

Identification of root diseases on Christmas trees

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About root diseases

Root diseases in trees generally fall into two categories: structural root diseases and cortical (feeder) root diseases. Structural root diseases, such as *Armillaria* and *Annosus* root rots, cause decay in the large, woody roots. Cortical or feeder root diseases, like *Phytophthora* root rot, primarily damage the fine roots responsible for water and nutrient uptake and infect the cambium, leading to cankers that girdle the stem and result in tree mortality.

When diagnosing a problem, it is best to examine a tree that has recently died or still has some healthy tissue, focusing on the margin between healthy and diseased areas when possible. Trees that have been dead for a long time are much harder to diagnose because over time, the original disease organism is replaced by opportunistic organisms such as decay fungi and molds.

Symptoms of root problems

Common symptoms of root disease resemble those of drought stress and include wilting, sparse or stunted foliage, premature foliage loss, and shoot or tip dieback. These problems occur because damaged roots cannot supply the tree with enough water, leaving the entire tree under stress.

Since other stresses such as drought, poor soils, or mechanical injury can look similar to root disease, it is important to carefully observe both signs (evidence of the pathogen) and symptoms (tree response) before making a diagnosis. Accurate identification is essential because management practices vary depending on the cause, and in many cases, multiple factors may be involved.



Dead trees in a field



Recently dead (L) and off-color (R) trees



Stunted growth of new flushes and off-color foliage indicate a problem with the roots associated with reduced water and nutrient uptake.



Rapid wilting and death of tree.



Resin flow near base of tree stem.



Lower branch flagging.

Identifying root diseases

The three most common root diseases on PNW-grown Christmas trees are *Phytophthora* root rot, *Armillaria* root disease, and *Annosus* root rot.

Phytophthora root rot (PRR)

Phytophthora spp. including *P. cambivora*, *P. cinnamomi*, *P. megasperma*, *P. cryptogea*, *P. cactorum*, and others.

Phytophthora root rot occurs in areas with wet soils, so areas at the bottom of slopes, with poor drainage, or heavy soils are the highest risk. *Phytophthora* is a fungus-like organism that produces swimming spores that move in saturated soil to infect roots. The most susceptible species are noble and Fraser firs. Eurasian species such as Nordmann, Turkish, and Trojan firs have shown some resistance to PRR. This disease can occur on seedlings in nurseries, and asymptomatic infected seedlings can spread the disease to newly planted fields. More commonly *Phytophthora* is already present in the soil at planting site, or moves into a site after flooding or via irrigation with infested water.



Branch flagging with cinnamon-colored canker under bark. The infection starts in the roots and moves up the stem. Once the stem is girdled, the tree will die



Dead, reddish brown root decay associated with *Phytophthora* infections. It is easy to distinguish the decayed roots from healthy roots.

Armillaria root disease

Armillaria spp. including *A. nabsnona*, *A. solidipes* (formerly *A. ostoyae*).

Armillaria is a fungus that is commonly found in forests where it attacks a wide range of woody hosts. It is considered a weak pathogen and larger trees can tolerate infection by *Armillaria* for years, becoming aggressive and causing symptoms when the tree is under drought stress. The fungus can live on stumps and roots in the soil and infect trees planted next to cut stumps, so it is important to remove woody material after harvesting if *Armillaria* is present on the site. Some species spread by means of rhizomorphs, which are black shoestring-like structures that grow through the soil in search of a new host.

Diagnostic signs of *Armillaria* are white mycelial fans under the bark, rhizomorphs, white spongy advanced decay, black “zone lines” between decayed and healthy wood, and mushrooms at the base of the tree seen in the fall.



Spongy advanced decay with black zone lines



White mycelial fans under bark of stump



Dark, root-like rhizomorphs on decayed stump



Fall honey-colored mushrooms at base of dead tree planted next to a stump from a previous rotation.

Annosus root rot (Heterobasidion root rot)

Heterobasidion occidentale

This fungus is a native pathogen of forests and can survive in stumps and roots of dead trees. The primary mode of infection is from airborne spores on freshly cut stumps. Following colonization of the stump, that pathogen spreads to the roots of trees that come

in contact with the colonized stumps or roots. Fruiting bodies form at the base of dead trees and on dead stumps, and infected roots may be covered with mycelium, but these signs are rare on Christmas trees. Staining of the heartwood on cut surfaces when the tree is harvested is diagnostic for this fungus. Because the xylem is damaged, cut Christmas trees with extensive staining do not take up water and dry out faster when displayed.



Staining of heartwood on cut Christmas trees.	Fruiting bodies in stump or base of tree (rare)
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Other Causes of Root Disease Symptoms

Not all symptoms that look like root disease are caused by pathogens. The table below lists common causes of similar symptoms and tips to help distinguish them from true root disease.

Cause	Typical Symptoms	How to Tell Apart from Root Disease
<i>Grovesiella</i> canker (disease)	Branch flagging, dieback from the branch tip	Look for cankers or sunken, discolored areas on branches; roots appear healthy
Root-feeding insects (aphids, root weevils, June beetle grubs)	Wilting, stunting, poor growth, seedling mortality	Dig near the base and inspect roots for insects or feeding damage. In some cases all fine roots will be eaten and stems girdled below the soil line.
Twig weevils	Branch flagging	Look for pupae or a small exit hole at the base of the flagged branch

Cause	Typical Symptoms	How to Tell Apart from Root Disease
Animal feeding (rodents, rabbits)	Wilting, seedling death, dieback	Check for chewing marks or missing bark near the soil line
Root girdling (improper planting)	Decline that appears several years after planting	Expose the root collar; look for circling roots constricting the trunk
Drought	Wilting, yellowing, needle drop, dieback	If no other signs are visible, check soil moisture, dry soil indicates drought rather than disease. Sandy soils are prone to drought stress
Chemical damage (herbicides, fertilizers)	Burned foliage, dieback, irregular decline	Injury often follows spray/drift patterns or appears near treated areas. Fertilizer applied on one side of the tree
Mechanical damage (equipment injury)	Broken branches, trunk wounds	Look for scars, cuts, or crushed tissue at the base or lower trunk. May look like cankers without fungal signs

References

Identifying and managing Christmas tree diseases, pests and other problems

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<https://extension.oregonstate.edu/catalog/pnw-659-identifying-managing-christmas-tree-diseases-pests-other-problems>

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Pacific Northwest Pest Management Handbooks

<https://pnwhandbooks.org/>