Utilizing new Technology for the Control of Cotton Root Rot in Arizona

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Characteristics – Root Rot

- Soil-borne fungus – high pH and low organic matter – typically associated with river basins
  - *Phymatotrichopsis omnivora*
- Rapid wilt
- Followed by death
- Dead and dying leaves remain on plant
- Tap root is destroyed
- Forms characteristic strands on root
  - Results in rotted, cortical outer tissue
- Geographically defined
Visual Symptoms
Roots and Shoots

Photos courtesy: Dr. Mary Olsen – UA Plant Pathology
2012-14 Research Projects

- Five locations
  - Solomon, AZ
  - Marana, AZ
  - Arlington, AZ
  - Coolidge, AZ
  - Thatcher, AZ

- Two rates
  - 16 floz/acre (0.13 lb ai/acre)
  - 32 floz/acre (0.26 lb ai/acre)
Topguard (Flutriafol)

- Flutriafol – active ingredient
  - Systemic demethylation inhibitor (DMI)
  - Disrupts sterol production which are needed for fungal membrane structure
- First screened for CRR control in Texas in 2008 as a stem drench
- At planting applications made in 2010 showed promising results
- First product known to have effective control of the pathogen
2012-14 Research Projects

• Application Techniques
  • Injected – pre-plant
  • T-band – at plant
  • Modified in-furrow – at plant
  • Post-direct – post-plant

• Evaluations
  • Phytotoxicity (emergence)
  • Disease incidence
  • Yield
2014 Plot Layout

<table>
<thead>
<tr>
<th>REP I</th>
<th>REP II</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 Rows - Treated @ Planting with &quot;T&quot; Band Application 32 fl oz/acre</td>
<td>8 Rows - Untreated Control</td>
</tr>
<tr>
<td>8 Rows - Untreated Control</td>
<td>24 Rows - Injected Pre-Plant 32 fl oz/acre</td>
</tr>
<tr>
<td>24 Rows - Injected Pre-Plant 32 fl oz/acre</td>
<td>8 Rows - Treated Post-Direct Application 32 fl oz/acre</td>
</tr>
<tr>
<td>8 Rows - Treated Post-Direct Application 32 fl oz/acre</td>
<td>148 Rows - Treated @ Planting with &quot;T&quot; Band Application 32 fl oz/acre</td>
</tr>
<tr>
<td>8 Rows - Untreated Control</td>
<td>8 Rows - Untreated Control</td>
</tr>
<tr>
<td>24 Rows - Injected Pre-Plant 32 fl oz/acre</td>
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</tr>
<tr>
<td>8 Rows - Treated Post-Direct Application 32 fl oz/acre</td>
<td>8 Rows - Treated Post-Direct Application 32 fl oz/acre</td>
</tr>
</tbody>
</table>

Planted: 30 April 2014
Irrigated: N/A
Buffer Rows: N/A
Plot Width: Varies (see map)
Plot Length: 1220 feet
Plot Location: 0.75 miles N on 1st Avenue off Highway 70 in Thatcher
### Treatment Percent Disease

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC</td>
<td>70.65 a*</td>
</tr>
<tr>
<td>Injected</td>
<td>41.45 ab</td>
</tr>
<tr>
<td>Post-Direct</td>
<td>41.00 ab</td>
</tr>
<tr>
<td>T-Band</td>
<td>18.70 b</td>
</tr>
<tr>
<td>Mean</td>
<td>42.95</td>
</tr>
<tr>
<td>LSD</td>
<td>36.1</td>
</tr>
<tr>
<td>OSL</td>
<td>0.0716</td>
</tr>
<tr>
<td>CV (%)</td>
<td>26.4</td>
</tr>
</tbody>
</table>

* Means followed by the same letter are not significantly different.
Yield Results

Seed cotton yield comparison:

