Fusarium Race-4

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Observations of FOV4

- 1960  Armstrongs identified FOV4 in India.
- 1997  We observed FOV4 in California.
- 2013  Growers observed FOV4 in Upper Rio Grande Valley.
- ????  Across the Entire Cotton Belt.
Previous work done with FOV4

- In water
- In all different soil types
- Not dependent on nematodes
- On equipment
- Host to most other crops
- Soil treatments not effective
- Seed treatments not effective
- Fumigants not effective
- Crop Rotations has no effect
- Screening varieties
- Spores in seed
Exacerbate Severity of FOV4

- Planting Date
- Spore count in soil
- Distribution of spores
- Plant Characteristics
- Cultivation Practices
- Water Movement
- Weather
- Rhizoctonia, Pythium, Thielaviopsis, etc.
- Transgenes
O&A Enterprises Pima Breeding Program

- 20 years working on this
- 6k accessions of Pima
- 5 year project, confirmed resistance in 3 years
- Found 20 families with resistance
- Developed into 1200 lines, foundation of our Pima breeding program
- We have not released a commercial Pima variety without FOV4 Resistance in over a decade.
FOV4 Field Testing Protocol

- **Year 1** Identify significantly infected area in commercial cotton field.
- **Year 2** Plant a moderately susceptible variety in the infected area to Map visually and take numerous soil and tissue samples to determine variability of spore counts.
- **Year 3** FOV4 variety screening site with calibration series used as checks.
Maintaining FOV4 Field Testing Sites

- Planting Moderately Susceptible Varieties
- Testing Soil and Plant Tissue
- Secure testing sites for long durations
3 Major Factors We Evaluate

- Survivability
- Vascular Root Stain
- Yield/Performance
Modified SSMS Protocol

For breeding FOV4 resistance in cotton
Calibration Series

- 4-5 levels of resistance
- Conventional and transgenic Series
Resistant Check

- Do NOT use Pima S-6
- Under high spore count field evaluation: Not Resistant, Not Highly Tolerant but just Tolerant
- Composite of 4 diverse lines
- FOV 4 is Polygenic
Differences in FOV4
Upland vs. Pima

- Pima – Lower number of plants survive

- Upland – Higher number of plants survive
  - Yield is still greatly affected
    (High rate of Vascular Staining)
Pathology Labs

- Marin Brewer at Univ. of Georgia
- Al Bell with USDA
Need to Positively Identify Resistant Conventional Uplands

- Mass screen germplasm to find resistance to FOV4
- We have secured the 3 hottest sites in TX
- Wanting to help the industry as a whole
- 7-10 years all upland varieties will need FOV4 Tolerance
The Answer
Breeding for Resistance by:

- State
- USDA
- Private Seed Co.

- Like Phytogen+O&A(DPL) Pima for FOV4
- Like CSIRO Uplands for FOV6
Breeding is the only proven solution