



Extension FactSheet

Plant Pathology, 2021 Coffey Road, Columbus, OH 43210-1087

Root Problems on Plants in the Garden and Landscape

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Roots of plants may decline and die from a variety of causes. Unfavorable environments that result in either waterlogged or drought conditions are common causes of poor root health on landscape plants. There are also fungi in the soils that have the ability to infect roots and cause root rot. If major roots or the crown are affected by root rots or other problems, the entire plant can wilt and die rapidly. If only the small “feeder” rootlets are affected, the plant may decline slowly and appear generally sickly and unproductive. Sick or damaged roots may be present only on part of a plant’s root system, resulting in a one-sided appearance of symptoms on leaves and stems.

Diagnosis

The first symptom of poor root health is usually dull foliage color (Figure 1). Sometimes leaves turn yellow and wilt. These changes may occur quickly or may take months to develop. Woody perennials such as trees or shrubs may live in a state of reduced vigor and decline for years.



Figure 1. Taxus showing above ground symptoms of Phytophthora root rot. Note the off-colored foliage and lack of vigor.

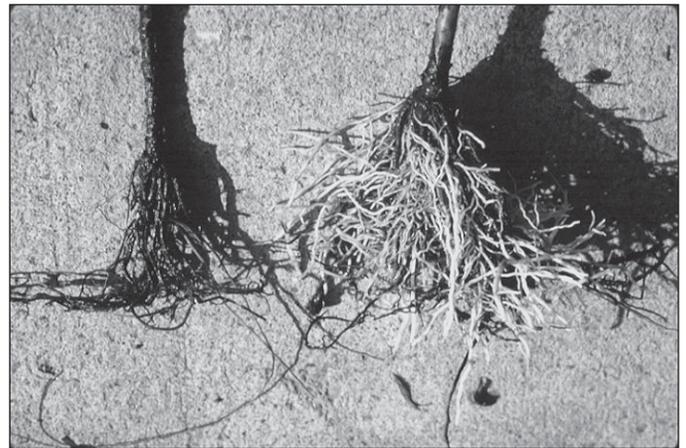


Figure 2. Healthy (white) roots on Taxus next to black dead roots killed by Phytophthora root rot.

Examine plant roots directly to further verify the presence of root problems. Examination should be made soon after the plant is showing symptoms or just after it is killed, not after it has been dead for some time.

On healthy root systems white feeder rootlets are visible (Figure 2). With many root disorders, these tiny feeder roots are absent. Rotted roots will be brown and mushy. Outer root tissue can be easily pulled or slid off the inner root core with your fingers (Figure 3). The core will remain, looking like a tiny piece of white or brown thread.

Many of the root rot fungi, in addition to attacking small roots, also invade older roots and stem tissue. On soft-stemmed plants, the symptoms are visible on the surface of the stem, extending various distances up the stem from the soil line. The region from the soil line to the junction of the primary roots (the crown area) can be examined on woody plants by peeling back the bark. Infections may be spotty or may cover the entire crown. Infections may first appear as brown streaks in the wood under the bark. Later, cankers may form and become well defined. Infected



Figure 3. Outer root tissues have been rubbed off this rotted *Taxus* root leaving the central core.

wood is often brick red or brown and there is a sharp line of demarcation between healthy and infected tissue (Figure 4).

Prevention

Root disorders and problems generally arise when plants are growing under unfavorable conditions (Figure 5). Management strategies, therefore, involve cultural changes aimed at increasing plant vigor. These include improving soil drainage and use of proper planting techniques. It is especially important to consider these management strategies in situations where plants have died and you intend to replace them in the same location.

Soil Drainage Improvement

Most root disorders can be prevented by providing good soil drainage. Most plants are attacked by pathogenic root rotting fungi when the base of the plant and roots are waterlogged for many hours (Figure 6). This is particularly true during the late spring and summer months, when the disease-causing organisms are most active.

Surface drainage problems can be easily prevented with planning. Soil surfaces should always slope away from build-



Figure 4. Older *Taxus* root showing a canker caused by *Phytophthora* root rot. Note brick red color of affected area and the sharp line of demarcation between healthy and infected tissue.

ings. Low areas sometimes cause problems because they cannot easily be graded to provide for adequate surface drainage. In such cases, drainage channels or underground drains may need to be constructed.

