The Ten Commandments for Better Bareroot & Container Seedling Survival

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Seedling Production: 1997-2013

Data from USFS, GFC and Nursery Cooperative

Seedling Production x 1000
0
200,000
400,000
600,000
800,000
1,000,000
1,200,000
1,400,000

1997 1999 2001 2003 2005 2007 2009 2011 2013

79.3%
0.8%
5.4%
0.6%
0.7%
1.2%
12%

The south accounts for what percent of total US production?

Total Seedling Production for US

FY 2012 – 1.1 Billion

Northeast
5.4%
North Central
0.8%
Southeast
79.3%
Southwest
1.2%
Intermountain
0.7%
Great Plains
0.6%
Northwest
12%

### Seedling Production by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>Bareroot</th>
<th>Container</th>
<th>Total Seedling Produced</th>
<th>Total % by Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern</td>
<td>755,413,000</td>
<td>81.4%</td>
<td>1,010,505,000</td>
<td>68.4%</td>
</tr>
<tr>
<td>Northeast</td>
<td>8,828,000</td>
<td>1.0%</td>
<td>1,198,000</td>
<td>0.5%</td>
</tr>
<tr>
<td>North Central</td>
<td>57,701,000</td>
<td>6.3%</td>
<td>6,168,000</td>
<td>2.3%</td>
</tr>
<tr>
<td>Great Plains</td>
<td>5,430,000</td>
<td>0.6%</td>
<td>1,109,000</td>
<td>0.4%</td>
</tr>
<tr>
<td>Intermountain</td>
<td>5,430,000</td>
<td>0.4%</td>
<td>1,109,000</td>
<td>0.4%</td>
</tr>
<tr>
<td>Pacific NorthWest</td>
<td>85,890,000</td>
<td>9.4%</td>
<td>56,041,000</td>
<td>21.1%</td>
</tr>
<tr>
<td>Pacific Southwest</td>
<td>-</td>
<td>-</td>
<td>14,323,000</td>
<td>5.4%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>916,563,000</td>
<td></td>
<td>265,223,000</td>
<td></td>
</tr>
</tbody>
</table>

### Stock Type in the South

- **Container**: 20%
- **Bareroot**: 80%

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What are the big 3 (all conifers)?

- Loblolly Pine: 77%
- Slash Pine: 11%
- Longleaf Pine: 10%
- Other: 2%

The Ten Commandments for Better Bareroot & Container Seedling Survival

Commandment #1

• Thou shall remember that superior seedling genetics will NEVER compensate for poor planting decisions.
Superior Seedling Genetics will not help with…..

- Planting holes that are too shallow or too deep (for longleaf pine)
- Allowing poor quality/culled seedlings to be planted
- Planting hold-over seedlings (container)
- Planting failure due to late season planting
- Planting too soon after chemical site prep

Superior Seedling Genetics will not help with…..

- Poor quality/unsupervised planting job
- Using hand-planting when machine planting is a better option
- Ignoring existing site problems
- Planting when environmental conditions say NO!

Commandment #2

- Thou shall focus on deeper planting holes; and planting loblolly, slash & shortleaf pine deeper on sandy sites or on sites where moisture is limited.

*Ignore this commandment for longleaf pine!*
Our focus tends to be on “J” or “L” rooted seedlings

- “J” and “L” rooted seedlings are not a problem if the planting hole is deep enough.
- Tree planters have been beat over the head with penalties for “J” or “L” rooted seedlings. Perhaps we have unknowingly fostered the practice of root pruning.
Commandment #3

• Thou shall **never never** allow root pruning or root stripping by tree planters.

If you do, … this is a “Do not pass go; go directly to … you know where!”

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Root pruning in nursery versus Root pruning by planters

<table>
<thead>
<tr>
<th>Nursery</th>
<th>Planting site by planters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Balanced seedlings</td>
<td>1. Unbalanced seedlings</td>
</tr>
<tr>
<td>2. Aids lifting</td>
<td>2. Survival decreased</td>
</tr>
<tr>
<td>3. Controlled and uniform</td>
<td>3. Uncontrolled &amp; nonuniform</td>
</tr>
<tr>
<td>4. Roots not exposed to air</td>
<td>4. Exposes roots to air</td>
</tr>
</tbody>
</table>
Commandment #4

- Thou shall remember that larger diameter (RCD) seedlings have larger root systems which are directly related to survival and early seedling establishment.

South (2000). Increasing pine survival and early growth by planting "morphologically improved" seedlings to increase survival and growth.

