

Objective 4

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

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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 QDAF Salisbury Research Facility (Trial 2)

4.3 – Initial compact experimental peeling trial at TUD, Nasinu, Fiji (Trial 3)

4.4 – Compact commercial peeling trial at VTB, Labasa, Fiji (Trial 4)

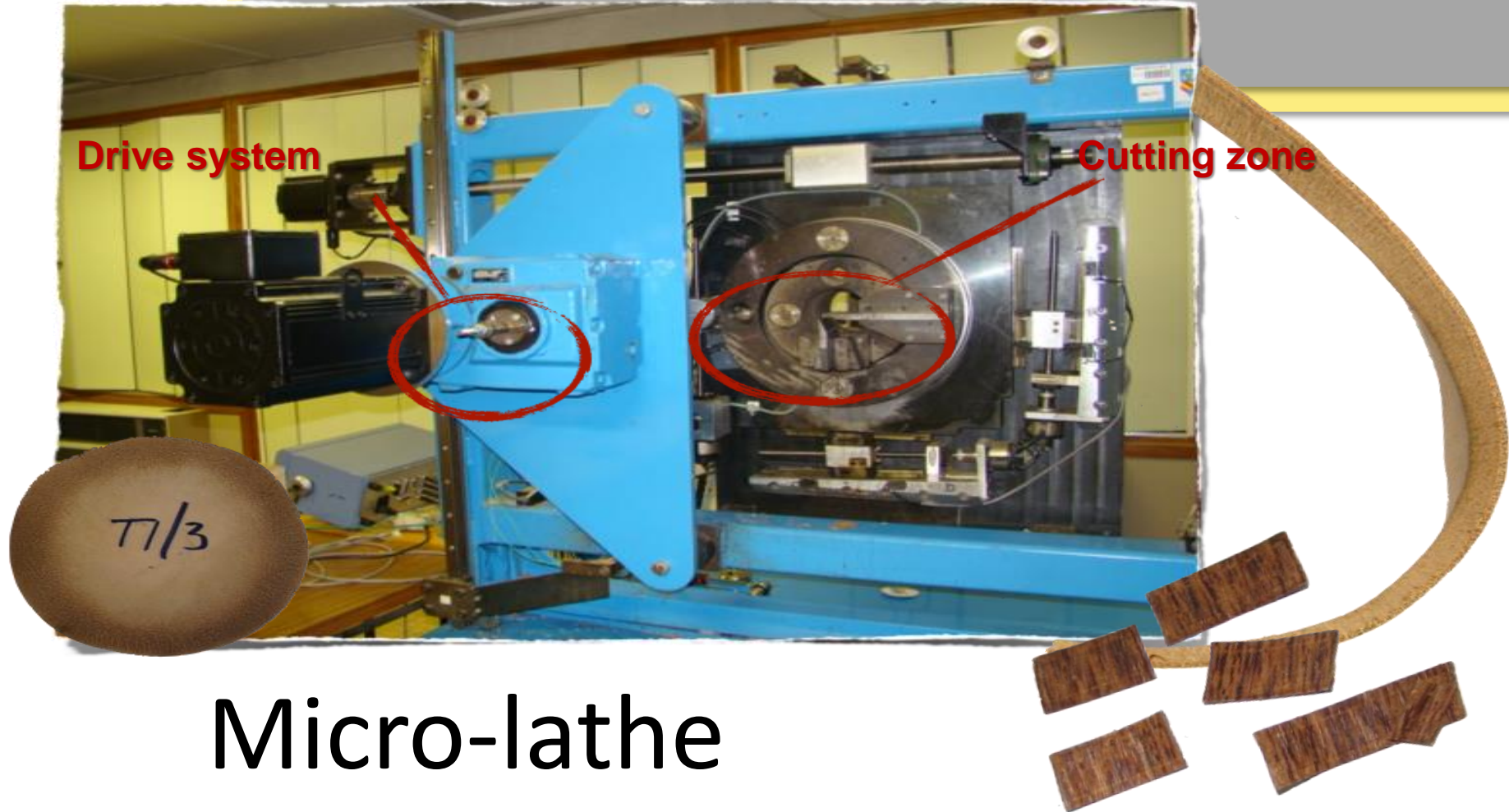
4.5 – Broad industrial peeling trial in Fiji at TUD, Nasinu, Fiji (Trial 5)

