3D Visualisation of Spiral Grain and Compression Wood in *Pinus Radiata* with Fluorescence and Circular Polarised Light Imaging

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Acknowledgements

- Dr Shakti Singh Chauhan, IWST, Bangalore
- Prof. John Walker, University of Canterbury
- Dr Luis Apiolaza, University of Canterbury
- Andrew McNaughton, University of Otago
- Dr Jonathan Harrington, Scion, New Zealand
- Dr Ashley Garrill, University of Canterbury
- SCION, New Zealand – PhD funding
- The Rubber Board, Govt. of India
Spiral Grain

~ Spiral grain and features.
~ New imaging technique with circular polarised light scanning.
~ Fluorescence imaging.
~ 3D visualisation of resin canals and spiral grain.
Spiral Grain

- Inclination of tracheids to the tree’s vertical axis.
- Present in most trees, and a normal growth feature.
- Significantly reduces strength, and causes twisting.
- Huge economic loss.
A New Imaging Technique

~ 8 month old plants.
~ 60 µm-thick, complete, transverse sections.
~ Scanned at 2400 dpi with a professional flatbed scanner.
~ Circular polarised light makes the resin canals (primary cell walls only) appear dark.
A New Imaging Technique

~ This novel approach replicates polarised light microscopy.
~ The high contrast images are suitable for image analysis.
~ Circularly polarised light eliminates the Maltese cross effect.
~ Rapid imaging of many slides / sections together.
Image Analysis

- ImageJ identified the resin canals in each section, and measured stack position and centroid.
- 3D Viewer plug-in.
- An algorithm in Matlab was used to measure grain angle.
• Resin canals demonstrated increasingly left-handed grain in young stems.
Fluorescence identifies compression wood, and suggests grain modifications may be associated with compression wood formation.
Conclusions

- New imaging technique using a document scanner and polariser films is novel.
- 3D visualisation of compression wood and spiral grain in young trees is now possible.
- Screening of pine clones on large number is now easy.
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