

Fusarium Wilt Race 4 of Upland Cotton in Texas and New Mexico

Tom Isakeit, Texas AgriLife Extension Service; Mauricio Ulloa, USDA-ARS; Robert Hutmacher, University of California, Davis; John Idowu, New Mexico State University; Robert Nichols, Cotton Incorporated.



Cotton
Incorporated



University of California
Agriculture and Natural Resources



Fusarium wilt of cotton, caused by the fungus, *Fusarium oxysporum* f. sp. *vasinfectum* Race 4 (FOV4), was confirmed in numerous fields in El Paso and Hudspeth counties in Texas in 2017. FOV4 was first identified in the United States in a single county of the San Joaquin Valley (SJV) of California in 2003 and has since become widespread across the SJV.

FOV4 Threatens Cotton Production

FOV4 differs from other FOVs found in the U.S. because it is highly virulent on cotton without requiring the root knot nematode (*Meloidogyne incognita*). In California, the disease has proliferated across soil textures and pHs. The fungus can also survive as a saprophyte in soil or on roots of plants other than cotton without evidence of disease. Once FOV4 is introduced into a field, it is a permanent resident. In California, crop rotation, summer fallow, and summer flooding have not eliminated FOV4. Weed-free summer fallow and long duration summer flooding have, however, reduced the adverse effects of FOV4 on a subsequent cotton crop. Evaluated seed-applied and in-furrow fungicides have not controlled FOV4.

Over a period of several years, the bare spots of dead or stunted plants will increase in size, and may spread and enlarge via movement of soil and plant debris by tillage, furrow irrigation, or storm water flows.



Figure 2. FOV4 can kill seedling cotton.
Photo: Tom Isakeit.

Field Infestation

FOV4 is introduced as spores into fields in three ways: **1.** infected seed; **2.** soil and plant debris transported from infested fields on equipment, vehicles, and clothing/shoes; **3.** in irrigation or storm waters. It can take several years after FOV4 has been introduced to notice disease symptoms. Early observations are typically random bare spots, indicating areas where young cotton plants were killed (**Fig. 1**). When FOV4 is first observed, it may be mistaken for seedling disease (**Fig. 2**).



Figure 1. Bare spots within a field can indicate the presence of *Fusarium oxysporum* f. sp. *vasinfectum* Race 4.
Photo: Tom Isakeit.

Disease Symptoms

Infected plants may show few leaf symptoms or stand loss up to 10 to 12 weeks after planting. However, infected plants show root vascular staining (**Figs. 3 & 4**).

Although other races of FOV can cause wilt symptoms, vascular damage from FOV4 is distinctive. FOV4 enters the tap and lateral roots and produces vascular staining that often is restricted to the roots. Vascular staining from FOV4 is dark and continuous, rather than streaked, and can be found in the core (central portion) of infected cotton tap roots and lateral roots. Such vascular staining of infected plants can be seen as early as the 1-2 leaf stage, or can appear later in plant development. Typically, the infection starts during early root development. Staining is generally limited to the roots and not always evident in above-ground stem tissue. As the fungus continues to grow, more tissues decay. Eventually, in severely infected plants, damage is seen as stunting, wilting, and death; while other infected plants may only be stunted and still survive the growing season.

Scouting for FOV4 is Essential if Contaminated Seed or Soil May Have Infested One of Your Fields

Walk fields and pull random and symptomatic plants, cut roots, and inspect for taproot staining. Look for symptoms between the seedling and first flower stages. Weak areas with stand losses become more difficult to see when scouting in mid-season; symptoms might be obscured by Verticillium wilt or other Fusarium wilt races. In cases of unexplained stand loss, collect several intact plants, put them in a paper bag, and place them in a cooler or air-conditioned space, until you can bring them to your county extension office. At the office, they will be photographed and the photos electronically transmitted to the extension plant pathologist who will evaluate them, offer a diagnosis, or recommend that the samples be sent (preferably overnight) to a plant disease diagnostic laboratory.

Crops other than cotton can be planted; they will not become diseased with FOV4. However, no crop rotation is known that will eliminate the pathogen from the soil. The disease will recur with subsequent cotton crops.



Figure 3. Pencil-line staining of pith, characteristic of FOV4.
Photo: Tom Isakeit.

Prevent or Restrict Infestation

Do not plant seed originating from fields known to be infested with FOV4. In Texas, the documented infested area is El Paso and Hudspeth counties. Not all fields in the area are infested, but at this time there is no verified test to ensure seed is free of FOV4.

Clean soil and plant material from farming equipment that has been in infested fields before moving to other fields. Use a pressure washer and a detergent soap, chlorine, or quaternary ammonia product when possible to increase spore kill.

Limit movement of tail water from infested fields.

Do not apply gin trash or manure of cattle fed cotton seed or gin trash from infested fields.

Investigate the cause of randomly distributed bare spots and seedling death in fields. Submit plant samples to your county agent, extension specialist, or plant disease diagnostic clinic. A qualified laboratory should be used to confirm the diagnosis of FOV4 in plant samples, as there are many types of Fusarium present in plant tissue. Currently there are no rapid, reliable tests for determining FOV4 in soil.



Figure 4. Continuous staining in taproot of late season Upland cotton.
Photo: Mauricio Ulloa.

The statements, recommendations and suggestions contained herein are based on experiments and information believed to be reliable only with regard to the products and/or processes involved at the time; however, no guarantee is made as to their accuracy. The information contained herein is given without warranty as to its accuracy or reproducibility, either express or implied, and no authorization is made for the use of the information for purposes of advertisement or product endorsement or certification. Likewise, no statement contained herein shall be construed as a permission or recommendation for the use of any information, product or process that may infringe on any existing patents. The use of trade names does not constitute endorsement of any product mentioned, nor is permission granted to use the name Cotton Incorporated or any of its trademarks in conjunction with the products or processes involved.