4.6 – Properties and recovery assessment at QDAF Salisbury Research Facility

Objective 4 – Trial 1

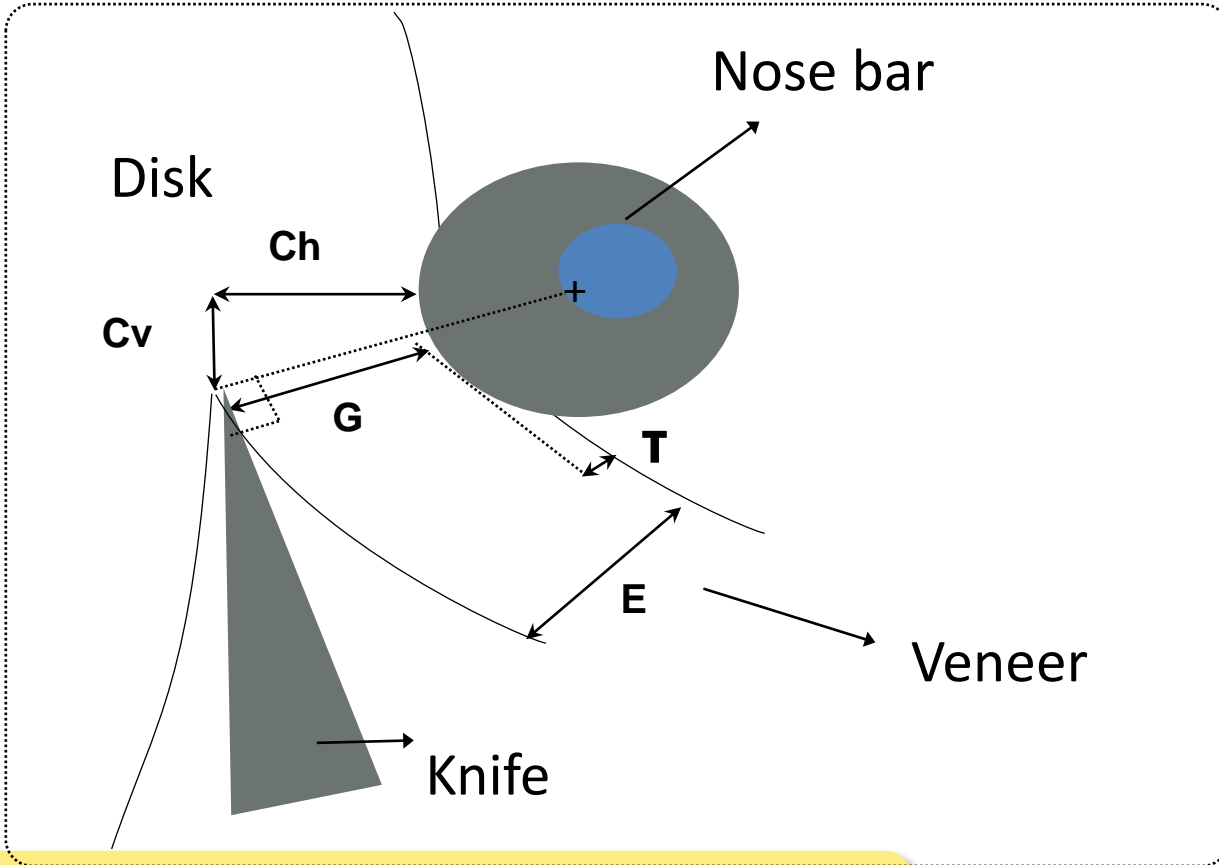
4.1 – Assessing veneer processing parameters for cocoveneer

- **LAB SCALE** – determine optimum peeling parameters assessed from disc trials at ENSAM in France
- Micro-lathes used to determine lathe settings and stem pre-conditioning requirements



