Lodgepole pine crop statistics from SelectSeed Ltd. orchards

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Why we care

▲ Cooperative provincial objectives
  ▲ 75% select seed use by 2014
  ▲ Economic basis for target
  ▲ SelectSeed charged with adding to supply to meet objectives
SelectSeed Ltd. financial objectives

- Sustainable profit by 2013
- Target return on capital employed of 3%
Planning seed orchard capacity to meet provincial demand

- Provincial priorities are set using economic analyses
  - 18 reforestation species and over 90 seed planning units
  - SPU = species/seed zone/elevation combination
    - i.e. Lodgepole pine / Prince George zone / 700-1400m
  - Target 75% of provincial seedling demand from select seed

- Orchard capacity set to meet SPU seedling demand
  - Breeding programs provide material for orchards
Determining needed orchard capacity

For SPUs deemed worthy of breeding and seed orchard investments, the question is: How much orchard capacity is needed to:

- Provide a secure supply of seed?
- Allow orchards to be upgraded and replaced?
First…..
What is the long-term seedling demand?

△ Lodgepole Pine / Prince George / 700-1400m

Seedling Use Trend - 2000 to 2013

5-year average
= 28.4 million

Data from SPAR
Second....
how much seed do we expect a ramet produce?

- Highly variable by year and site
- Orchard management inputs matter

Coastal Douglas-fir seed orchard production
Historical and predicted production - grams / orchard tree

Lots of data
Not much data
Second.... how much seed does an orchard ramet produce?

△ A best-guess smoothed production curve is applied
Third…. what seedling recovery factor should be used?

▲ Seedling recovery factor = seeds per seedling (seedlings per gram of seed)

▲ Current practice is not necessarily future practice
  ▲ Higher seed cost will influence nursery and nursery-customer decisions regarding sowing factors
  ▲ Nursery practice
    ▲ Outdoor compound vs. greenhouse
Seedling recovery factors vary by species

<table>
<thead>
<tr>
<th>Species</th>
<th>Recovery Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pli</td>
<td>1.25 seeds/seedling</td>
</tr>
<tr>
<td>Fdc</td>
<td>1.79</td>
</tr>
<tr>
<td>Fdi</td>
<td>1.79</td>
</tr>
<tr>
<td>Sx</td>
<td>2.2</td>
</tr>
<tr>
<td>Lw</td>
<td>2.0</td>
</tr>
<tr>
<td>Pw</td>
<td>2.5</td>
</tr>
<tr>
<td>Cwr</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Curve developed in seedlings / ramet

A mature-ramet production level is applied for orchard-size planning

1500 seedlings per orchard tree per year
Estimate needed orchard capacity

Example for Pli Prince George 700-1400m

Calculate the number of ramets of orchard capacity needed to meet demand

\[
\text{28.4 million average annual demand} \div \text{1500 seedlings worth of seed per year per ramet} = \\
\text{18,930 ramets needed}
\]
But....this assumes everything works and orchards are always mature....

Therefore, an expansion factor is needed to accommodate:
- The maturing phase for orchards
- Risk....like trees dying, pests, wind, etc
- Errors in estimates

Expansion factors of 1.3 for all species except spruce (1.25)

28.4 million average annual demand / 1500 seedlings worth of seed per year per ramet =

18,930 ramets needed x 1.3 = 24,610 ramets
Actual lodgepole pine seed production in SelectSeed Ltd. orchards (with partners)

▲ SelectSeed Pli orchards (in partnership with others)
  ▲ 9 orchards; 29.5 thousand ramets
  ▲ 3 southern populations (Nelson, Thompson Okanagan high and low)
  ▲ 3 northern populations (Pr. George, Bulkley Valley, Central Plateau)
Age-adjusted cone production per orchard position

Pli cone production in age adjusted liters per orchard position

Approximate ramet age

Liters cones per orchard position

All Pli orchards
Age-adjusted cone production per orchard position: Northern vs. southern SPUs

[Graph showing Pli cone production in age adjusted liters per orchard position]

- Approximately ramet age
- Liters cones per orchard position
- Pli cone production in age adjusted liters per orchard position
  - All Pli orchards
  - Pli north SPUs
  - Pli south SPUs
Seed yields per hectoliter of cones
Northern vs. southern SPUs

Pli grams seed per hectoliter

Grams seed / Hl

Pli north SPUs
Pli south SPUs
Pli age-adjusted seed production per orchard position

Forecast is per ramet
Actual is per orchard position (some vacant)

4 grams per position = approximate profit level
Pli age-adjusted seed production per orchard position

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Age-adjusted seed production per orchard position: Northern vs. southern SPUs

- Forecast is per ramet
- Actual is per orchard position (some vacant)
- 4 grams per position = approximate profit level
Business implications

- Orchard financial objectives
  - Southern SPU orchards on track
  - Northern SPU orchards below expectations (to date)

- Meeting seed demand
  - Southern SPUs at or approaching targets
  - Northern SPUs not meeting customer demand
General observations

▲ More ramet management vs. larger orchards and less management – technology is not always the best fix

▲ Pli orchard locations
  ▲ Transitional environments that are just outside the Pli range, but cooler and wetter than the north Okanagan

▲ Meeting financial objectives with Pli
  ▲ Advantage of crops nearly every year
  ▲ Very large orchards = high site costs relative to other species
  ▲ Expensive to harvest

▲ The likely future
  ▲ Extensive, low-cost and low-input Pli orchards (similar to Sweden)
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