



Fusarium Race-4

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O&A Enterprises Inc.



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

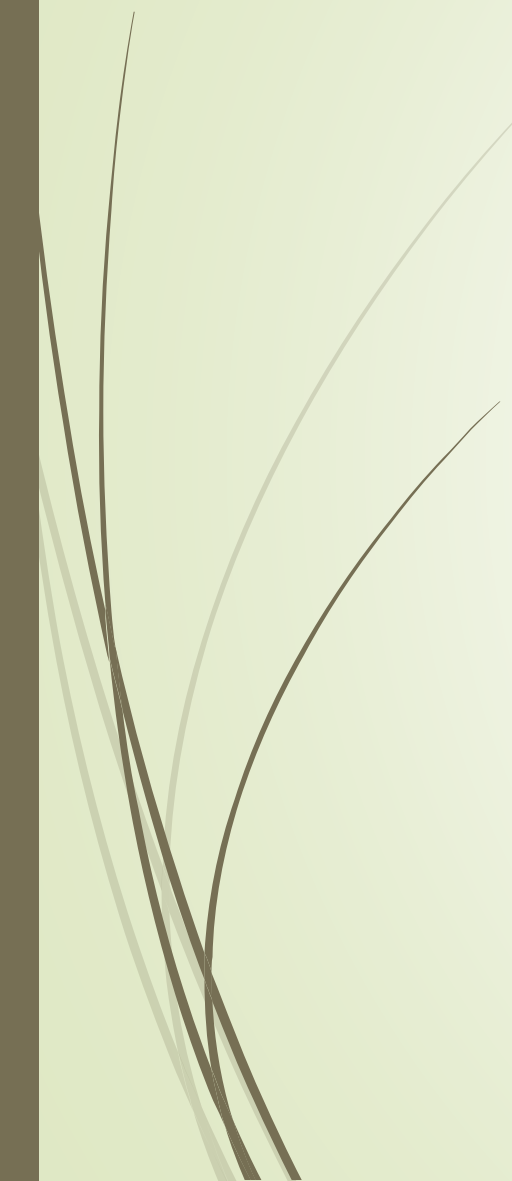


Previous work done with FOV4

- ▶ 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

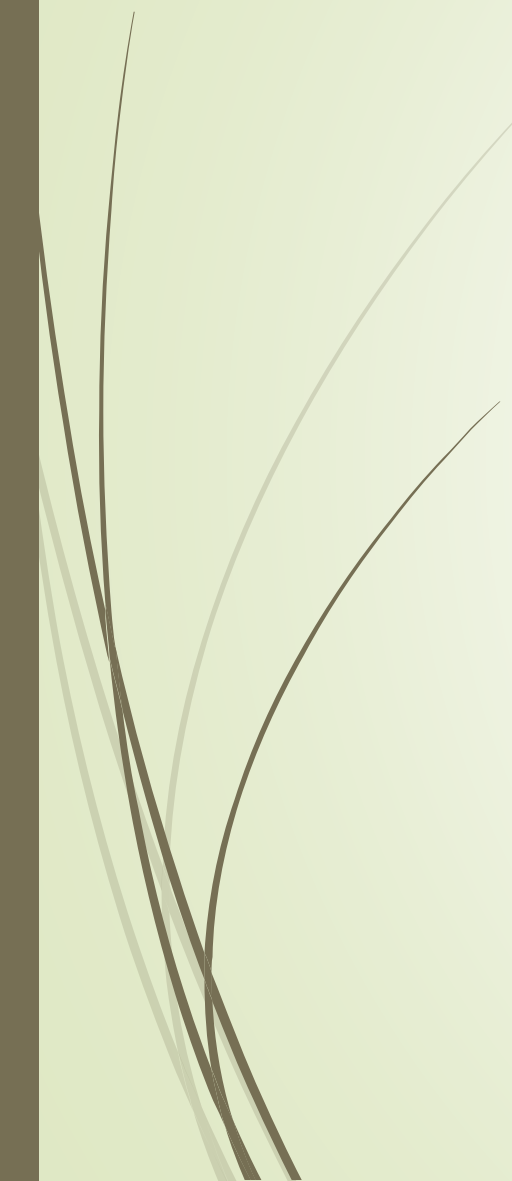


Exacerbate Severity of FOV4

- 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.
