Pecan scab #1 biological production constraint in this region.
Desirable + Stuart = 60% Trees in Georgia

Desirable

Stuart

- Nuts from a sprayed orchard in 2005.
Goals of the pecan breeding program

- Increase pest resistance
- Stabilize production
- Increase quality
- Change harvest date
- Increase productivity
Scab Resistance

• Several cultivars have high levels of resistance.

Unsprayed 'Faircloth' nuts.  
Unsprayed 'Excel' nuts.

• But, nut quality does not match susceptible cultivars like 'Desirable'.
Breeding Strategy

Recurrent Mass Selection

1. Select superior seedlings from chance populations.


3. Selection superior offspring for use as parents in the next cycle or as cultivars.
Cross 2 parents which in combination have the desired traits and select seedlings which have desired traits.

Cultivar #1
1. Large nuts
2. Early harvest
3. Disease susceptible

Cultivar #2
1. Small nuts
2. Late harvest
3. Disease Resistant

X

New cultivar
1. Large nuts
2. Early harvest
3. Disease resistant

Most seedlings
1. Small nuts
2. Late harvest
3. Disease Susceptible

"Quantity makes Quality" — The breeder must find clever ways of selecting from as many seedlings as possible.
Pecan Breeding Methods
Pollen Collection
Pollination Technique
Seedling Evaluation Phase I

• Initial Screen
  – 10 year selection cycle
  – Evaluate for:
    • nut size and quality
    • tree vigor
    • earliness
    • disease resistance
    • insect resistance
Seedling Nursery – Year 1
Seedling Nursery – Year 2

Remove all scab susceptible seedlings. 20-90% eliminated
Transplanting selected seedlings.
Seedling Orchard – Year 3
Seedling Orchard – Year 6
Seedling Evaluation Phase II

- Propagate best selections for replicated trials

- Compare to elite cultivars
  - tree productivity
  - alternate bearing intensity

- Use best new selections as cultivars or parents in breeding program.
Where are we now?

- Program started in 1999.
- New crosses made each year.
- 106 controlled crosses.
- 10,000 seedlings screened.
- First nuts produced from the 1999 crosses in 2006.
- 300-400 seedlings fruiting in 2007.
- Will begin testing new selections in replicated trials in 2 years.
Ponder Farm Variety Trial

- Planted in 2002
- 5-6 trees per cultivar
- 2-week fungicide spray schedule
- Commercial level care.
- Microjet irrigation
- Desirable and Stuart as check cultivars
Data collection

- Yield for each tree
- 50-nut sample
  - nut weight
  - nut volume
  - % kernel
  - % fuzz
- Pest resistance
  - leaf scab
  - nut scab
  - black aphid damage
  - sooty mold buildup
- Bloom times
Cherryle

Quality for years 1-5.

<table>
<thead>
<tr>
<th></th>
<th>Yield</th>
<th>Nuts/lb</th>
<th>% Kernel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherryle</td>
<td>0.3</td>
<td>40</td>
<td>55</td>
</tr>
<tr>
<td>Desirable</td>
<td>0.4</td>
<td>52</td>
<td>51</td>
</tr>
<tr>
<td>Stuart</td>
<td>0.1</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

- Alabama grower selection
- Good size and quality
- Precocity similar to Desirable
Cherryle

- Moderate scab resistance
  - Needs fungicide
- Scabs badly in original orchard
- Reports of suture split

Pest resistance years 2003-2006.

<table>
<thead>
<tr>
<th></th>
<th>Leaf Scab</th>
<th>Nut Scab</th>
<th>Black Aphid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherryle</td>
<td>1.6</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Desirable</td>
<td>3.0</td>
<td>2.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Stuart</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Nacono

Quality for years 1-5.

<table>
<thead>
<tr>
<th></th>
<th>Yield</th>
<th>Nuts/lb</th>
<th>% Kernel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nacono</td>
<td>1.1</td>
<td>44</td>
<td>51</td>
</tr>
<tr>
<td>Desirable</td>
<td>0.4</td>
<td>52</td>
<td>51</td>
</tr>
<tr>
<td>Stuart</td>
<td>0.1</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

- USDA release
- Good size and quality
- Precocious
- Excellent sheller
- Large cluster size
Nacono

- Very scab susceptible

<table>
<thead>
<tr>
<th></th>
<th>Leaf Scab</th>
<th>Nut Scab</th>
<th>Black Aphid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nacono</td>
<td>2.4</td>
<td>2.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Desirable</td>
<td>3.0</td>
<td>2.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Stuart</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Pest resistance years 2003-2006.
McMillan

Quality for years 1-5.