Root Collar Diameter

- 2.5mm: 9%
- 4.5mm: 11%
- 6.5mm: 17%
- 8.5mm: 19%
- 10.5mm: 20%

Root Weight Ratio

<table>
<thead>
<tr>
<th>RCD at planting (mm)</th>
<th>Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>8</td>
<td>30%</td>
</tr>
<tr>
<td>10</td>
<td>50%</td>
</tr>
<tr>
<td>12</td>
<td>69%</td>
</tr>
</tbody>
</table>

(Y = 100 - 0.207X)
Commandment #5

• Thou shall aim to plant all seedlings early.

Forget I created the month of March!

Why should I plant early?

1. Planting early allows the seedlings to become established before spring growth begins.

New root growth and planting date

- Seedlings planted every 2 weeks Nov to March
- All dug up on April 23 or June 13
Why should I plant early?

1. Planting early allows the seedlings to become established \textit{before} spring growth begins.

2. \textbf{Planting early provides the greatest chance of survival and minimizes the potential impact of bad weather.}

From Wakeley 1954, pg 127

Effects of planting date on bareroot loblolly pine survival

Why should I plant early?

1. Planting early allows the seedlings to become established \textit{before} spring growth begins.

2. Planting early provides the greatest chance of survival and minimizes the potential impact of bad weather.

3. \textbf{Planting early gives you a jump on seedling growth.}
Why should I plant early?

1. Planting early allows the seedlings to become established before spring growth begins.
2. Planting early provides the greatest chance of survival and minimizes the potential impact of bad weather.
3. Planting early gives you a jump on seedling growth.

4. **Seedlings coming from the nursery early have higher level of nutrition.**

Seedling Nutrition

- Bareroot and Container nurseries manage seedling growth during the growing season so they reach their target size at the beginning of the shipping season.
- Prior to and after this target size is achieved, fertilization is normally reduced or stopped.
- Therefore, seedlings shipped early generally will have the highest seedling nutrition.
- The level of nutrients in the spring determines the ability of the seedling to initiate root growth.
When should I plant?

- **Container Seedlings:**
  1. When site prep is properly completed
  2. When there is adequate soil moisture
  3. When the container plug holds together

- **Bareroot Seedlings:**
  1. Mid-November to February
  2. When site prep is properly completed
  3. When there is adequate soil moisture

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**Commandment #6**

• Thou shall not skimp on planting cost with high value seedlings such as controlled mass pollinated seedlings.

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Hand or Machine Planting?
Other site concerns – wet sites and pine tip moth
Commandment #7

- Thou shall always remember that the “once in a 100-year” freeze, flood or drought may happen this year.

That 1 in 100 year event

- Can’t predict these events
- Best advice?

Freeze Injury

- Seedlings can recover!
Commandment #8

• Thou shall handle the seedlings with care after picking them up from the nursery – avoid conditions that may stress the seedlings.

• Never pick up seedlings in an uncovered - nontarped truck.
• Watch where you park the truck or trailer.
• This goes for both bareroot and container seedlings

• Minimize seedling exposure
  • "If they dry, they die"

• The best protection, especially for a large planting job is an on-site reefer or only pick-up as many seedlings as you can plant in a day.
Commandment #9

• Thou shall plant the seedlings properly.

  Remember
  Green side up!

The Do's and Don'ts of Planting

Do

• Plant seedlings as soon as they arrive at the site.
• Create a good planting hole (at least 8” deep).
• Properly align the seedling in the hole.
• Pack the soil around the seedling to insure contact of the soil and roots.
• Check planting quality by gently pulling on top of seedling.

Don't

• Plant in dry soils.
• Plant if temperatures are < 35 F and falling.
• Plant if soils are frozen.
• Plant too fast - both hand and machine planters.
• Allow handplanters to carry seedlings out of the bag in their hand from hole to hole.
• Plant too soon after chemical site prep.
Improper Planting with Hoedad

Lack of contact between the roots and soil.

HOEDAD

PLANTING PROCEDURE WITH HOEDAD

YES!

IMPROPER PLANTING WITH HOEDAD

NO!

Lack of contact between the roots and soil.
Commandment #10

• Thou remember that all container seedlings are not created equal.

Marketing is not the same thing as research

• Container trays are made of different materials.
• The growing configuration of seedlings (density, root volume and dimensions) within a container differs.
Summary

1. Don’t make poor decisions
2. Focus on deep planting holes
3. Never allow root pruning
4. Large diameter seedlings and large roots are your friend
5. Plant early
6. For high price seedlings don’t skimp on planting costs
7. Watch out! – this may be the 1 in 100 year event
8. Handle the seedlings carefully
9. Plant seedlings properly
10. All container seedlings are not created equal

Questions?

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Research Toward Increasing Nursery Productivity