Short-term carbon partitioning fertilizer responses vary among two full-sib loblolly pine clones

Jeremy P. Stovall
John R. Seiler
Thomas R. Fox

2/15/2011
Clonal Fertilizer Response
Hypotheses

• So how are clones responding to fert?
  – Photosynthesis..... Some clones (King et al. 2008)
  – Biomass partitioning..... (Stovall et al. 2011)
  – Respiratory C fluxes.....  ?
Greenhouse Experiment

- Wakulla series (SETRES)
- 2 Clones w/ same parents
  - C 34: Narrow crown
  - C 769: Wide crown
- 2 Fertilizer levels
- 4 Monthly Harvests
- 8 Replications
The influence of N and P supply and genotype on carbon flux and partitioning in potted *Pinus radiata* plants

HORACIO E. BOWN, MICHAEL S. WATT, PETER W. CLINTON, EUAN G. MASON and DAVID WHITEHEAD


Primary production and carbon allocation in relation to nutrient supply in a tropical experimental forest

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C Budgeting Simplified

- GPP = ANPP + APR + TBCF
- TBCF = $F_S + \Delta C_R$
Measuring APR & $F_S$ Directly
Quantifying ANPP & $\Delta C_R$

Using Monthly Harvest Data

\[ \text{biomass} = a \cdot (\text{basal diameter})^b \cdot (\text{height})^c \]

### Aboveground Biomass

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Coefficients</th>
<th>Statistics</th>
<th>F</th>
<th>p-value</th>
<th>$R^2$</th>
<th>N</th>
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<td>b</td>
<td>c</td>
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### Belowground Biomass

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Other Method Details

• All values integrated over 121 days
• $Q_{10}$ 2.0 for respiration rates (Ryan et al. 1991)
• All data treatment-combo specific
• Harvest vs. other tree measurements
Growth Is Similar

![Bar chart showing growth comparison between clones C34 NF, C34 F, C769 NF, and C769 F. The chart indicates that growth is similar for all clones.]
Fertilizer Effect on C Allocation

![Bar chart showing the effect of fertilizer on C allocation. The x-axis represents different components of C allocation, and the y-axis represents g C. The chart indicates significant differences (p < 0.01) for certain categories.](chart.png)
Belowground Allocation Clonal Effect

p < 0.01
Total Belowground C Flux

- C 34
- C 769

p < 0.01
Aboveground Respiration Interaction

![Bar chart showing the interaction of aboveground respiration for different treatments. The chart indicates statistical significance with p < 0.05 for certain comparisons.](chart.png)
Clone x Fert Allocation Interactions

- NPP / GPP: p < 0.05
  - C34 Control
  - C34 Fert
  - C769 Control
  - C769 Fert

- ANPP / GPP: p < 0.05
- APR / GPP: p < 0.10
Whole Carbon Budget
Differences in Clonal Allocation

C 34

APR

ANPP

$F_S$

$\Delta C_R$

C 769

APR

ANPP

$F_S$

$\Delta C_R$
Conclusions and Implications

• So how do clones respond to fertilizer?
  – Photosynthesis..... Some clones (King et al. 2008)
  – Biomass partitioning..... (Stovall et al. 2011)
  – Respiratory C fluxes..... This greenhouse study

• Can’t generalize across clones

• Can we find ideotypes?
Questions?

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