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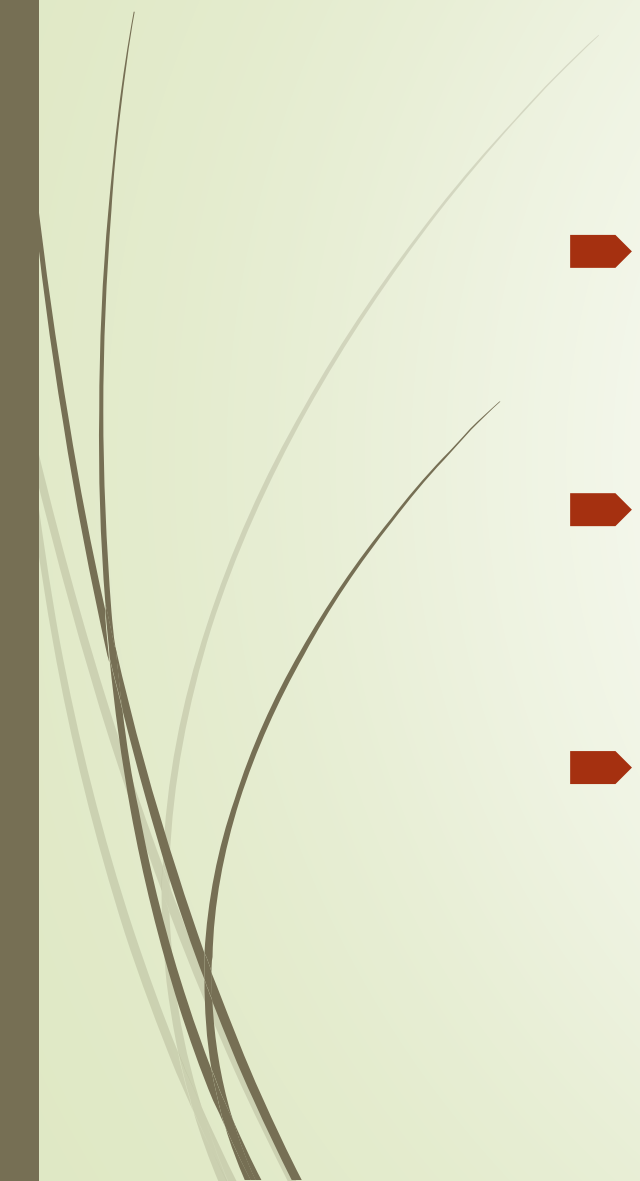


FOV4 Field Testing Protocol

- 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
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3 Major Factors We Evaluate



Survivability



Vascular Root Stain



Yield/Performance

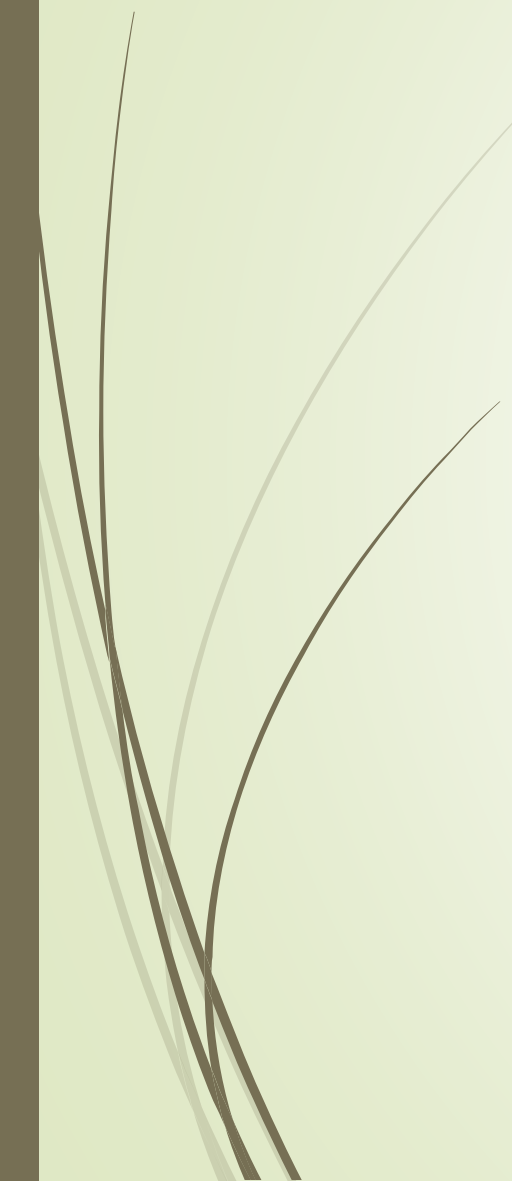


Modified SSMS Protocol

For breeding FOV4 resistance in cotton



Calibration Series

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