Comparative Performance of BARBREN and LONREN

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BARBREN-713 activities at Auburn

Since April 2011, four BARBREN related activities were started:

(1) Uniform Field Evaluation of BARBREN
    conducted in collaboration with LSU Agricultural Center and Texas AgriLife Research

(2) Inclusion in ongoing Yield + Quality trial (LONREN-1 × Fibermax 966 progenies)

(3) Various inoculums assay in greenhouse

(4) BARBREN progeny development

These activities were supported by cooperative agreements from Cotton Incorporated.
Activity 1

Uniform Evaluation of BARBREN-713 and LONREN 21-4

- 2 lines of interest
  - LONREN 21-4
    - GB 6-1-2
      - a.k.a. BARBREN-713
  - 4 checks
    - DP5415
    - ST5288B2F
    - PHY375WR
    - FM9160B2F

- 3 locations
  - Belle Mina, AL
  - Lubbock, TX
  - St. Joseph, LA

- Common design
  - 6 x 6 Latin Square
  - 2 row plots - 50 ft ea.
  - common fungicide treatment
  - 4 seed / foot

- Field data
  - nematode counts (pre-plant and mid-August)
  - stand count (30 DAP)
  - plant heights (45 DAP)
  - node count (45 DAP)
  - yield and turnout fiber analysis

- Root analysis
  - 10 seedlings/plot
    - (excavate at 30 DAP)
    - nematode count
    - egg count
seedling development
at the 2011 uniform evaluation test

early plant growth
mean of plot averages
Belle Mina, AL

- BARBREN-713
- LONREN 21-4
- DP5415
- ST5288B2F
- PHY375WR
- FM9160B2F

plant height (cm)
days after planting
Belle Mina, July 14, 2011 (58 days after planting)

plot 301 – BARBREN-713

plot 302 - LONREN 21-4

four row plots
# Seed cotton Yields

<table>
<thead>
<tr>
<th>variety</th>
<th>Belle Mina (1)</th>
<th>Lubbock (1)</th>
<th>St. Joseph (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LONREN 21-4</td>
<td>776 c (3)</td>
<td>163 b</td>
<td>317 c</td>
</tr>
<tr>
<td>BARBREN-713</td>
<td>2698 a (4)</td>
<td>381 a</td>
<td>513 bc</td>
</tr>
<tr>
<td>DP5415</td>
<td>1462 b</td>
<td>181 b</td>
<td>350 c</td>
</tr>
<tr>
<td>ST5288B2F</td>
<td>1196 bc</td>
<td>184 b</td>
<td>1232 a</td>
</tr>
<tr>
<td>PHY375WR</td>
<td>1124 bc</td>
<td>161 b</td>
<td>666 bc</td>
</tr>
<tr>
<td>FM9160B2F</td>
<td>1235 bc</td>
<td>304 a</td>
<td>827 b</td>
</tr>
<tr>
<td>LSD0.05</td>
<td>549</td>
<td>109</td>
<td>400</td>
</tr>
</tbody>
</table>

(1) Belle Mina and Lubbock: means from 6 replications
(2) St. Joseph: means from 4 replications
(3) Means in columns followed by the same letter do not differ significantly at the 0.05 probability level
(4) Lint percentage = 37.5%; lint yield = 1015 lbs/acre
End of season reniform nematode counts

<table>
<thead>
<tr>
<th>variety</th>
<th>Belle Mina (1)</th>
<th>Lubbock (1)</th>
<th>St. Joseph (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>reniform nematode per 100 cm3 soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LONREN 21-4</td>
<td>601 c (2)</td>
<td>23 d</td>
<td>5911 c</td>
</tr>
<tr>
<td>BARBREN-713</td>
<td>893 bc</td>
<td>533 bcd</td>
<td>6709 bc</td>
</tr>
<tr>
<td>DP5415</td>
<td>1519 abc</td>
<td>1893 ab</td>
<td>11221 abc</td>
</tr>
<tr>
<td>ST5288B2F</td>
<td>1983 ab</td>
<td>767 bcd</td>
<td>14432 a</td>
</tr>
<tr>
<td>PHY375WR</td>
<td>2086 a</td>
<td>2233 a</td>
<td>15957 a</td>
</tr>
<tr>
<td>FM9160B2F</td>
<td>1245 abc</td>
<td>1447 abc</td>
<td>14091 ab</td>
</tr>
<tr>
<td>LSD0.05</td>
<td>1196</td>
<td>1223</td>
<td>7597</td>
</tr>
</tbody>
</table>