Micro-lathe

Trial 1 - Range of parameters trialed



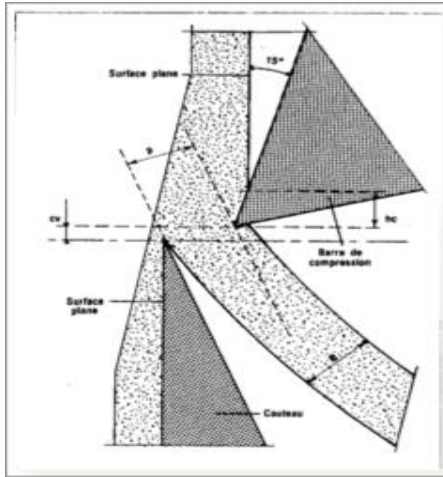
G : Gap between knife and nose bar

E : Veneer Thickness

Ch : Horizontal Gap

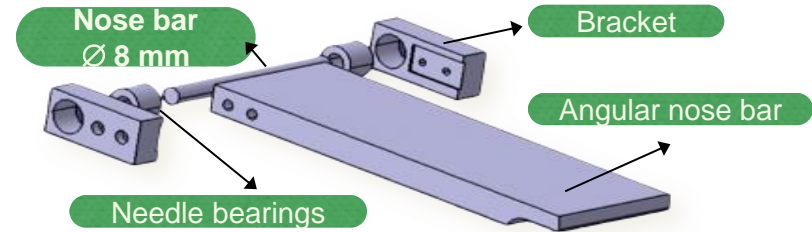
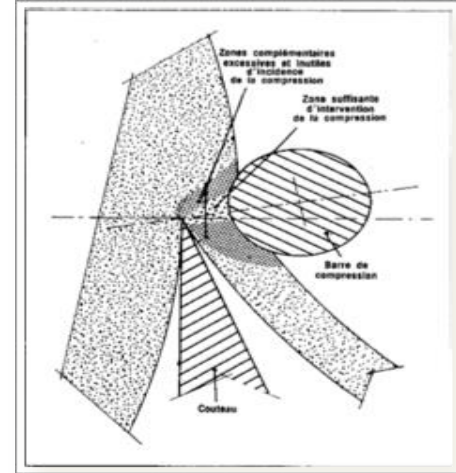
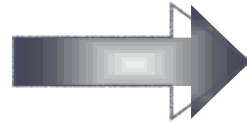
Cv : Vertical Gap

