



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

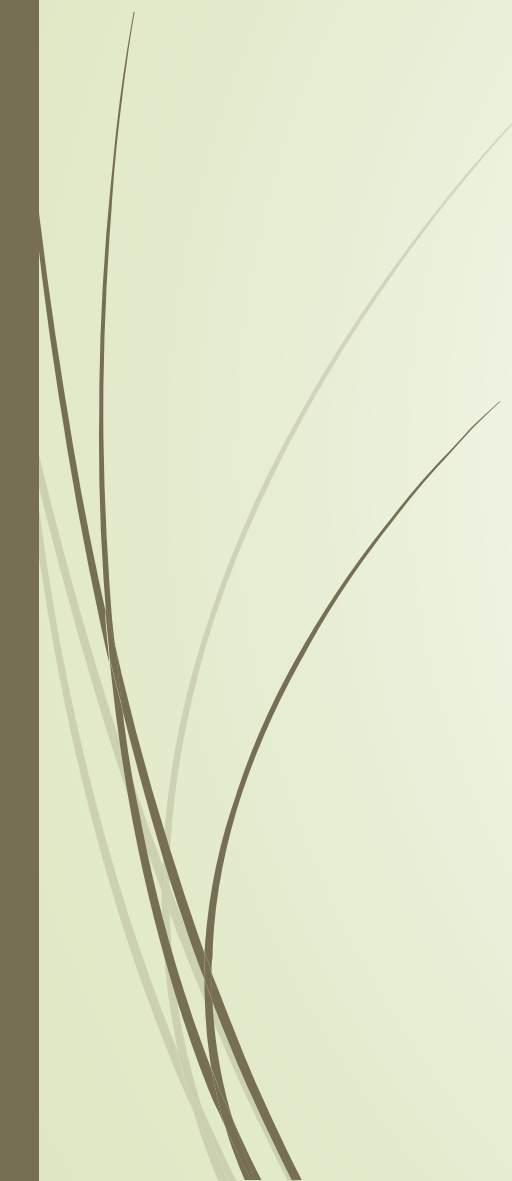


Previous work done with FOV4

- 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

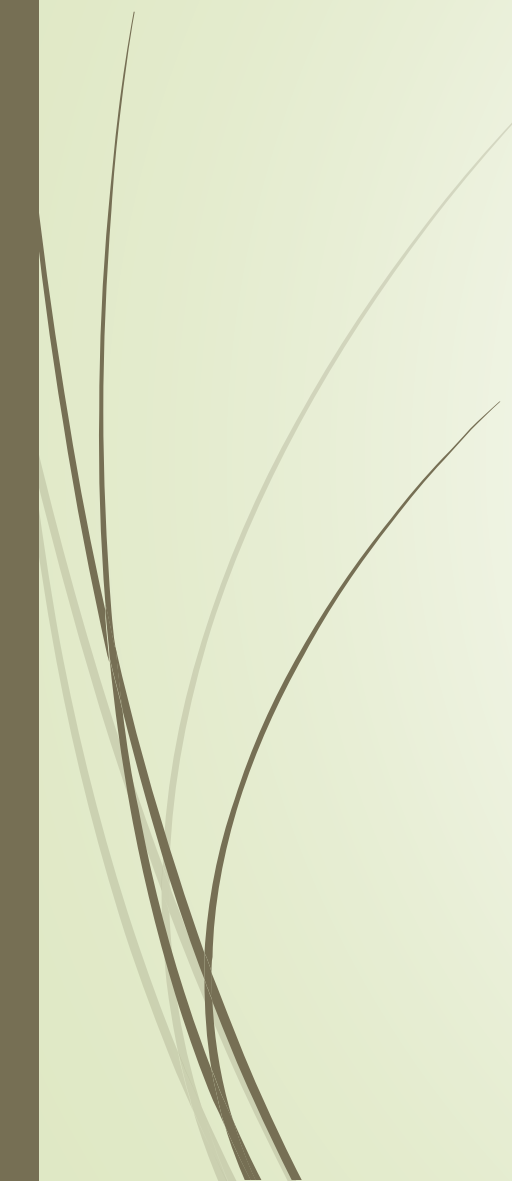


Exacerbate Severity of FOV4

- Planting Date
 - Spore count in soil
 - Distribution of spores