- **INJECTED**: 4550
- **POSTDIRECT**: 4500
- **TBAND**: 4900
- **UTC**: 4550

Yield data from Norton, 2015.
# Seedcotton Yield - ANOVA

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Seedcotton Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-Band</td>
<td>4841.2 a*</td>
</tr>
<tr>
<td>Injected</td>
<td>4652.7 ab</td>
</tr>
<tr>
<td>UTC</td>
<td>4565.0 ab</td>
</tr>
<tr>
<td>Post-Direct</td>
<td>4555.4 b</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>5075.7</strong></td>
</tr>
<tr>
<td><strong>LSD</strong></td>
<td><strong>226.7</strong></td>
</tr>
<tr>
<td><strong>OSL</strong></td>
<td><strong>0.0732</strong></td>
</tr>
<tr>
<td><strong>CV (%)</strong></td>
<td><strong>1.5</strong></td>
</tr>
</tbody>
</table>

*Means followed by the same letter are not significantly different*
Visual Comparisons

Solomon Flutriafol Evaluation - 2013

Untreated

Treated 32 oz/acre

Solomon Flutriafol Evaluation - 2013

Untreated

Treated 32 oz/acre
2014 Trials in Marana, AZ

Untreated

Treated – 32 floz/acre
2014 Drip Applications

- 2014 application in drip
- Off-label
- 14 acres
- History of high CRR levels on top end of field
- Sub-Surface Drip Injection
- Injected near match head square
- 32 fl oz/acre (0.26 lb ai/acre)
- Treated entire field
2014 SDI Evaluations

2013 Season Yield Map

August 2006 Google Earth Image

Norton, 2015
Symptomatic Field in Thatcher, AZ – 2013
Conclusions

- Promising results from 2012-2014
  - Close to 70% disease reduction @ 32 fl oz/acre
  - Observed delayed emergence (24-36 hours)
    - 2014
    - 2015

- Continued work in 2015
  - Full registration expected in summer of 2015
    - As of 2 February section 3 Label (Full) granted by EPA
    - Sold as TopGuard Terra – approx. 4lb/gal material
    - Pursuing another section 18 for use in Arizona Alfalfa production systems in 2016
# Topguard/Topguard Terra

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Flutriafol</th>
<th>Flutriafol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulation Concentration</td>
<td>4.16 lb ai/gallon</td>
<td>1.04 lb ai/gallon</td>
</tr>
<tr>
<td>Use Rate</td>
<td>4–8 fl oz/A</td>
<td>16–32 fl oz/A</td>
</tr>
<tr>
<td>Registration and Use Status</td>
<td>EPA registered Jan. 30th, 2015 (EPA Reg No. 67760-126). Check your state for registration status. See TOPGUARD Terra label for use directions.</td>
<td>Section 18 in TX only (effective Feb. 1st through June 30th, 2015). Must have Section 18 label (15-TX-02) on hand at application.</td>
</tr>
</tbody>
</table>
Seed Contact and Emergence

- Current label has two application techniques (at-planting)
  - T-band
  - Modified in-furrow
- Seed contact results in delay in emergence
- Exploring alternative techniques for application
  - Pre-plant
  - Post-plant
T-Band and Modified In-Furrow
Emergence Delay

Untreated

Treated
## 2015 Evaluations

<table>
<thead>
<tr>
<th>Location</th>
<th>Pre-Plant Injected</th>
<th>At Plant T-band</th>
<th>At Plant Modified In-Furrow</th>
<th>Post Plant Spike Wheel</th>
<th>Post Plant Side-Dress</th>
<th>Post Plant Directed Spray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yuma</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Marana</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Safford</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Pre-Plant Injection
Spike Wheel Injection
Side-Dress Application
Post Plant Directed Spray
Precision Management

• Apply material in areas where disease exists
• Oftentimes no need to treat entire field
• Need source of map data – options
  • Experience??
  • Yield maps – confounding factors
    • Free once you purchase the equipment – already geo-referenced
  • UAV imagery – cost for equipment or contract imagery
  • Google Earth – confounding factors
    • Free – can get geo-reference images
Precision Management

Marana area, Cotton – 9/2013 Google Earth Image
72 acres
Marana area, Cotton – 9/2013 Google Earth Image
72 acres – treated 22 acres
Precision Management

• Combination of multiple sources
  • Experience
  • Imagery – satellite (Google Earth)
  • Additional mapped data (i.e. yield data, UAVs)

• Cotton Incorporated:
  • Dr. Bob Nichols
    • Developing algorithms to map fields based on spatial data
    • May be ground-truth – experience and other data
    • Develop maps for application (on/off)