Objective 4

Determine the optimum processing parameters & protocols for peeling coconut stems & the properties of the recovered veneer

Rob McGavin
Research Facility and Project Manager, Qld DAFF
Project Objectives

1. Identify markets
2. Forestry: stem harvesting
3. Peeling in S. Pacific
4. Peeling trials
5. Assemble and test products

By-product utilisation

Advanced veneer and other products from coconut wood
Objective 4 – Peeling Trials

1. Identify markets
2. Forestry: stem harvesting
3. Peeling in S. Pacific
4. Assemble and test products

By-product utilisation

Advanced veneer and other product from coconut wood
Objective 4 – Peeling Trials

Objective 4 – Determine the optimum processing parameters & protocols for peeling coconut stems & the properties of the recovered veneer

4.1 – Assessing veneer processing parameters for cocoveneer (Trial 1)

4.2 – Calibrating processing parameters at QDAFF Salisbury Research Facility (Trial 2)

4.3 – Initial compact experimental peeling trial in Fiji (Trial 3)

4.4 – Compact commercial peeling trial in Fiji (Trial 4)

4.5 – Broad industrial peeling trial in Fiji (Trial 5)

4.6 – Properties and recovery assessment
4.1 – Assessing veneer processing parameters for cocoveneer

• Optimum peeling parameters assessed from disc trials at ENSAM in France
• Micro-lathes used to determine lathe settings and stem pre-conditioning requirements
• Physical work completed, analysis and reporting in progress
Cocowood

Relative Radius (mm)

Height (m)

Density (Kg/m³)

Cocowood
Cocowood
Peeling + =
Micro-lathe

Drive system

Cutting zone
Classical chuck system

Modification for coco-disk
SMOF + Lathe checks = 

[Image of SMOF machine and image of lathe checks]
Lathe checks
## Temperature effect

### Experiment plan

<table>
<thead>
<tr>
<th></th>
<th>50 °C</th>
<th>60 °C</th>
<th>70 °C</th>
<th>80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1h</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>4h</td>
<td>×</td>
<td>-</td>
<td>-</td>
<td>×</td>
</tr>
</tbody>
</table>

### Results

![Graph showing effort (N/cm) vs temperature and time](image1)

![Graph showing effort (N/cm) vs temperature and time](image2)
Ambient Temperature

Damages on the knife

Conclusion

- Temperature
- Time

- 80°C
- 1 hour (disc)
Pressure

Definition

\[ P = \frac{E - G}{E} \]

G : Gap between knife and nose bar
E : Veneer Thickness
Ch : Horizontal Gap
Cv : Vertical Gap
Pressure

Experiment plan

<table>
<thead>
<tr>
<th>Nose bar</th>
<th>5 %</th>
<th>7 %</th>
<th>10 %</th>
<th>12 %</th>
<th>15 %</th>
<th>20 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angular</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cylindrical</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Observations

Angular:
- Chipping
- Image analysis (SMOF) **impossible**

Cylindrical:
- Continuous ribbon (low and medium density)
- Image analysis (SMOF) **possible** (low and medium density)
Pressure

Results

<table>
<thead>
<tr>
<th>Ribbon quality</th>
<th>- -</th>
<th>-</th>
<th>+</th>
<th>++</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean. Xc (N/cm)</td>
<td>-14,39</td>
<td>-11,35</td>
<td>-10,06</td>
<td>-7,50</td>
</tr>
<tr>
<td>Std Dev. Xc</td>
<td>2,34</td>
<td>1,78</td>
<td>1,62</td>
<td>1,09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure</th>
<th>5%</th>
<th>10%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean. Xc (N/cm)</td>
<td>-9,05</td>
<td>-10,17</td>
<td>-15,10</td>
</tr>
<tr>
<td>Mean. Thickness (mm)</td>
<td>2,55</td>
<td>2,53</td>
<td>2,43</td>
</tr>
<tr>
<td>% lathe checks</td>
<td>47,89</td>
<td>45,48</td>
<td>49,97</td>
</tr>
</tbody>
</table>

