



THE
AMERICAN
CHESTNUT
FOUNDATION®

TACF Fact Sheet

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Dealing with *Phytophthora* *Tips to Survive the “Stealth” Killer* *

What is *Phytophthora*?

Phytophthora cinnamomi, also known as Ink Disease or *Phytophthora* root rot (PRR), is a virulent pathogen of American chestnut. *Phytophthora* species are from a class of microorganisms known as Oomycetes (related to water molds and brown algae). There are currently more than 80 described species of *Phytophthora*, with an estimated 200 to 600 species worldwide - the vast majority of which are plant pathogens. PRR was accidentally introduced to the United States in the early 1800s. There is substantial emphasis on breeding American chestnut for resistance to PRR that involves the same backcross breeding program as the current blight resistance breeding program, crossing American and Asian species of *Castanea* and screening for demonstrated resistance.



Seedling dying of *Phytophthora cinnamomi*

For more information on *Phytophthoras*, including background, educational material, management strategies and references visit the website *Forest Phytophthoras of the World* at: <http://www.forestphytophthoras.org/species/cinnamomi>

Where is PRR?

PRR is most common in the south, at low elevation sites, in soils with high clay content, and more often in old cultivated fields, nurseries and old Christmas tree farms. However, PRR can be found just about anywhere... southern states, Mid-Atlantic States, low elevation, high elevation, clay soils, coarse soils, forests, etc.

Identify the Problem

Phytophthora root rot symptoms on American chestnut seedlings often include: Chlorosis (yellowing) and wilting of foliage, dead and decayed roots and necrotic lesions advancing up from the root crown area on the lower stem as seen in the photos. Note that unlike blight-induced mortality, if a seedling dies from PRR, they will NOT resprout – they are completely dead.

Management of *P. cinnamomi*

In order to avoid problems associated with PRR – especially if you live in the south – remember to **plant seedlings in well-drained soil**. Dry, sandy or gravelly soils are best and loamy soils are good. Avoid clay soils or those that retain water.



Phytophthora cinnamomi lesion coming up from roots into stem

Tips to Survive the Stealth Killer

If your seedlings are beginning to show signs of PRR infection some of the following options have been recommended.

- **Mulching and proper irrigation** can be important first steps. The *Phytophthora* cell wall is made of cellulose. The microorganisms that break down mulch also break down the cell walls of PRR, so mulching around your tree also offers some protection against low-levels of PRR. Additionally, *Phytophthora* species do well in wet, poorly drained soils – water wisely!
- **Phosphite-based chemicals** (or phosphonates, including potassium phosphite, phosphorous acid, fosetyl-Al, etc.) such as **Agri-Fos, Allude, Aliette, Subdue Maxx, and Ridomil** are some effective choices that can be used as foliar sprays, bark penetrants or soil drenches. (Note: TACF does not endorse specific products; this list merely highlights products commonly used by some of our cooperators).
 - **Foliar sprays** can be used on young seedlings, but should be applied after the leaves have matured (+/- 6 weeks of mid-June, depending on region), but not hardened off (late July to mid-August). Use a surfactant, drench leaves, and reapply at 6 to 8 weeks.
 - **Bark penetrants** can be applied to young trees (smooth bark) any time after tree has fully leafed-out, use a surfactant, drench bark, and reapply every 6 – 8 weeks.
 - **Soil drenches** can be used with trees of any age and don't require surfactants. Soil drenches can be applied once in the spring and once in the fall...it shouldn't take a lot to do the job.
- **Petrabark** is a surfactant that should be used when treating with a foliar spray or bark penetrant

Difference between Phosphites and Phosphates:

Phosphites (and related compounds: phosphonate, phosphorous acid, potassium phosphite, phosphorous acid, fosetyl-Al) are products that have fungicidal properties, but do not make good fertilizers.

Phosphates (including ammonium phosphate, potassium phosphate, and calcium phosphate) are fertilizers with no fungicidal properties.



Chestnuts dominated high-elevation Appalachian mountains where incidence of Ink Disease is low or non-existent

Is TACF developing trees with resistance to *Phytophthora*?

Yes! There is a significant effort to breed chestnut that are resistant to both pathogens. This includes advanced Meadowview sources of resistance, as well as new regional sources of resistance. Select progeny are pre-screened for PRR resistance before being transferred to backcross orchards. Once selected for PRR resistance, seedlings are eventually screened for blight resistance, as per the standard breeding strategy.

However, it should also be noted that PRR may not be as big of a problem for chestnut restoration as believed. PRR is primarily a problem in low elevation southern sites, in predominantly clayey soils. American chestnut was a dominant canopy tree in high elevation Appalachian sites; these site characteristics are significantly different! Though, it may be true that American chestnut had been found in parts of the low elevation south, it was sporadic not dominant. Likewise, PRR can be found in high-elevation sites with coarse soils, but that is also rare. The overlap between the two species' ranges is probably very small, but the problem is not insignificant, and efforts to create resistance to both pathogens will continue until American chestnut is safely restored to the eastern US forests.

* From Dr. Joe James' 2012 poster *Phytophthora Cinnamomi: The "Stealth" Killer*