(1) all locations: data are means of 6 replications
(2) Means in columns followed by the same letter do not differ significantly at the 0.05 probability level
Activity 2

Inclusion of BARBREN-713 in ongoing Yield + Quality trial

* Second year of progeny testing of the cross LONREN-1 × FM966 (F2:5 seed planted in 2011)
* Consist of 20 RN resistant lines + 20 RN susceptible lines + 4 checks
* Conducted at Tennessee Valley Research Station (Belle Mina)
* Conducted on two adjacent fields:
  - one inoculated with reniform nematode
  - one free of reniform nematode (verified yearly)
Field view - 58 days after planting
TVREC - July 14, 2011

row 2227
LONREN 21-4

row 2228
LONREN-1

row 2229
LONREN-1 x FM966
resistant line A107

row 2230
BARBREN-713

single row plots
### Results of the Yield and Quality test 2011

#### Lint Yield (summary)

<table>
<thead>
<tr>
<th>group</th>
<th>RN present</th>
<th>RN absent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate (lbs/acre)</td>
<td>StdErr (lbs/acre)</td>
</tr>
<tr>
<td>BARBREN-713</td>
<td>979 ± 186</td>
<td>731 ± 77</td>
</tr>
<tr>
<td>LONREN 21-4</td>
<td>525</td>
<td>721</td>
</tr>
<tr>
<td>RN resistant lines (1)</td>
<td>782 ± 43</td>
<td>920 ± 20</td>
</tr>
<tr>
<td>RN susceptible lines (2)</td>
<td>921 ± 42</td>
<td>962 ± 20</td>
</tr>
<tr>
<td>LONREN-1 and -2</td>
<td>746 ± 132</td>
<td>906 ± 55</td>
</tr>
<tr>
<td>Susceptible checks (3)</td>
<td>1044 ± 132</td>
<td>1031 ± 55</td>
</tr>
</tbody>
</table>

#### Reniform Nematode Counts (summary)

<table>
<thead>
<tr>
<th>group</th>
<th>36 days after planting</th>
<th>4 days after harvesting</th>
<th>season increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(RN/150cm3 of soil)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARBREN-713</td>
<td>973</td>
<td>1916</td>
<td>+ 97</td>
</tr>
<tr>
<td>LONREN 21-4</td>
<td>464</td>
<td>1097</td>
<td>+ 137</td>
</tr>
<tr>
<td>RN resistant lines (1)</td>
<td>1126</td>
<td>1242</td>
<td>+ 10</td>
</tr>
<tr>
<td>RN susceptible lines (2)</td>
<td>1031</td>
<td>2813</td>
<td>+ 173</td>
</tr>
<tr>
<td>LONREN-1 and -2</td>
<td>765</td>
<td>1406</td>
<td>+ 84</td>
</tr>
<tr>
<td>Susceptible checks (3)</td>
<td>1035</td>
<td>3160</td>
<td>+ 205</td>
</tr>
</tbody>
</table>

