

Are you sure you know what is killing your seedlings? Identifying causes of seedling mortality

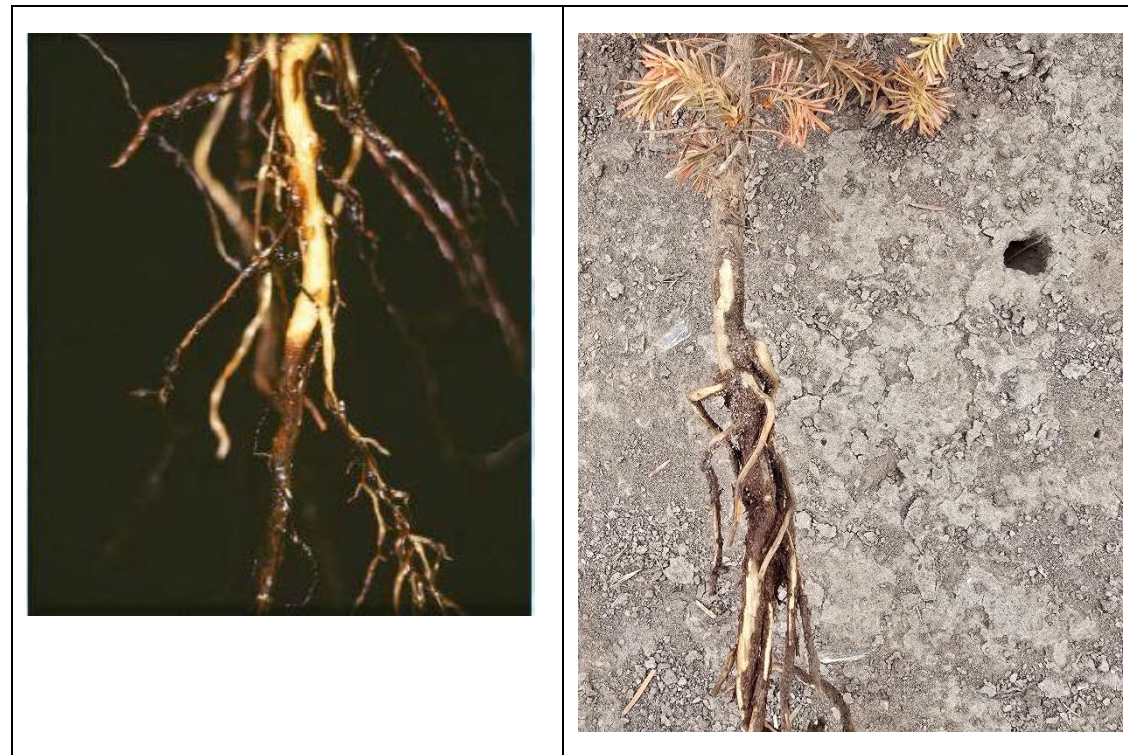
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Establishing or replanting a Christmas tree site can be challenging and costly. There are a number of biotic and abiotic factors which contribute to seedling losses. Climate related issues, such as periods of drought or late frosts generally cannot be prevented, but steps can be taken to mitigate their impact. Others are controllable with proper planning and oversight, such as planting technique and disease and pest management. Understanding the causes of seedling mortality is essential to develop strategies to minimize losses.

Diseases and Pests

***Phytophthora* root rot:** Caused by a water mold (*Phytophthora* spp.) found in poorly drained soils that attacks fine roots, moving into the stem. Symptoms are more severe at the bottom of a slope or areas that have standing water.

Root-feeding beetle grubs: Root weevils (in nursery production) and June beetle (in loose, sandy soils) feed on the roots and girdle stems below the soil line.



Blackened, necrotic fine roots on seedling with *Phytophthora* root rot (L), and seedling with fine roots chewed and larger roots girdled by tenlined June beetle. The exit hole for the adult beetle is to the right of the seedling (R).

Environmental and Climate Stressors

Drought and heat stress: Extended dry periods and record-high temperatures dry out root systems before young trees establish, especially on non-irrigated sites.

Flooding: Extended periods of winter or spring flooding will suffocate young seedlings due to lack of oxygen to the roots, as well as creating conditions for *Phytophthora* root rot.

Extreme cold and frost: Extreme cold can cause winter burn and unseasonable late frosts can damage newly emerging foliage.

Cultural and Planting Practices

Improper planting: Shallow planting holes and J-roots (deformed roots) cause stress on seedlings. Beetle grubs can feed and girdle lower stems on seedlings that are planted too deep.

Nursery storage and seedling handling: Prolonged or improper cold storage and handling of seedlings before planting in the field can weaken overall plant vigor and increases the potential risk of seedling desiccation during the growing season.

Planting date: Late-spring plantings can limit the amount of root growth that occurs prior to the emergence of new shoot growth, which increases the levels of potential for drought stress.

Root-to-shoot ratio: While growers often want to plant large seedlings, numerous studies have shown that seedlings with a large root biomass related to their shoot biomass are much more tolerant of soil moisture stress.

Weed competition: In the PNW, where summers are dry, heavy herbaceous ground cover which occupies the root zone can increase the depletion of essential soil moisture during dry periods. This is less of an issue in the eastern US where summer rainfall commonly occurs.