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Phytophthora Crown Rot of Strawberry[1]

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Introduction

Phytophthora crown rot, caused mainly by *Phytophthora cactorum*, is an important disease in Florida strawberry fields. On average, about 30% of the strawberry crown rot samples received in the Plant Diagnostic Clinic located at the UF/IFAS Gulf Coast Research and Education Center (GCREC) are diagnosed with Phytophthora crown rot. Although *P. cactorum* is the most common species isolated from symptomatic plants, *P. nicotianae* has also been identified as causing crown rot. These *Phytophthora* species also infect fruit under certain conditions and cause a fruit rot commonly called leather rot.

Causal Agent and Symptoms

Phytophthora species are filamentous "fungi-like" organisms classified as oomycetes, which are more closely related to brown algae than fungi. These organisms can produce asexual zoospores with flagella that allow them to move through water. The disease is characterized by a sudden wilting and collapse of plants in fruit production fields (Figure 1A). When cut open, the internal crown of wilting plants shows brown-to-orange necrotic areas (Figure 1B). The wilt and crown rot symptoms caused by *Phytophthora* species are difficult to distinguish from those caused by other crown rot pathogens found in Florida, such *Colletotrichum gloeosporioides* and *Macrophomina phaseolina*. Since recommendations for disease management drastically differ according to each crown rot pathogen, samples should be submitted to a diagnostic clinic for pathogen isolation and identification of the pathogen.



Figure 1. Strawberry plant wilting (A), and crown rot symptoms (B) caused by *Phytophthora* species.
Credit: UF/IFAS GCREC Strawberry Pathology

Disease Development and Spread

In some pathosystems and locations, *Phytophthora* species can produce survival structures such as oospores, which can persist for years in the soil and plant debris. In Florida, based on surveys of infested fields, *P. cactorum* and *P. nicotianae* do not seem to survive in the soil over the summer (off-season). Thus, the primary source of inoculum for epidemics in Florida is likely quiescent-infected transplants from nurseries. Disease development is triggered under wet conditions. Hence, disease outbreaks commonly occur early in the season (October and November) when overhead irrigation, warm temperatures, and rapid juvenile growth favor the disease. The disease can also occur during the peaks of fruit production, particularly after high rainfall.

Control

Management of Phytophthora crown rot involves a combination of cultural and chemical control methods.

Cultural

In Florida, the combination of hot, wet summers and fall fumigation appears to be sufficient to prevent over-summer survival of inoculum. Thus, the best control of Phytophthora crown rot is to use disease-free transplants, if available.

Phytophthora crown rot incidence is usually lower in sites with improved soil drainage, which is more permeable to water.

Studies performed at UF/IFAS GCREC have shown that nursery transplants exposed to aerated steam in a closed chamber (i.e., a *plant sauna*) at 37°C (98.6°F) for 1 hour followed by 44°C (111.2°F) for 4 hours were much less likely to die from Phytophthora crown rot (Figure 2). Therefore, thermotherapy of transplants could be a good alternative for nurseries to manage *Phytophthora* populations in plant stock.



Figure 2. 'Florida 127' Sensation™ plants inoculated with a mixture of mefenoxam sensitive and resistant isolates of *P. cactorum* and planted after steam-treatment at 37°C (98.6°F) for 1 hour followed by 44°C (111.2°F) for 4 hours (A), or not steam-treated (B).
Credit: UF/IFAS GCREC Strawberry Pathology

Cultivars differ significantly in their susceptibility to this disease. The old cultivar 'Strawberry Festival' was quite tolerant. Among currently grown cultivars, 'FL 127' Sensation™ is susceptible, whereas 'Florida Brilliance', 'Florida Medallion', 'Florida Ember', 'Florida Encore', and the Pearl cultivars are more tolerant but not resistant.

Chemical

In fruit production fields, the disease can be controlled by applications of metalaxyl or mefenoxam (i.e., Ridomil Gold®), oxathiapiprolin + mefenoxam (Orondis Gold®), or by potassium phosphite products such as Prophyt®, K-Phite®, and Fosphite®.

To prevent epidemics in fruiting fields where resistance is not present, mefenoxam and related products containing mefenoxam should be applied through the drip irrigation system immediately after plant establishment. A second application between 45 and 60 days after transplanting, usually at fruit set, has been shown to suppress disease development in studies conducted at the UF/IFAS GCREC.

Resistance to mefenoxam has emerged, but it is still at low frequency and often linked to only a few nursery sources. To confirm resistance to mefenoxam, infected plant samples should be submitted to our diagnostic clinic for testing.

Orondis Gold® has been recently registered and is a good alternative as a first application in case mefenoxam-resistant strains are introduced with the transplants. The PHI (pre-harvest interval) of 14 days after soil applications limits its use early in the season.

Fosetyl-aluminum and the phosphite products are considered low-risk for developing fungicide resistance and should serve as a useful tool for integrated management of Phytophthora crown rot caused by *P. cactorum*. However, they are less effective against *P. nicotianae*, reinforcing the need for correct diagnosis. Phosphite products can be applied by foliar spray or drip injection at 2- to 3-week intervals starting after overhead irrigation for plant establishment. These products should not be tank-mixed with copper fungicides, adjuvants, or foliar fertilizers as the combination may burn the leaves.

References

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Table 1. Products recommended for management of Phytophthora crown rot in Florida.

Product Name (Active Ingredient)	Fungicide Group[a]	Maximum Rate Per Acre Per		Min. Days to		Remarks
		Application	Season	Harvest	Reentry	
Metalaxyl 2E AG, MetaStar 2E AG (Metalaxyl)	4	2 qt	6 qt	0	2	See label for use in drip irrigation
Ridomil Gold EC, Ridomil Gold SL, Ultra Flourish (mefenoxam)	4	1 pt	1 1/2 qt	0	2	See label for use in drip irrigation
Orondis Gold (oxathiapiprolin + mefenoxam)	49	62 fl oz	124 fl oz	28	2	Not for use in nursery production
Alude, Confine Extra, Fosphite, Fungi-Phite, K-Phite, Phorcephite, Phostrol, Rampart, TKO (many products)	33	SEE INDIVIDUAL LABELS		0	4 hr	Do not tank-mix with copper fungicides

[a] Fungicide group (FRAC Code): Numbers (1–37) and letters (M) are used to distinguish the fungicide mode of action groups. All fungicides within the same group (with the same numbers or letter) indicate same active ingredient or similar mode of action. This information must be considered for the fungicide resistance management decisions. M = Multi-site inhibitors, fungicide resistance risk low. Source: FRAC Code List 2019; https://www.frac.info/ (FRAC = Fungicide Resistance Action Committee). n.a.: not applicable.

Reference: *Vegetable Production Handbook of Florida*. Available at https://ask.ifas.ufl.edu/publication/CV292

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