Conclusion

- 20% unfavorable
- 5% et 10% favorable
- 10% : Best quality
Définition

Disk

Nose bar

Couteau

Ch

Cv

G

T

E

Placage

Experiment plan

<table>
<thead>
<tr>
<th>Cv</th>
<th>5 %</th>
<th>10 %</th>
<th>20 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,26</td>
<td>-</td>
<td>×</td>
<td>-</td>
</tr>
<tr>
<td>1,1</td>
<td>-</td>
<td>×</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>0,9</td>
<td>-</td>
<td>×</td>
<td>-</td>
</tr>
<tr>
<td>0,7</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>0,5</td>
<td>-</td>
<td>×</td>
<td>-</td>
</tr>
<tr>
<td>0,4</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>0,3</td>
<td>-</td>
<td>×</td>
<td>-</td>
</tr>
<tr>
<td>0,1</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>
Results

- Correlation -0.61 between thickness standard deviation and vertical gap.
- Effect of the diameter of the cylindrical nose bar?
Conclusion on the best settings

- temperature 80 °C and time (1h)
- cylindrical bar pressure
- 10% pressure

The implementation on production lathe will require a larger diameter cylindrical nose bar in order to make the pressure more uniform and get away from the stress field model of the angular bar.
4.2 – Calibrating processing parameters at QDAFF Salisbury Research Facility

• Peeling trials in order to validate and refine parameters established during Trial 1
• Trial includes
  — Pre-conditioning
  — Peeling
  — Grading
  — Drying
  — Handling
• Using QDAFF lathe and new lathe
4.2 QDAFF Calibrating Trials

- Trial 2 – either with QDAFF or new lath
- Stems sourced from North QLD but low density
- Stems harvested in Taveuni, cored at Pacific Green and being shipped to QDAFF
Objective 4 – Peeling trials

4.3 – Initial compact experimental peeling trial in Fiji

• Stems from two sites in Fiji processed to verify parameters developed
  • Recovered material shipped to QDAFF used for production trials
  • Stems to be
    — Peeled
    — Dried
    — Graded
Objective 4 – Peeling trials

4.4 – Compact commercial peeling trial in Fiji

- Trial to assess viability of commercial production
- Stems from two sites in Fiji processed at VTB mill at Labasa
- Lathe setup verified
- Processing and handling protocols tested and refined
- Recovered material shipped to QDAFF used for product trials
4.5 – Broad industrial peeling trial in Fiji

- Peeling trial at experimental facility in established in Fiji
- Stems from each resource centre peeled
- Material characteristics determined
- Peeling, handling and grading protocols tested
- High quality recovered material shipped to QDAFF for product tests
Objective 4 – Peeling trials

4.6 – Properties and recovery assessment

- Recovered veneer quality assessed
- Strength, dimensional stability, gluing characteristics etc. will be determined
- Recovery data collected for economic assessment
## Key completion dates –

<table>
<thead>
<tr>
<th>Activity</th>
<th>Planned</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc peeling at ENSAM micro-lathes</td>
<td>Feb 2013</td>
<td>July 2013</td>
</tr>
<tr>
<td>Calibration peeling trials at QDAFF</td>
<td>Sep 2013</td>
<td>Feb 2014*</td>
</tr>
<tr>
<td>Peeling trial in Fiji</td>
<td>Sep 2014</td>
<td>Sep 2014*</td>
</tr>
<tr>
<td>Compact commercial peeling trial in Fiji</td>
<td>Jan 2014</td>
<td></td>
</tr>
<tr>
<td>Commercial peeling trial</td>
<td>August 2015</td>
<td></td>
</tr>
<tr>
<td>Recovered material assessments</td>
<td>after each peeling trial</td>
<td></td>
</tr>
</tbody>
</table>

* Revised planned date
**Key activities next 12 months** –

<table>
<thead>
<tr>
<th>Activity</th>
<th>Anticipated completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peeling trial 2 complete on modified lathe at QDAFF</td>
<td>February 2014</td>
</tr>
<tr>
<td>Advanced planning for Trial 3</td>
<td></td>
</tr>
</tbody>
</table>