Apple Tree Architecture: More Profitable Orchards (But what about Fireblight?)

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Changes in the US Apple Orchard
## Apple Rootstocks

### Intensified Orchards in 1980s

<table>
<thead>
<tr>
<th>Malling 9</th>
<th>M26</th>
<th>M7a</th>
<th>MM 106</th>
<th>MM 111</th>
</tr>
</thead>
<tbody>
<tr>
<td>(M 9)</td>
<td></td>
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<tr>
<td>Bud9</td>
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Orchard Evolution

1960s Orchard
Red Delicious and Golden Delicious on Seedling Rootstock
Fireblight resistant scions and rootstocks

1980s Orchard
Gala and Fuji on M9 or M26
Fireblight susceptible scions budded onto blight susceptible rootstocks
Fireblight symptoms in August
Orchard Evolution

1990s Paul Steiner created MaryBlyt to predict *Erwinia amylovora* infection events for timing Streptomycin sprays.

Within a decade, Strep-resistant strains evolve and disseminated via commercial nursery stock.
Orchard Evolution

Paul also recognized the problem of rootstock blight, when *Erwinia* moves asymptomatically through the tree and kills the rootstock.

This was formerly thought to be a *Phytophthora* problem.

Particularly troublesome were widely-planted combinations such as Gala / M.9 and Fuji / M.9 for ‘pedestrian orchards’.
Most new, profitable apple cultivars are fireblight susceptible.

To avoid problems, growers would like to use Geneva rootstocks.

While Geneva rootstocks don’t control shoot blight, they can reduce tree mortality from rootstock blight.
Released GENEVA® Apple Rootstocks
Arranged by Tree Size

Seedling Size
M.7-MM106 Size

M.27 Size
M.9 T337
M.9 PAJ 2

M.26 Size

G.65
G.11
G.41
G.935
G.202
G.30

http://cornell.flintbox.com/public/project/21526
This is the Tall Spindle System: No Ladders but a Lot of Labor
High Density Systems
Dependent on Location

Geneva NY ~1200 trees per acre
North Carolina ~450-600 trees per acre

What about here?

Bryan Butler Planting
At Keedysville
April 2010 (Latin Square)
• Cripps Pink and Brookfield Gala budded into all rootstock
• Trained to tall-spindle system: 6’x12’
Planting at Keedysville WMREC

Data
- Fruit Quality
- Tree Size
- Productivity
- Tree Survival
Preliminary Conclusions

• Few differences in fruit quality or fruit size over four years

• Yield and Efficiency (Harvest Index)
  Greater for Brookfield Gala/G935
  No difference among rootstocks used with Cripps Pink (Pink Lady)
Tree Survival Differences

Storm Damage July 2011
Hail Storm August 2013
Storm Damage July 2014
<table>
<thead>
<tr>
<th>Gala</th>
<th>Cripps Pink</th>
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<tbody>
<tr>
<td>(not significant)</td>
<td>- G.202TC (3) nearly 100% survival</td>
</tr>
<tr>
<td>- G.935 (1)</td>
<td>- G.41 (13/28 lost)</td>
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<tr>
<td>- G.935 (9/28 lost)</td>
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</tbody>
</table>

Key:
- 202TC
- 935
- 202
- 41

Brookfield Gala
Cripps Pink

G.41 Cripps Pink
G.202 Cripps Pink
Preliminary Conclusions

Tree Survival – Depended on scion

G.202 and G.202TC exhibited near 100% survival while G.41 and G.935 experienced significant losses.

Cripps Pink is a fireblight susceptible weak scion.

Trade-off?

Fireblight tolerance vs wind damage
Released GENEVA® Apple Rootstocks
Arranged by Tree Size

http://cornell.flintbox.com/public/project/21526
Anecdotal and Research Reports

Graft union weakness in G stocks

Our study at Keedysville
- Rootstock losses severe on G.41
- Union weak, or brittle stock?

Cornell, Penn State and Utah State
- Anatomical differences at the union

Observations in Virginia
- Rootstock shank brittle; not just a weak union
Other long-term fruit projects to reduce fireblight risk in MD orchards

‘Antietam Blush’ Apple:
A grower friendly, fireblight-tolerant scion bred for our hot, humid conditions

Asian pear:
Identify blight-tolerant Asian pear cultivars Olympic for sustainability
Any Questions?