Trial 1 - Range of parameters trialed



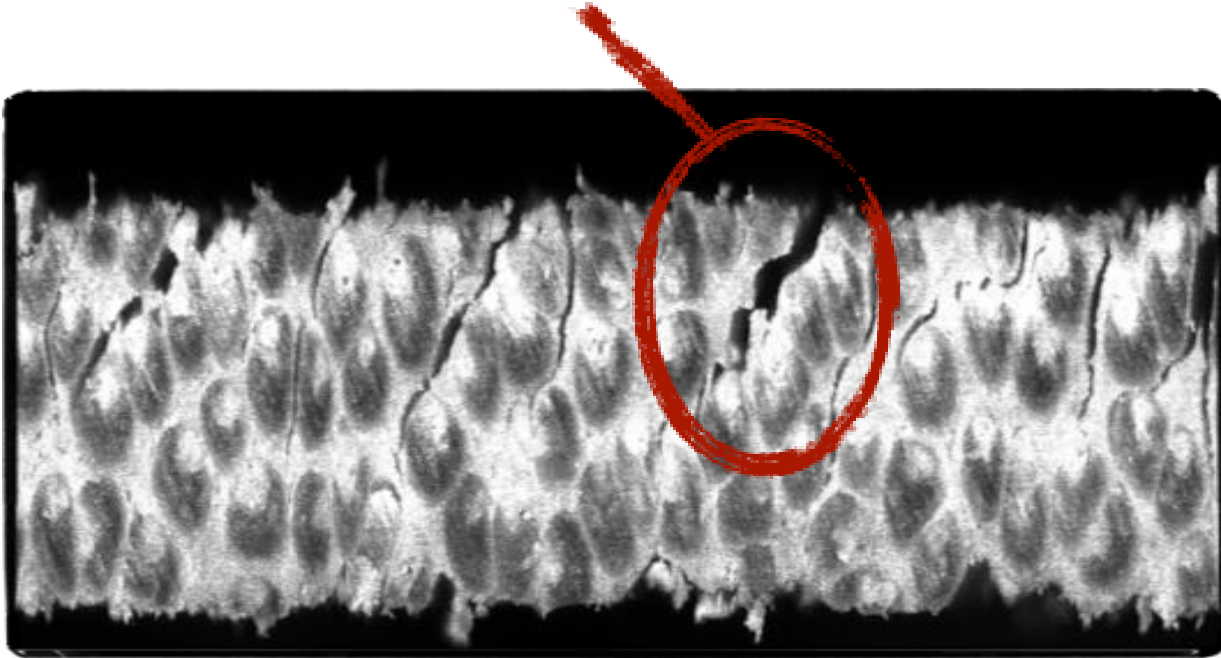
Angular

Cylindrical



Trial 1 - Range of parameters trialed

Lathe checks



Trial 1 – Completed

PEER-REVIEWED ARTICLE

bioresources.com

Experimental Investigation on Rotary Peeling Parameters of High Density Coconut Wood

Henri Bailleres,^{a,*} Louis Denaud,^b Jean-Claude Butaud,^b and Robert L. McGavin^a

Substantial quantities of senile coconut palms are present in plantations within the Asia-Pacific region. Once coconut palms become over-mature, their production of traditional products, such as coconuts, significantly decreases, resulting in profitability challenges for farmers. Presently, few profitable markets exist for over-mature, senile coconut palms. Using the coconut palm stem in composite or engineered wood products could, however, provide an attractive alternative. Due to some of its unique characteristics, a processing system able to recover wood from the high-density zone near the stem periphery is desirable. A series of rotary veneer laboratory trials were undertaken to establish fundamental benchmark lathe settings and veneering characteristics for coconut palm stems. Different pressure bar configurations, billet pre-treatment temperatures, and veneer thicknesses were tested, and the resulting cutting forces and veneer quality were assessed. Optimal setting recommendations for peeling coconut wood are provided.



EXPERIMENTAL APPROACH OF COCONUT PEELING PROCESS



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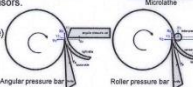
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Introduction

A substantial area of senile coconut palms exists within the Asia-Pacific region. Once coconut palms become over-mature and senile, their production of traditional products, such as coconuts, significantly decreases, resulting in profitability challenges for farmers. Due to some of its unique characteristics, a processing system able to recover wood from the high-density zone near the stem periphery is desirable. A series of rotary veneer laboratory trials were undertaken to establish fundamental benchmark lathe settings and veneering characteristics for coconut palm stems.

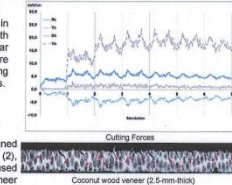
Material and Methods

- Cocowood Sampling**
A total of 43 senile coconut palms (70 or more years old) were sampled from several Fiji plantations. Four discs, 25 mm thick, were taken from each palm trunk. These were cut from the trees at breast height (approximately 1.3 m from the ground) and then 25, 50, and 75% of the stem height and were labeled D1, D2, D3, and D4, respectively.
- Veneer processing**
Veneer processing was done using an instrumented micro-lathe system developed by the LaBoMaP (Arts et Métiers ParisTech AMPT) in Clunay, France (1). The micro-lathe system peels discs equipped with force sensors.
- Trials:**
 - Pressure bar/type (pressure)
 - Heating temperature
 - Veneer thickness
 - Clearance angle



Quality indicators

- Cutting Forces**
The forces exerted in the cutting plane, both on the pressure bar and the knife, were measured using piezoelectric load cells.
- Veneer Quality**
A specifically designed apparatus (SMOF) (2), optical system) was used to characterize veneer lathe checks. Veneer checks produced during peeling are opened by bending the veneer on a diameter roller. The software algorithm identifies each check, calculates its depth, and determines the distance between consecutive checks. Only veneers with a visual score of 2 or above were assessed with the SMOF.