 - Plant Characteristics
 - Cultivation Practices
 - Water Movement
 - Weather
 - Rhizoctonia, Pythium, Thielaviopsis, etc.
 - Transgenes
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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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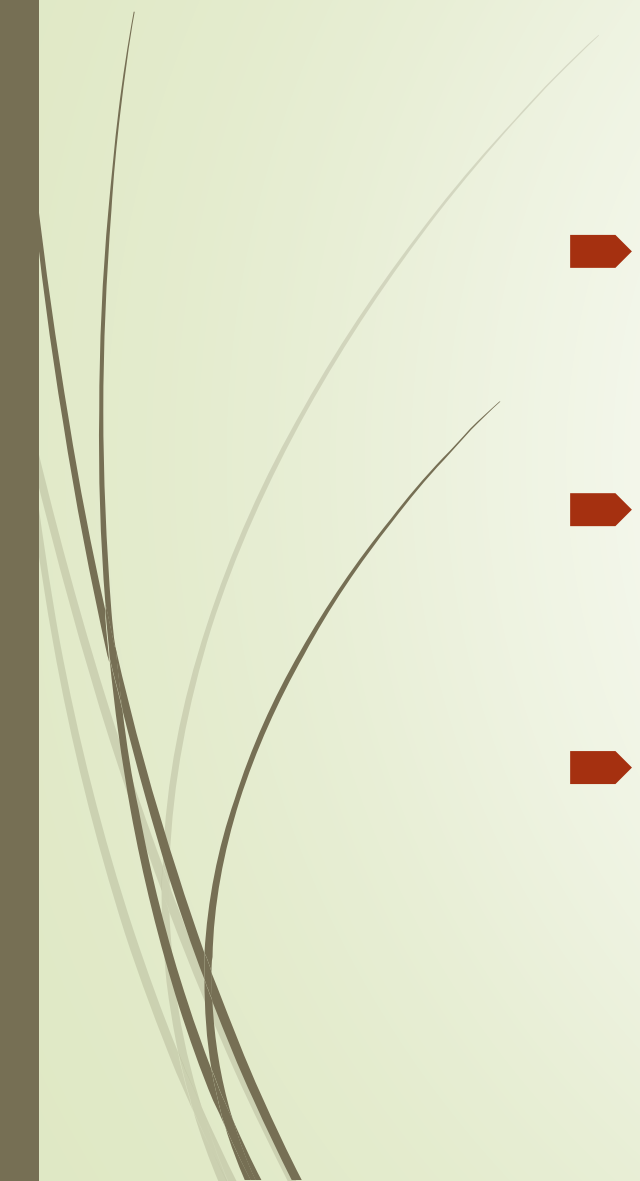