<table>
<thead>
<tr>
<th></th>
<th>Yield</th>
<th>Nuts/lb</th>
<th>% Kernel</th>
</tr>
</thead>
<tbody>
<tr>
<td>McMillan</td>
<td>0.7</td>
<td>51</td>
<td>47</td>
</tr>
<tr>
<td>Desirable</td>
<td>0.4</td>
<td>52</td>
<td>51</td>
</tr>
<tr>
<td>Stuart</td>
<td>0.1</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

- Alabama seedling
- Low percent kernel
- Somewhat unattractive
- Medium size on mature trees
McMillan

- No scab so far
- Clean tree

Pest resistance years 2003-2006.

<table>
<thead>
<tr>
<th></th>
<th>Leaf Scab</th>
<th>Nut Scab</th>
<th>Black Aphid</th>
</tr>
</thead>
<tbody>
<tr>
<td>McMillan</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Desirable</td>
<td>3.0</td>
<td>2.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Stuart</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Zinner

Quality for years 1-5.

<table>
<thead>
<tr>
<th></th>
<th>Yield</th>
<th>Nuts/lb</th>
<th>% Kernel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinner</td>
<td>0.2</td>
<td>51</td>
<td>55</td>
</tr>
<tr>
<td>Desirable</td>
<td>0.4</td>
<td>52</td>
<td>51</td>
</tr>
<tr>
<td>Stuart</td>
<td>0.1</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

• Auburn selection
• Good size and quality
• Bright kernel
• Not precocious
• Vigorous tree
Zinner

- Needs full-season spray schedule
- Resistance similar to Stuart

Pest resistance years 2003-2006.

<table>
<thead>
<tr>
<th></th>
<th>Leaf Scab</th>
<th>Nut Scab</th>
<th>Black Aphid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinner</td>
<td>1.9</td>
<td>1.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Desirable</td>
<td>3.0</td>
<td>2.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Stuart</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
### Jenkins

*Quality for years 1-5.*

<table>
<thead>
<tr>
<th></th>
<th>Yield</th>
<th>Nuts/lb</th>
<th>% Kernel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenkins</td>
<td>0.5</td>
<td>47</td>
<td>52</td>
</tr>
<tr>
<td>Desirable</td>
<td>0.4</td>
<td>52</td>
<td>51</td>
</tr>
<tr>
<td>Stuart</td>
<td>0.1</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

- Mississippi seedling
- Large cluster size
- Kernel fuzz is common
- Low % kernel on older trees
Jenkins

- No scab so far.

**Pest resistance years 2003-2006.**

<table>
<thead>
<tr>
<th></th>
<th>Leaf Scab</th>
<th>Nut Scab</th>
<th>Black Aphid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenkins</td>
<td>1.0</td>
<td>1.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Desirable</td>
<td>3.0</td>
<td>2.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Stuart</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Excel

Quality for years 1-5.

<table>
<thead>
<tr>
<th></th>
<th>Yield</th>
<th>Nuts/lb</th>
<th>% Kernel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excel</td>
<td>0.3</td>
<td>44</td>
<td>48</td>
</tr>
<tr>
<td>Desirable</td>
<td>0.4</td>
<td>52</td>
<td>51</td>
</tr>
<tr>
<td>Stuart</td>
<td>0.1</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

- Georgia seedling
- Large size
- Low % kernel
- Hard to shell
Excel

- No scab so far.
- Clean tree.

Pest resistance years 2003-2006.

<table>
<thead>
<tr>
<th></th>
<th>Leaf Scab</th>
<th>Nut Scab</th>
<th>Black Aphid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excel</td>
<td>1.0</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Desirable</td>
<td>3.0</td>
<td>2.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Stuart</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Thanks to
The Georgia Agricultural Commodity Commission For Pecan
for its support of our breeding program!