The fungus *Phymatotrichopsis omnivora* causes the most severe root rot disease of crops and landscape plants in the southwestern United States. This soilborne pathogen infects over 2000 plant species. Its common names are cotton root rot (CRR), Ozonium root rot, or Texas root rot. The broad host range includes most dicotyledonous, tap-rooted plants. Permanent crops such as fruit trees, grapes, landscape trees and shrubs, and semipermanent forages such as alfalfa and similar crops experience significant losses.

First described on cotton in 1888, this alarmingly destructive disease threatened the cotton industry in Texas (Fig. 1) and became a research focus of scientists with the Texas Agricultural Experiment Station (now Texas A&M AgriLife Research). Controlling CRR became a formidable goal due to the persistent survival of the pathogen in the Blackland prairie soils of Central Texas. As the Texas winegrape industry expands, CRR has become a limiting factor to establishing successful vineyards in some parts of the state (Fig. 2).

**Biology of the Disease**

CRR is a problem in alkaline, calcareous (minimal organic matter and more than 1 percent calcium carbonate) soils because high soil pH in the range of 7.2 to 8.0 favors the growth and development of *P. omnivora* and its ability to infect plants. The pathogen grows in soil by using a network of microscopic threads called mycelia. These mycelia produce strands that grow short distances through the soil and along roots (Fig. 3). As the fungus grows, it produces tiny, black structures called sclerotia that can survive for decades at great depths (more than 10 feet) in the soil to initiate new infections.

*All of the Texas A&M University System*
CRR Symptoms in Winegrapes

The most common symptom of CRR in grapes is sudden wilt and decline of the infected vine (Fig. 4). All of the leaves on the vine become yellow and then suddenly turn brown and die (Fig. 5). The symptoms become most obvious during the mid-to-late summer months, or when soil temperatures exceed 82°F. Vines often die in groups as the fungus advances underground to adjacent vines of the same species or species with similar susceptibility. Dead plant clusters appear down a row or hedge, or in irregular oval or circular bunches (Fig. 6). Removing dead bark with a pocket knife reveals taproot, crown, and lower stem tissues that are dark brown and decayed.

Managing CRR

Understanding the history of a potential vineyard site can reduce the risk of planting grapevines in infested soils, especially fields previously planted to cotton. Such fields have the potential for high populations of *P. omnivora* in the soil.

A variety of approaches for controlling CRR in cotton and landscape plants have had varying degrees of success:

- Until recently, none of the chemicals applied to eradicate the pathogen from infested soils were effective. But, research studies for controlling CRR in cotton proved that the fungicide flutriafol reduces crop losses. Testing flutriafol on winegrapes produced similar results, providing evidence to make this tool available for use in Texas vineyards.
- Many attempts have been directed at using biological control to manipulate the microbes in the soil to suppress the growth of *P. omnivora* and reduce infection levels.
Disease-Tolerant Rootstocks

As early as 1924, field trials with native Texas grapes and American hybrids demonstrated they were tolerant to CRR. Varieties included Champanel, Black Spanish, Mustang, and St. George. Consistent results, repeated over the years in statewide trials, added Dogridge, La Pryor, V. solonis, V. monticola (mountain grape) and V. berlandieri (Fall Grape) to the list of CRR-tolerant varieties. One cross between V. berlandieri and V. rupestris, 1103 Paulson, is suitable for a wide range of soil conditions and commonly recommended in Texas for its vigor and tolerances to drought and CRR. Research on rootstock tolerance to CRR shows survival results from roots having a high capacity for regeneration rather than from controlling P. omnivora growth in infected vines. The ability to resprout roots in spite of the loss of tissue to infection allows the scion to continue to thrive and bear fruit. Growers have many commercially available choices to match rootstocks to the site, growing conditions, and grape variety.

Cultural and Biological Control

Cultural controls such as deep plowing, high nitrogen fertilization, and various mulching protocols have met with variable results for CRR control in cotton as well as landscape plants. Successes from these practices may be the result of altering the soil microbiome so that “healthy” microorganisms (mostly fungi and bacteria) outcompete P. omnivora. Also, the altered soil environment is sometimes unsuitable for the pathogen. For example, using acidifying fertilizers to decrease the soil pH to below 6.5 would presumably be a viable control for CRR. But, because the calcareous clay soils of Central Texas are highly buffered, pH change will be limited and temporary. Similar recommendations include avoiding saturated soils with drainage issues and planting resistant ground covers within the vineyard.

Soil amendments for managing CRR include compost teas, manures, mulches, and formulations of “beneficial” microbes. There is a wide array of these products as well as instructions for how to make specific blends on site. However, due to the lack of any systematic, long-term, controlled research results, there are no specific recommendations for selecting and applying these products to control CRR—only anecdotal testimonials. Cultural and biological controls of persistent plant pathogens like P. omnivora are often temporary and inconsistent.

- Host resistance is the ultimate goal for controlling recalcitrant pathogens such as P. omnivora. In this regard, CRR-tolerant rootstocks are available for grape production in Texas.

The following examples discuss each of these approaches for controlling CRR in winegrapes:

Direct Control with Flutriafol

Flutriafol is the generic name for the active ingredient known by the trade name TopGuard Terra. The registration for its use in Texas is under a FIFRA 24c Special Local Needs label that could soon become permanent. When applying TopGuard Terra on winegrapes, obtain the proper label and keep it on site for recordkeeping and to comply with Texas Department of Agriculture pesticide regulations (see Additional Resources below).

Detailed label instructions explain how to apply TopGuard Terra through properly configured drip (trickle) chemigation systems. There are options for a one-time application in early spring (no later than May), or a split application in the spring with a second, postharvest application in late summer (not to exceed the annual rate of 15.3 oz. (0.5 lbs. ai/A)). Application method, timing, and rates are crucial because misuse can cause failure to control the disease as well as create phytotoxicity issues on the grapevines (Fig. 7).

Fig. 7. Phytotoxicity on vine caused by misapplication of TopGuard Terra. Source: Sheila McBride
**Summary**

Although the long history of research on cotton root rot in Texas has developed many approaches for dealing with the disease, the fungicide flutriafol is the only proven direct-control method. Even so, no control measure, including flutriafol, permanently eradicates the pathogen from infested soils.

**Additional Resources**

Download the label for TopGuard Terra from the following websites:

- https://plantclinic.tamu.edu/2016/01/21/new-treatment-crr/
- Texas Plant Disease Diagnostic Laboratory blog, Texas A&M AgriLife Extension Service
- Website of the FMC Corporation
- Newsletter of the Texas A&M AgriLife Extension Service Viticulture and Enology Program

---

**Texas A&M AgriLife Extension Service**

AgriLifeExtension.tamu.edu

More Extension publications can be found at AgriLifeBookstore.org

Texas A&M AgriLife Extension provides equal opportunities in its programs and employment to all persons, regardless of race, color, sex, religion, national origin, disability, age, genetic information, veteran status, sexual orientation, or gender identity.

The Texas A&M University System, U.S. Department of Agriculture, and the County Commissioners Courts of Texas Cooperating.