FOV4 Field Testing Protocol

- 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.
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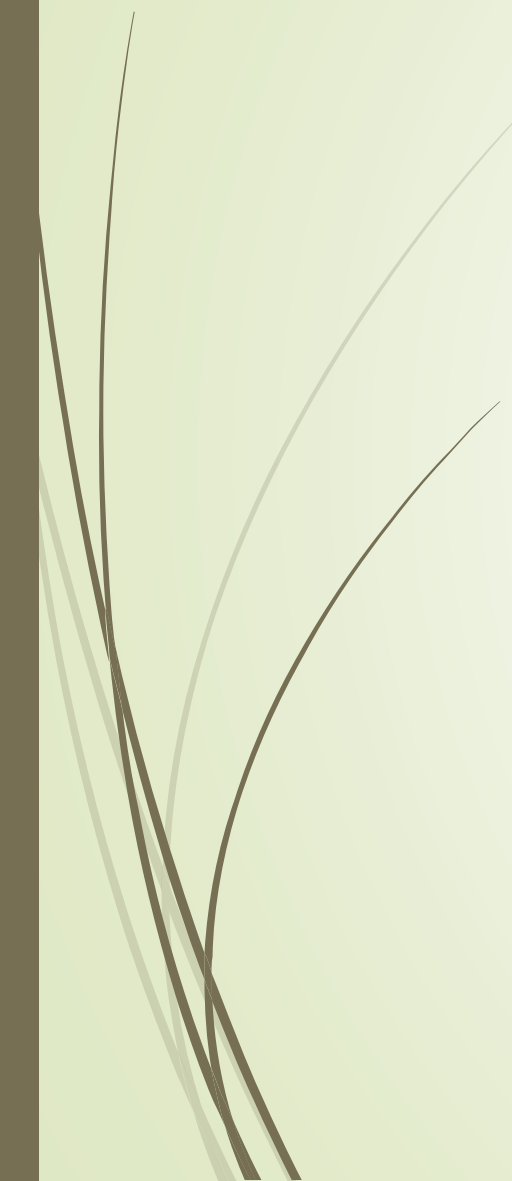


Maintaining FOV4 Field Testing Sites

- 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
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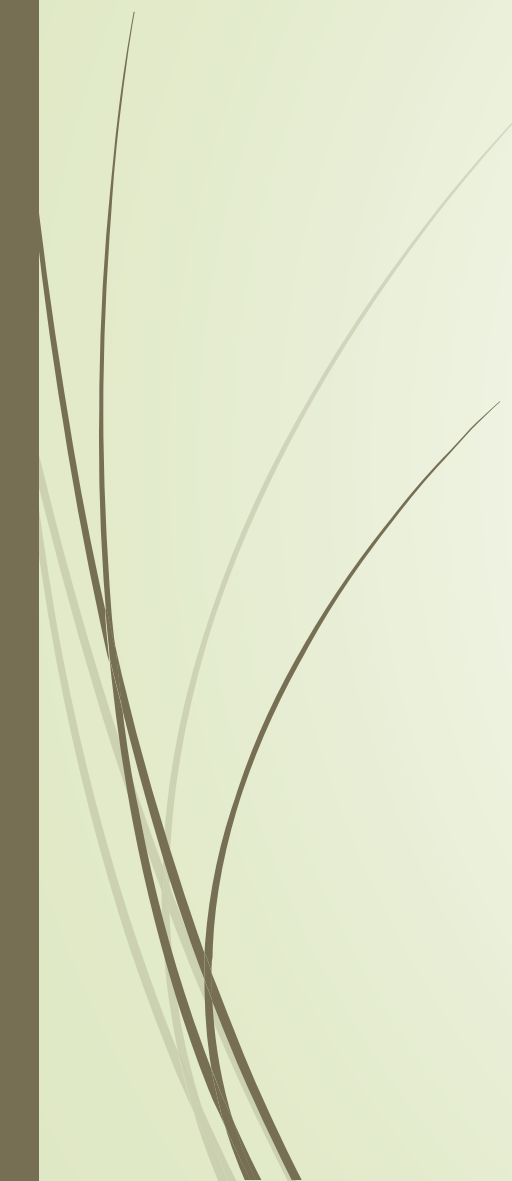


