

Assessment of Fusarium in the San Joaquin Valley: Field Evaluations and Variety Screening

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Fusarium wilt of cotton in California has been considered a potentially serious fungal disease caused by the organism *Fusarium oxysporum vas infectum* (also called "FOV") for many decades in several areas of the San Joaquin Valley (SJV). In the past, however, damage associated with FOV in SJV cotton has been notable only in areas with the combination of: (a) moderate to high populations of one or more specific races of FOV (usually race 1); (b) soils with a sandy or sandy loam texture; and (c) where root knot nematodes were present in high-enough populations to cause some significant root damage. Past research generally indicated that FOV damage was worst when both FOV inoculum and nematodes were present in relatively high concentrations.

Most cotton crop loss in the San Joaquin Valley associated with the fungal disease Fusarium wilt likely remains associated with nematode damage and race 1 FOV. However, field investigations in the SJV have found Fusarium symptoms in cotton in a wide range of soil textures in which root knot nematode populations are extremely low. In this project, numerous fields were surveyed in 2005 and 2006 (similar work underway since 2002) to look for plant symptoms of Fusarium wilt. This project has been directed toward two primary purposes: (1) support field efforts to collect plant tissue samples for identification and characterization of a race of FOV (race 4) newly-identified in SJV cotton fields; and (2) to conduct germplasm screening trials directed toward identifying useful genetic differences in susceptibility / resistance to race 4 FOV that can be utilized in further genetic evaluations and in use of improved host plant resistance as a way to overcome potential disease impacts. This work complements efforts of a University of CA Plant Pathologist (Dr. R.M. Davis, UC Davis) and staff in another CI supported project currently involved in identification of characteristics and origin of this FOV race, development of genetic tools to evaluate differences across Fusarium races in California and in comparison with damaging Australian strains.

This project has been directed toward two primary purposes: (1) support field efforts to collect plant tissue samples for identification and characterization of FOV race (focusing on race 4, a recently-identified disease in SJV cotton fields); and (2) to conduct germplasm screening trials to identify useful genetic differences in susceptibility / resistance to race 4 FOV that can be utilized in further genetic evaluations and to identify sources of host plant resistance useful to growers and breeders. The field survey efforts in answering requests for field FOV analyses have been considered complementary to the screening efforts in that they have helped identify suitable test locations for field FOV screens. The activities of field surveys and disease identification are closely tied in to a Cotton Incorporated project headed up by Dr. Michael Davis of the UC Davis Plant Pathology Department. (CI Project No. 02-238 CA "Characterization of CA isolates of *Fusarium oxysporum vas infectum*"). Most of the plants and Fusarium samples detailed in the genetic analyses of Fusarium strains in that project were collected through the field collection and survey efforts of this project (CI # 02-303 CA, so the two projects are complementary in evaluating project results.

Screening trial efforts have included *Gossypium hirsutum* (Upland) and *Gossypium barbadense* (Pima) plantings as well as other, more exotic *Gossypium* species to gain a broader perspective of susceptibility and potential host plant resistance to race 4 FOV. Experimental varieties included in the field and greenhouse screening included commercial Upland, commercially-available Acala varieties, commercial Pima varieties, plus exotic and experimental entries including *Gossypium hirsutum*, *Gossypium barbadense*, *Gossypium herbaceum* and *arboretum*. Dr, Mauricio Ulloa and Dr, Richard Percy of the USDA-ARS in Shafter, CA and Maricopa AZ respectively were primarily responsible for help in selecting field and greenhouse screening selections.

Germplasm evaluations to date can be summarized as follows: (1) most Pima varieties show more severe symptoms and suffer higher levels of stunting and plant mortality than Acala/Uplands; (2) one highly-resistant commercial Pima variety and several USDA experimentals have been identified at screenings done at multiple sites; (3) most Acala / Upland germplasm tested, while less severely impacted than most Pima varieties, were infected by the race 4 FOV when present in the soil at field sites or when inoculated in greenhouse trials. Field evaluations and greenhouse plus field screening work are expected to continue during the 2006 season.

Two field screening studies at sites known to have race 4 damage present, and one greenhouse study with race 4-inoculated plants compared foliar and vascular symptom development, plant stunting and losses. A wide range of genetic materials were tested for race 4 FOV susceptibility, including commercial Acala and Pima varieties and USDA experimentals. Significant findings arising from these combined research projects to date include:

- (1) none of the sampled fields (to date) were found to be infected with the highly virulent Australian strains;
- (2) a wide range of strains have been identified across different soil types and production regions within the San Joaquin Valley;
- (3) the race 4 FOV has been more virulent on tested Pima varieties than on tested Acala varieties, and
- (4) the race 4 FOV causes significant foliar and vascular disease symptoms, stand loss or stunting even without nematode populations and root damage (particularly in Pima varieties tested, lesser symptoms and stunting in tested Upland varieties
- (5) most Pima varieties show more severe symptoms and suffer higher levels of stunting and plant mortality than Acala/Uplands;
- (6) one highly-resistant commercial Pima variety and several USDA experimentals have been identified at screenings done at multiple sites;
- (7) most Acala / Upland germplasm tested, while less severely impacted than most Pima varieties, were infected by the race 4 FOV when present in the soil at field sites or when inoculated in greenhouse trials.

These field screening efforts are planned to continue in the 2007 season at multiple sites, including the UC Kearney Agricultural Center greenhouse facilities.