Manipulating chain type and flail drum speed for better fibre recovery in CFDDC operations

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Overview

- Background
- Description of study and site
- Results
- Conclusions
Background

- Western Australia has 253,000ha hardwood plantations (*E. globulus*), 28% of Australia’s total
- Second rotation decline in marginal areas is an issue for plantation managers
- Low yielding sites require an innovative approach

Abares 2019
Goals of the study was to determine if the installation of new lighter chains run at a slower speed would result in a measurable increase of:

- Fiber recovery
- Productivity and
- Fuel efficiency
- Without incurring a significant decline in quality of chip product
Study Description

- Compare flail chains within a Peterson Pacific 5000H Chain Flail Delimber Debarker Chipper (CFDDC)
  - Standard chain
  - Light chain

- The CFDDC was run under three different treatments
  - Control – Standard chain, standard settings (661rpm)
  - Light – Light chain, standard settings (661rpm)
  - Light Slow – Light chain, optimised settings (440rpm)
Function Standard chain –
17mm, 5 square 3 oval, 2492g

Function Light chain –
15mm, 8 oval, 1919 g
Study site

• 12-year-old (P.94) second rotation Bluegum plantation, originally harvested in 2006, then coppiced. ~120km NE of Albany
• Coppice thinned at age ~2 years
• 21.1ha
• 64 green tonnes/ha chips
• Average piece size 0.1m³
Study site
Site was cut using different gullets for each treatment
Measurements

• Fiber recovery was estimated by matching the mass of a chip load with the raw mass of the trees fed to the CFDDC in order to produce that same chip load.

• Each tree pack for the whole compartment was weighed on a purpose built 12t frame.

• 452 packs, 2611t, ave pack weight 5.8t

• Productivity and fuel efficiency were estimated by associating chip mass output with time and fuel inputs.
Chip quality

- 1348.5t of chips harvested (64t/ha)
- Chip quality determined at the receiving plant, where 2kg samples were collected from the trucks upon arrival during the unloading process
- Fraction classified with a Kazon vibrating separator
- Bark allowance <1%

Results of the chip quality study (% of sample weight)

|                      | Mean |  
|----------------------|------|------
| Bark                 | 0.5  | 0.7  |
| Accepts (28 - >5mm)  | 88.9 | 88.4 |
Results

Box Plot
Split By: Treatment

Units

Box Plot
Split By: Treatment

Units

Box Plot
Split By: Treatment

Units

Forest Industries Research Centre
## Results

### Results of the productivity study

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>45.7</td>
<td>8</td>
</tr>
<tr>
<td>Light</td>
<td>50.4</td>
<td>6</td>
</tr>
<tr>
<td>Light slow</td>
<td>59.7</td>
<td>12</td>
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Productivity at PMH⁻¹ with p = 0.0120.

Differences were statistically significant at the 5% level.
## Results

### Results of the fuel efficiency study

<table>
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<tr>
<th>Treatment</th>
<th>Mean</th>
<th>n</th>
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<tr>
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<tr>
<td>Light</td>
<td>3.2</td>
<td>6</td>
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<tr>
<td>Light slow</td>
<td>2.6</td>
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Differences were statistically significant at the 5% level.
## Results

### Results of the fiber recovery study

<table>
<thead>
<tr>
<th>Fiber Recovery % Mass in</th>
<th>Treatment</th>
<th>Mean</th>
<th>n</th>
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</thead>
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<tr>
<td></td>
<td>Control</td>
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<td>16</td>
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<tr>
<td></td>
<td>Light</td>
<td>51</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Light slow</td>
<td>55</td>
<td>24</td>
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</table>

Differences were statistically significant at the 5% level.
Conclusion

Comparison of Standard verses Light slow

- Fibre recovery +12%
- Fuel consumption -30%
- Nett productivity +20%
- Chip quality no significant difference

- Light slow in this type of plantation is now the preferred method
Acknowledgments

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Thank-you