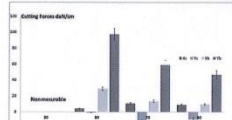


Results and conclusions (3)

	Mean Xz (daN)	Mean Yz (daN)	Mean Zz (daN)	Mean Tz (daN)	Mean veneer quality score
N=11	9.05 (1.48)	8.60 (2.86)	2.28 (0.91)	-16.65 (8.93)	2.84 (1.39)
N=7	19.17 (7.71)	19.30 (2.60)	2.85 (0.76)	-23.68 (8.06)	2.42 (1.16)
N=5	18.30 (9.29)	14.61 (8.19)	5.77 (1.36)	-33.65 (8.06)	1.67 (1.32)

Mean Cutting Forces and Mean Veneer Quality Scores for Different Compression Rates

Compression rate (%)	Mean Cutting Force (daN)	Mean Veneer Quality Score
r1	1.30	2.94
r2	0.50	1.57
r3	1.21	4.08
r4	0.10	2.31
r5	1.21	2.03



Objective 4 – Trial 2

4.2 – Calibrating processing parameters at QDAF Salisbury Research Facility

- Peeling trials in order to validate and refine parameters established during Trial 1
- Difficulties sourcing suitable coconut billets
 - North Qld billets – low/medium density
 - Fiji high density hollow billets – not successful
- Modified lathe preliminary testing



Trial 2



4.3 – Initial compact experimental peeling trial

- Fiji stems processed to verify parameters developed
- Experimental veneer processing equipment at TUD, Nasinu, Fiji
- Preliminary training of TUD staff in equipment operation
- Recovered material shipped to QDAF
 - Veneer quality assessments
 - Veneer compression trial
 - Preliminary product investigation

Trial 3 – TUD

4.3 – Initial compact experimental peeling trial in Fiji

- Lathe performed well
- Some issues with supporting equipment
 - pretreatment chamber: couldn't heat logs hot enough!
- 23 logs (1.5 m³), 249 veneer sheets
- Around 60% recovery
- Veneer quality negatively impacted by lack of log heating capacity and lack of opportunity to optimise lathe settings
- Quality and volume insufficient for product development
- Additional processing scheduled in June 2015
 - Supporting equipment not prepared
 - Logs weren't available



Objective 4 – Peeling trials



Advanced veneer and other product from coconut wood

Trial 3 – TUD

Department of Agriculture and Fisheries

- Report completed
 - Includes veneer quality assessments

ACIAR FST/2009/062 Development of advanced veneer and other products from coconut wood to enhance livelihoods in South Pacific communities

DAF Report - Coconut palm stem veneer processing

Trial 3

July 2015



Trial 4 – VTB commercial trial

4.4 – Compact commercial peeling trial in Fiji

- Scale up to commercial production
- Fiji stems processed at VTB production mill at Labasa
- Lathe settings verified
- Processing and handling protocols tested and refined
- Recovered material shipped to QDAF

Trial 4 – VTB commercial trial

4.4 – Compact commercial peeling trial in Fiji

- Completed in June 2015
- 171, 2500mm billets processed
- About 15 m³ of veneer
- Demonstrated the challenges of peeling coconut
- Further reinforced the necessity of billet pre-conditioning
- No drying challenges
- Good quantity of suitable quality veneer for product development activities.

Success!!

Trial 4 – VTB commercial trial



Trial 4 – VTB commercial trial



Trial 4 – VTB commercial trial



Trial 4 – VTB commercial trial



Trial 4 – VTB commercial trial



Trial 4 – VTB commercial trial

4.4 – Compact commercial peeling trial in Fiji

- Veneer scheduled for arrival to DAF Salisbury Research Facility
- Veneer volumes, grade quality etc etc. to follow

4.5 – Broad industrial peeling trial in Fiji

- Peeling trial at TUD's using experimental veneer processing facility
- Material characteristics confirmed
- Peeling, handling and grading protocols confirmed
- Recovered veneer shipped to QDAF for product testing

4.6 – Properties and recovery assessment

- Recovered veneer quality assessed
- Strength, dimensional stability, gluing characteristics etc to be determined
- Recovery data collected for economic assessment