(1) 20 RN resistant lines of the cross LONREN-1 × FM966
(2) 20 RN susceptible lines of the cross LONREN-1 × FM966
(3) FM966 and DP393
<table>
<thead>
<tr>
<th>Group</th>
<th>Turnout (%)</th>
<th>Upper Half Mean Micronaire (inch)</th>
<th>Uniformity Index (%)</th>
<th>Strength (g/tex)</th>
<th>Elongation (%)</th>
<th>Short Fiber Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nematode present:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARBREN-713</td>
<td>36.8</td>
<td>1.11</td>
<td>4.3</td>
<td>82.9</td>
<td>30.3</td>
<td>5.9</td>
</tr>
<tr>
<td>LONREN 21-4</td>
<td>38.5</td>
<td>1.15</td>
<td>4.6</td>
<td>83.1</td>
<td>30.6</td>
<td>5.9</td>
</tr>
<tr>
<td>RN resistant lines (1)</td>
<td>39.2</td>
<td>1.14</td>
<td>4.5</td>
<td>84.2</td>
<td>33.2</td>
<td>5.7</td>
</tr>
<tr>
<td>RN susceptible lines (2)</td>
<td>39.0</td>
<td>1.14</td>
<td>4.5</td>
<td>83.6</td>
<td>31.1</td>
<td>6.0</td>
</tr>
<tr>
<td>LONREN-1 and -2</td>
<td>39.5</td>
<td>1.13</td>
<td>4.3</td>
<td>83.4</td>
<td>30.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Susceptible checks (3)</td>
<td>39.4</td>
<td>1.19</td>
<td>4.5</td>
<td>84.8</td>
<td>32.6</td>
<td>6.2</td>
</tr>
<tr>
<td><strong>Nematode absent:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARBREN-713</td>
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<td>4.5</td>
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<td>40.3</td>
<td>1.12</td>
<td>4.5</td>
<td>84.6</td>
<td>32.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Susceptible checks</td>
<td>42.1</td>
<td>1.16</td>
<td>4.6</td>
<td>85.0</td>
<td>32.6</td>
<td>4.8</td>
</tr>
</tbody>
</table>

(1) 20 Reniform Nematode resistant lines of the cross LONREN-1 × FM966
(2) 20 Reniform Nematode susceptible lines of the cross LONREN-1 × FM966
(3) FM966 and DP393
Activity 3

**Various inoculums assay**

Similar to an assay conducted in 2010
see *Nematropica* 2011, Vol. 41, No. 1, pp. 68-74

**Seven genotypes**
RN resistant: BARBREN-713, LONREN 21-4, LONREN-1 and -2
RN susceptible: FM966, DP393 and line B211 (of LONREN-1 × FM966)
10 replications (2 for intermediate observations)

**Six inoculum levels**
0 - 500 - 1000 - 5000 - 10,000 - 50,000 RN per 150 cm³ of soil

**Reniform Nematode extraction at 60 DAI**
all seedlings photographed after extraction
data on fresh shoot and root mass collected
Combined results across all inoculum levels

Extracted reniform nematode:
- per cone-tainer (150 cm³)
- per gram of fresh root mass

(*) B211 is a RN susceptible line of the cross LONREN-1 x FM966
At 60 DAI, roots of BARBREN-713 showed, in general, less damage than those of the LONREN lines, but results varied widely.
Shoot and root development

In this assay BARBREN-713 simulated the behavior of the LONREN lines.
Summary of conclusions of the BARBREN-713 studies

BARBREN-713 limits reniform nematode reproduction compared to non-resistant RN genotypes, though this RN reproduction reduction seems to be less than achieved with LONREN lines.

BARBREN-713 does not show signs of seedling stunting.

BARBREN-713 yields on RN infested fields are encouraging due to varied nature of the interaction between cotton and reniform nematode, more field experience in a range of environments is required to allow for a more qualified conclusion.

BARBREN-713 fiber quality is acceptable a breeding program incorporating the RN resistance of BARBREN-713 into high yielding, high quality germplasm lines could combine desired traits.

BARBREN-713's mechanism of RN resistance needs further investigation more physiological and histological information is required.
activity 4

BARBREN-713 breeding program

Currently underway:

cross LA06307025 × BARBREN-713 made in Summer 2011
  LA06307025 is a high yielding RBTN entrant
  F₁ planted at Mexico winter nursery

5 other crosses with BARBREN-713 made later in 2011
  including one with RN resistant lines of LONREN-1 × FM966
  generation advancement currently underway in greenhouse

Planned:

F₂:₃ populations will be generated during the growing season of 2012

RN resistance screening will start in October 2012 and continue till Spring 2013

Advancement to F₂:₄ and seed increase will be done during 2013

Field evaluation, including RN stress tests, will commence in 2014