Good internal drainage, which is the movement of water through the soil, will influence the effective rooting depth and resulting plant vigor. Many landscapes remain internally saturated because of underlying clay and rock layers. Sandy soils are generally well drained, but can be subject to dryness. Frequent light watering may be required because of their low water-holding capacities.

Internal drainage should be good on deep soils with sloping surfaces. Layers that restrict downward water movement, however, may cause poor internal drainage, even on slopes. This generally appears as a down-slope damp or soggy condition showing at the ground surface. Obviously, rooting conditions and plant vigor are adversely affected in such areas. Additionally, a slope may have good surface and internal drainage but often the base of the slope will remain wet for a long time. Placing a drain across the slope near its base or just above a damp spot on a slope will collect water from above and improve drainage.

Shallow underground water or high water tables are sometimes found in urban soil. If this standing water is below rooting depth, there is no problem. If it is shallow, underground drains may be installed to remove excess water. Expert advice should be obtained before these drains are installed.

Compacted layers of dense clay subsoil, or solid rock often cause internal drainage problems. A saturated soil area or perched water table will develop above the compacted layer or other barrier to water percolation. This zone is favorable for damaging root rot organisms unless it is deeper than the root system. If the soil below the compacted layer is found to be noncompacted, then the condition might be improved. This is done by removing the compacted layer through shoveling or back-hoeing and returning the soil to the hole. Drainage holes can sometimes be drilled through compacted layers to relieve or remove the perched water table.

Planting holes with drains can be built in rock or compacted soil to provide a desirable site for a particular tree or shrub. These



Figure 5. *Taxus* planted at base of drain pipe. Conditions such as this result in excessive soil moisture during rainy periods.



Figure 6. Standing water at the base of a *Taxus* plant.
Note that the plant is dead.

measures are usually special cases. For good plant growth on such sites, they are necessary.

Planting to Avoid Root Rot

The planting hole should be at least twice the width of the root ball if potted plants are being used. The hole should be large enough to accommodate the roots without crowding. The sides of the hole should be rough and jagged. Check drainage conditions by filling the hole with water. If water drains in 24 to 28 hours it can be assumed that there is enough drainage. If water stands in the hole, corrective measures should be taken (see above), or only plants tolerant of poorly drained sites should be used.

Mix the removed soil to break up compacted layers and return some to the hole just prior to placement of the plant. Break some

of the roots on the root ball surface of potted plants to encourage root growth into the surrounding soil. Make sure to straighten out any twisted roots to avoid girdling later on.

Place the plants so that they will be slightly higher after settling than they were in the container or nursery field. Never set the plant deeper than originally grown. Bring surrounding soil up to the old soil level. On poorly drained sites, it may be necessary to plant in raised beds. These beds may be bordered by rocks, old railroad ties, or other structural materials specially treated and designed for landscape use. Mulch the soil surface lightly to reduce the likelihood of heat and moisture stress.

Treating Root Problems

What can be done to save a plant that is already damaged? Certain fungicides are somewhat effective against root and crown rotting fungi in nursery or greenhouse production programs. Insufficient tests have been conducted to prove that they are effective in the landscape. Improving drainage, as mentioned above, can save some plants. Here are some other treatments which may help:

1. Avoid overwatering. A number of plants used in landscaping require little watering once they are established. Always allow the soil around plants to dry out a few inches below the surface before watering again.
2. Do not water the base of trees and shrubs directly. Water away from the trunks.
3. Improve moisture conditions around the crown of the plant by exposing the base of the plant to drying conditions. Remove some of the soil or the mulch. However, do not expose roots.
4. Do not fertilize plants during hot, dry weather periods.
5. Vertically mulch or core aerate to improve landscape soils. Vertical mulching will hasten drainage of excessive water, preserve necessary aeration during wet periods, improve water infiltration during dry periods, and promote the formation of fine feeder roots. Drill one-inch or two-inch wide, 18-inch deep holes in the soil on 12 to 20-inch centers under affected trees near the drip line of the branches (where fine feeder roots are located). Fill holes with a mixture of equal parts of peat and a coarse aggregate such as pumice or calcined (baked) clay particles.
6. Thoroughly water plants that will hold green leaves or needles through the winter in late fall if conditions are dry. Evergreen plants continue to need water throughout the year.
7. Fungicide drenches are generally not prescribed for root rot control of landscape plants. The reasons for this are that the cultural practices listed above will naturally control most of the associated infectious disease problems. Furthermore, fungicides are difficult to apply to the roots of mature plants and will not cure already infected roots.

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