Veneer assessment

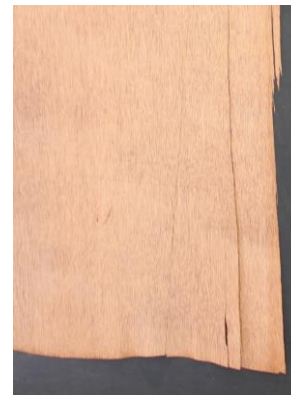
Veneer quality assessment

- Trial 2 produced limited veneer
- Trial 3 produced 249 sheets but quality compromised
 - Recovery – 60% ungraded, graded ?? (quality compromised)
 - Visual quality assessments
 - Properties assessments
 - Pressing characteristics

Veneer assessment

Visual assessments

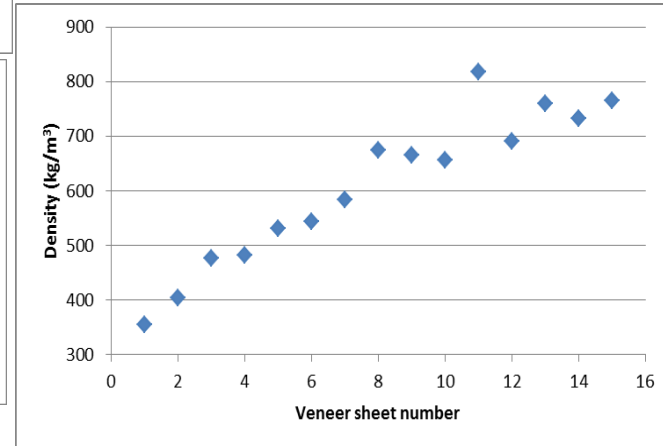
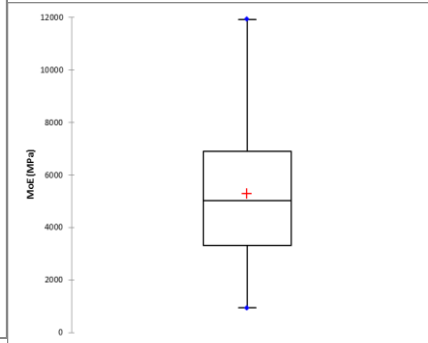
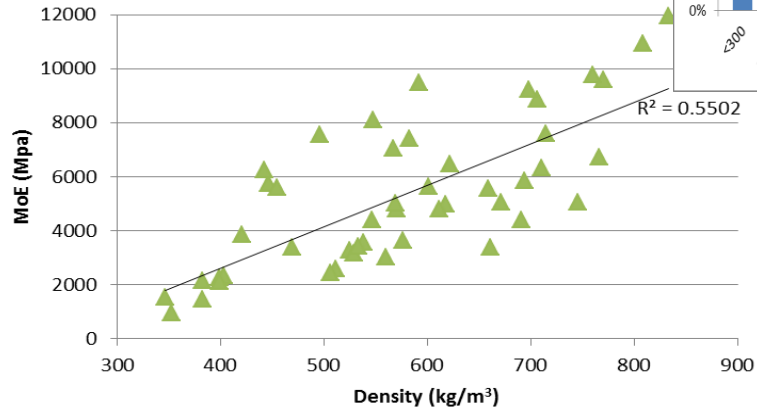
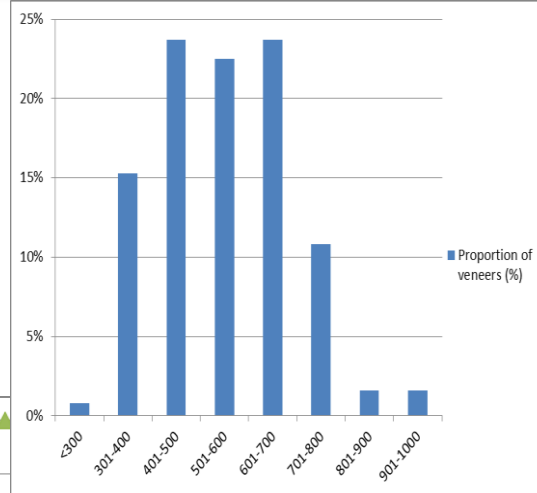
- Colour
- **Roughness**
- **Splits**
- Brittleness
- **Collapse**
- Decay
- Compression
- Wane
- Insects, etc



