees cannot be “cured,” but cultural practices help reduce the spread of white pine root decline. Fungicides are not used to control this disease.

- Remove and destroy infected trees including stumps, if possible.
- Do not replant white pine among the stumps of recently killed trees.
- Avoid planting eastern white pine in wet sites.
- Reduce stress (see Additional Resources) and maintain vigorous healthy plants.

Growers who suspect white pine root decline in their Christmas tree planting or landscape may collect samples and submit them to their local county Extension office for confirmation. Collect sections of discolored wood from the basal canker (bark removed), and follow directions as suggested by the local county Extension office.

PHYTOPHTHORA ROOT ROT

Symptoms and Cause

Phytophthora root rot disease is caused by several species of *Phytophthora* water molds. The pathogen infects a broad range of landscape plants, including white pine, and favors poorly drained sites. Trees infected with Phytophthora root rot have soft, brown decaying roots, while above-ground symptoms include stunted, yellow needles. Decay may also be evident in lower trunks as reddish-brown discoloration beneath the bark. Some trees may become stunted, wilt, or gradually exhibit dieback. In contrast, others (typically younger trees) may turn uniformly brown (Figure 4) and die rapidly.



FIGURE 4. ROOT LOSS FROM PHYTOPHTHORA ROOT ROT CAN CAUSE DEATH OF ENTIRE PLANTS, ESPECIALLY IN YOUNG TREES.

Motile (“swimming”) spores are released into wet soils and infect roots of nearby susceptible plants. Specialized resting spores allow *Phytophthora* water mold pathogens to survive during drought or extreme conditions and to overwinter in soil. The pathogen may persist as survival structures in soil for several months or years.

Management

Phytophthora root rot cannot be cured. Prevent disease development by following these practices:

- Plant white pine (and other susceptible plants) in well-drained sites, or improve drainage by diverting water flow, tiling, installing raised plantings, etc.
- Soil drenches with water mold-targeting fungicides are used in commercial sites (especially nursery or Christmas tree plantings) to suppress pathogen spread. These fungicides are not often used in landscapes.

Growers who suspect Phytophthora root rot in their planting may collect root samples or whole tree samples (if feasible) and submit them to their local county Extension office for confirmation.

ADDITIONAL RESOURCES

- Mulch Myths (HO-106)
<http://www2.ca.uky.edu/agc/pubs/ho/ho106/ho106.pdf>
- Planting Balled and Burlapped Trees and Shrubs in Your Landscape (HO-91)
<http://www2.ca.uky.edu/agc/pubs/ho/ho91/ho91.pdf>
- Principles of Home Landscape Fertilization (ID-72)
<http://www2.ca.uky.edu/agc/pubs/id/id72/id72.pdf>
- Transplant Shock: Disease or Cultural Problem? (PPFS-OR-W-19)
http://www2.ca.uky.edu/agcollege/plantpathology/ext_files/PPFShtml/PPFS-OR-W-19.pdf
- Tree Planting (video)
<http://video.ca.uky.edu/videos/video/471/>
- Stress & Decline in Woody Plants (ID-50)
<http://www2.ca.uky.edu/agc/pubs/id/id50/id50.pdf>
- Submitting Plant Specimens for Diagnosis (PPFS-GEN-9)
http://www2.ca.uky.edu/agcollege/plantpathology/ext_files/PPFShtml/PPFS-GEN-09.pdf

TABLE 1. QUICK REFERENCE GUIDE OF COMMON WHITE PINE PROBLEMS IN KENTUCKY.

	White Pine Decline	White Pine Root Decline (Procerum root disease)	Phytophthora Root Rot
Age of trees typically affected	Established trees; 10 to 12 years old	Young to established trees; 3 to 15 years old	Young trees; 3 to 5 years old
Soil/site	Clay soil/high soil pH (above 6)	Variable	Wet/poor drainage
Early symptoms	Yellowing, stunting, wrinkled bark on branches	Thinning canopy; resin at base of trunk	Browning, rapid wilting, dieback
Rate of symptom development	Slow progression	Rapid decline (once symptoms become visible)	Rapid decline
Treatment	Prevention through site selection	Tree removal to protect roots of nearby trees	Prevention through site selection

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