The American Chestnut Foundation’s Breeding Program, Restoration on Mined Lands

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Figure 1.—Natural range of American chestnut.
Chestnut & ARRI

• Why chestnuts?

• Timeline

• Prospects
• Why chestnuts? A lot of open land will be needed for serious chestnut restoration. Appalachian coal country is in the heart of the range of American chestnut. Mine operators will already be restoring their land to forest. Chestnut formerly grew on soils similar to those on mined lands.
Chestnut & ARRI

• Why chestnuts?

• Timeline When will we have good trees for planting?

• Prospects
Our oldest seed orchard: we’re still 5-10 years away from serious nut production
Backcrossing

Expected Proportion
Chinese

1/2

1/4

1/8

1/16

1/16

1/16

C x A

↓

F₁ x A

↓

B₁ x A

↓

B₂ x A

↓

B₃ x B₃

↓

B₃-F₂ x B₃-F₂

↓

B₃-F₃
Blight-resistant Chinese to American $B_3-F_2$.

Nuts from this generation will be planted back into the forest and onto mined land.
Backcrossing

<table>
<thead>
<tr>
<th>Year</th>
<th>Cross Made</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930s</td>
<td>1940s</td>
<td>C × A → F₁ × A → B₁ × A</td>
</tr>
<tr>
<td>1989-1995</td>
<td></td>
<td>B₂ × A</td>
</tr>
<tr>
<td>1996-2003</td>
<td></td>
<td>B₃ × B₃</td>
</tr>
<tr>
<td>2001-</td>
<td></td>
<td>B₃-F₂ × B₃-F₂</td>
</tr>
<tr>
<td>2005-</td>
<td></td>
<td>B₃-F₃</td>
</tr>
</tbody>
</table>
Backcrossing
Need more than one American parent

\[
\begin{align*}
C \times A_1 \\
\downarrow \\
F_1 \times A_2 \\
\downarrow \\
B_1 \times A_3 \\
\downarrow \\
B_2 \times A_4 \\
\downarrow \\
B_3
\end{align*}
\]
Backcrossing

Need more than one American chestnut line

\[
\begin{align*}
C \times A_1 & \quad C \times A_5 & \quad C \times A_9 & \quad C \times A_{13} \\
\downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow \\
F_1 \times A_2 & \quad F_1 \times A_6 & \quad F_1 \times A_{10} & \quad F_1 \times A_{14} \\
\downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow \\
B_1 \times A_3 & \quad B_1 \times A_7 & \quad B_1 \times A_{11} & \quad B_1 \times A_{15} \\
\downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow \\
B_2 \times A_4 & \quad B_2 \times A_8 & \quad B_2 \times A_{12} & \quad B_2 \times A_{16} \\
\downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow \\
B_3 & \quad B_3 & \quad B_3 & \quad B_3 \\
\downarrow & \quad \downarrow & \quad \downarrow & \quad \downarrow \\
B_3^{F2} & \quad B_3^{F2} & \quad B_3^{F2} & \quad B_3^{F2}
\end{align*}
\]
## Number of Trees at Meadowview in 2007

<table>
<thead>
<tr>
<th>Type of Tree</th>
<th>Number of Nuts or Trees</th>
<th>Number of Sources of Resistance</th>
<th>Number of American Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>American</td>
<td>2161</td>
<td>53</td>
<td>222</td>
</tr>
<tr>
<td>Chinese</td>
<td>3404</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁</td>
<td>511</td>
<td>20</td>
<td>83</td>
</tr>
<tr>
<td>B₁</td>
<td>582</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>B₂</td>
<td>1683</td>
<td>11</td>
<td>95</td>
</tr>
<tr>
<td>B₃</td>
<td>1683</td>
<td>9</td>
<td>78</td>
</tr>
<tr>
<td>B₄</td>
<td>30</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>B₁-F₂</td>
<td>471</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>B₂-F₂</td>
<td>223</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>B₃-F₂</td>
<td>18169</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>B₃-F₃</td>
<td>217</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>F₂</td>
<td>253</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>F₃</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>4063</td>
<td>73</td>
<td>116</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33456</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chestnut & ARRI

• Why chestnuts?

• Timeline

• **Prospects** We will have trees more resistant than American chestnut. Whether or not they are resistant enough or American enough to dominate our forests is not clear yet.
Blight-resistant Chinese to American $B_1$-$F_2$, ‘Clapper’ x ‘Graves.’

Obtaining trees like this suggests it should be possible to backcross the blight resistance of Chinese into American chestnut.
Old-timey American chestnut trees. This is the goal. We’re not there yet.