Veneer assessment

Properties assessments

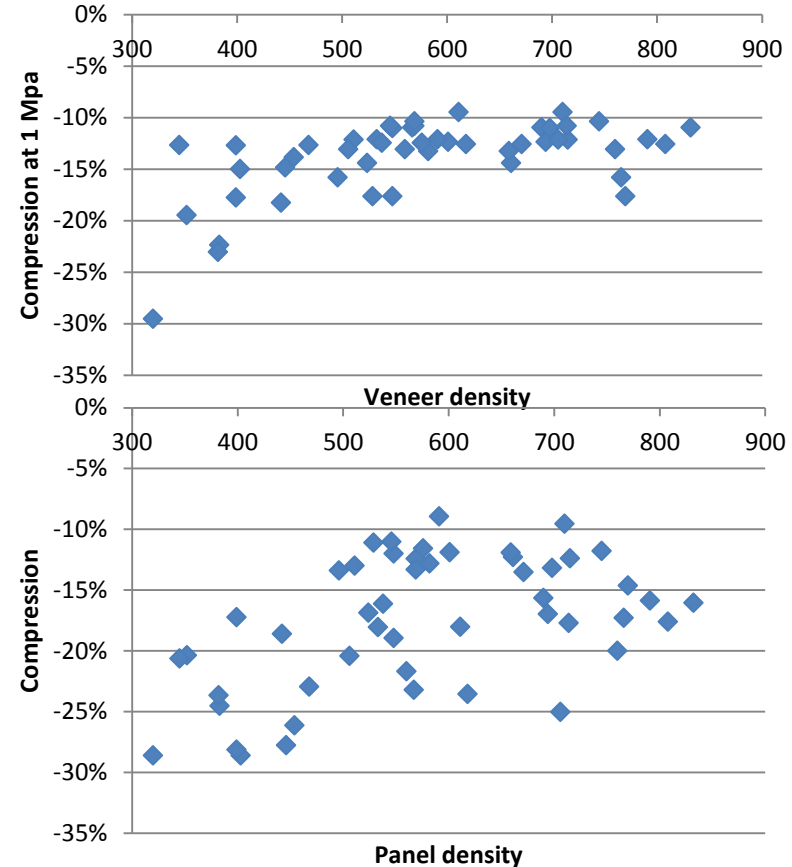
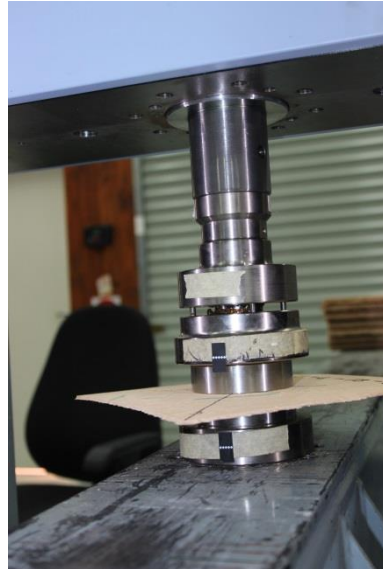
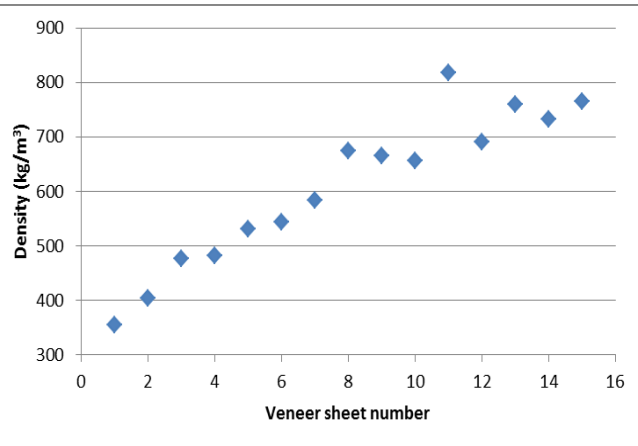
- Density
- Stiffness (MoE)



Veneer assessment

Pressing characteristics

- Material behavior
- Influence of temperature and adhesive



Questions

