

Sanitation to limit *Fusarium* wilt spread in tomatoes

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Fusarium diseases in tomatoes are becoming more common in Central California. *Fusarium* wilt race 3 has become especially problematic since 2014, occurring in fields without a known history of these diseases. Although movement may occur at any time there is movement of soil or plant material between fields, with processing tomatoes, harvest has the greatest potential to introduce this tomato pathogen. There are three main types of *Fusarium* that attack tomatoes: *Fusarium* Wilt, *Fusarium* Crown and Root Rot, and *Fusarium* Foot Rot.



Bright yellow leaves of single shoots are typical in early onset of *Fusarium* wilt

Fusarium* wilt of tomato caused by *Fusarium oxysporum* f.sp. *lycopersici

Fusarium wilt of tomato is not new to this area, but genetic resistance to *Fusarium* wilt Race 1 and 2 in most processing and fresh market tomato varieties protected the crop from this disease for decades. However, Race 3, which had previously been documented in Florida and in Northern California, was found in 8 fields in 2014 in Fresno County and distribution within Fresno and Kings Counties has increased annually since then. In Merced County, it was found in 2008 in one field, and like Fresno, has increased annually ever since. Race 3 has two forms that are genetically distinct: a Florida strain and a California strain. Both cause the characteristic *Fusarium* wilt symptoms of vascular discoloration in stems, leaf yellowing, plant collapse and death. Symptoms are initially observed about 50 to 60 days after transplanting. The California strain may cause a canker at the soil line, however, we are still trying to determine if there are significant differences in disease development between the two strains.

Fusarium* root and crown rot caused by *Fusarium oxysporum* f.sp. *radicis-lycopersici

Another disease documented in Fresno County in 2014 with occasional detection in additional fields since is *Fusarium* root and crown rot. Symptoms include leaf yellowing, leaf death and plant collapse; but there is also a canker present on the crown. Reddish-brown vascular discoloration in the stem does not extend throughout the plant and is largely confined to the tissue near the soil line. It has been less common in Fresno County than *Fusarium* wilt, but it can be in the same field as the wilt pathogen.



Vascular discoloration associated with *Fusarium* wilt

Fusarium* foot rot caused by *Fusarium solani* f.sp. *eumartii

Fusarium foot rot has been identified sporadically in Fresno and Merced Counties. Plants have chlorosis and necrotic spotting on new growth, and symptoms can be mistaken for a virus disease. However, fruit will lack the characteristic lesions and deformities caused by TSWV or AMV. Roots develop reddish-brown internal discoloration. As with *Fusarium* wilt, symptoms usually occur about 60 days after transplanting.

Importance of correct identification

Distinguishing the *Fusarium* diseases from each other without laboratory tests is difficult, because typical symptoms can overlap and may vary considerably. The resistance that protects against one of these pathogens does not protect against the other, so correct identification is critical. For example, an F3 resistant variety is one of the best ways to protect against *Fusarium* wilt race 3, but will still be susceptible to *Fusarium* foot rot if present.

***Fusarium* pathogens tend to be very specific to hosts:**

While *Fusarium* is common in soils, the specific *Fusarium* that causes wilt in tomatoes will only cause disease in tomato. Likewise, the *Fusarium* wilt pathogen for cotton will only cause disease on cotton. The *Fusarium* wilt pathogen of cantaloupe is very specific for cantaloupe and will not cause disease of watermelon. However, the pathogen that causes root and crown rot has a larger host range that includes beans, beets, cucumber, barley, onion and asparagus. Research is underway to determine if there are certain crops that are cross-susceptible, or may serve as a host for subsequent crops.

Limit spread of the fungus

The *Fusarium* pathogen is a soil-borne fungus that can live on the roots of many plants and weeds in the absence of tomatoes. It also produces survival spores that can rest in the soil for years until a susceptible variety is planted. Any movement of soil off an infested field by equipment can then move into another field and may result in the contamination of that field. Furthermore, if shoots or stems that are colonized by the *Fusarium* wilt pathogen are moved into a field, the risk is even greater since the concentration of inoculum in these infected stems is much higher than in the soil. These spores are then spread throughout the field from normal tillage practices. With F3, it can take as little as 3 years for the disease to cause significant reduction in yield. Cleaning equipment between fields, especially harvesters and trailers, may help reduce the introduction and spread of this disease to new fields