Modified SSMS Protocol

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

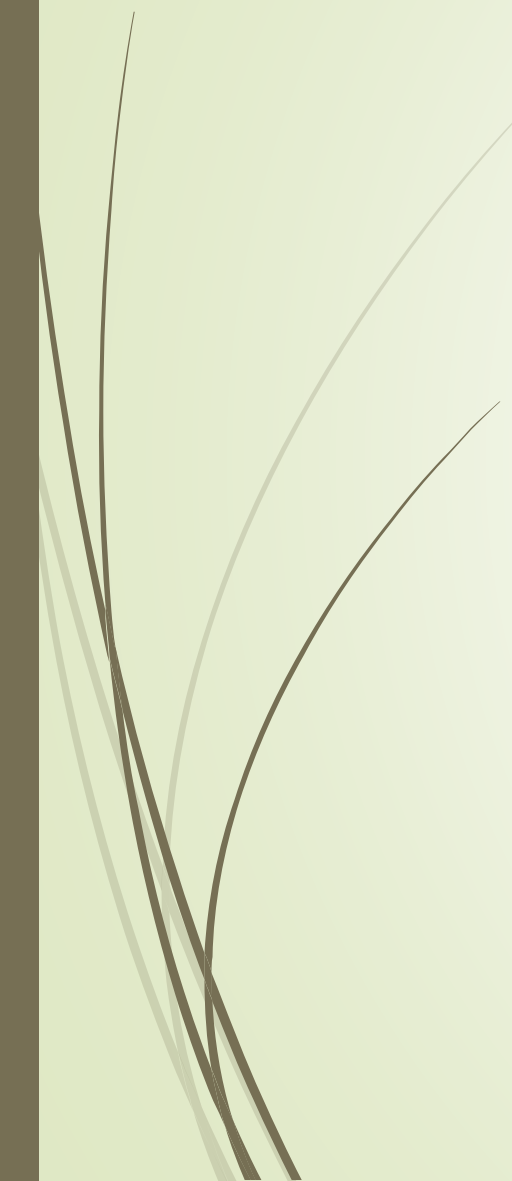


Differences in FOV4 Upland vs. Pima

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

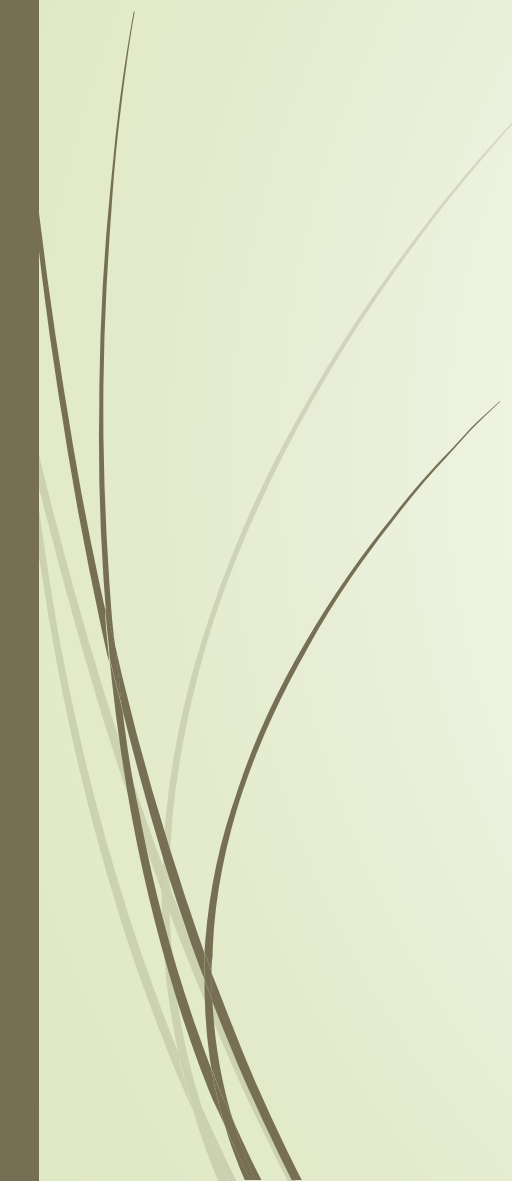


Pathology Labs

- ➡ Marin Brewer at Univ. of Georgia
 - ➡ Al Bell with USDA
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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
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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