Forest Research

Tree Breeding and Selection for the Future

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Thanks to Barry Gardiner, Shaun Mochan, Stuart Kennedy, Andrew Cameron and John Moore

Timber Quality Steering Group

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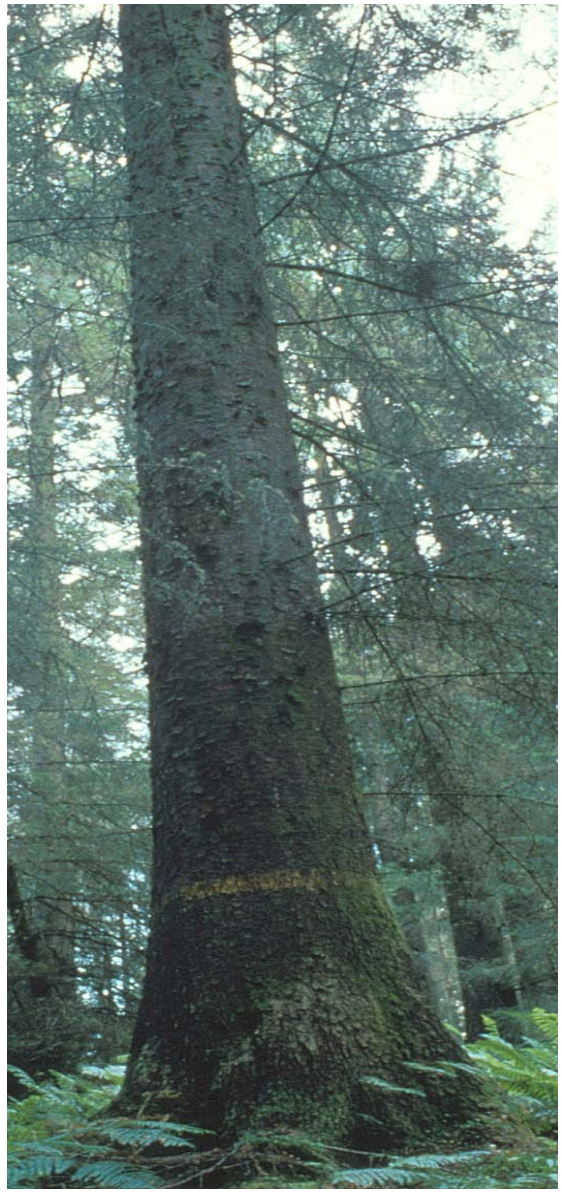
Outline

- Gains from Sitka spruce breeding programme
- Wood and timber properties from improved Sitka spruce
- Improving mechanical properties through breeding
- Screening in young trees

Gains from Sitka spruce breeding

- Predicted volume gains of around 25%
- Straightness and branching – improvements of up to 15%
- Wood density – little or no reduction
- Up to date information about predicted gains from seed orchards and “family-mixtures” is available at:

  www.forestry.gov.uk/fr/treeimprovement



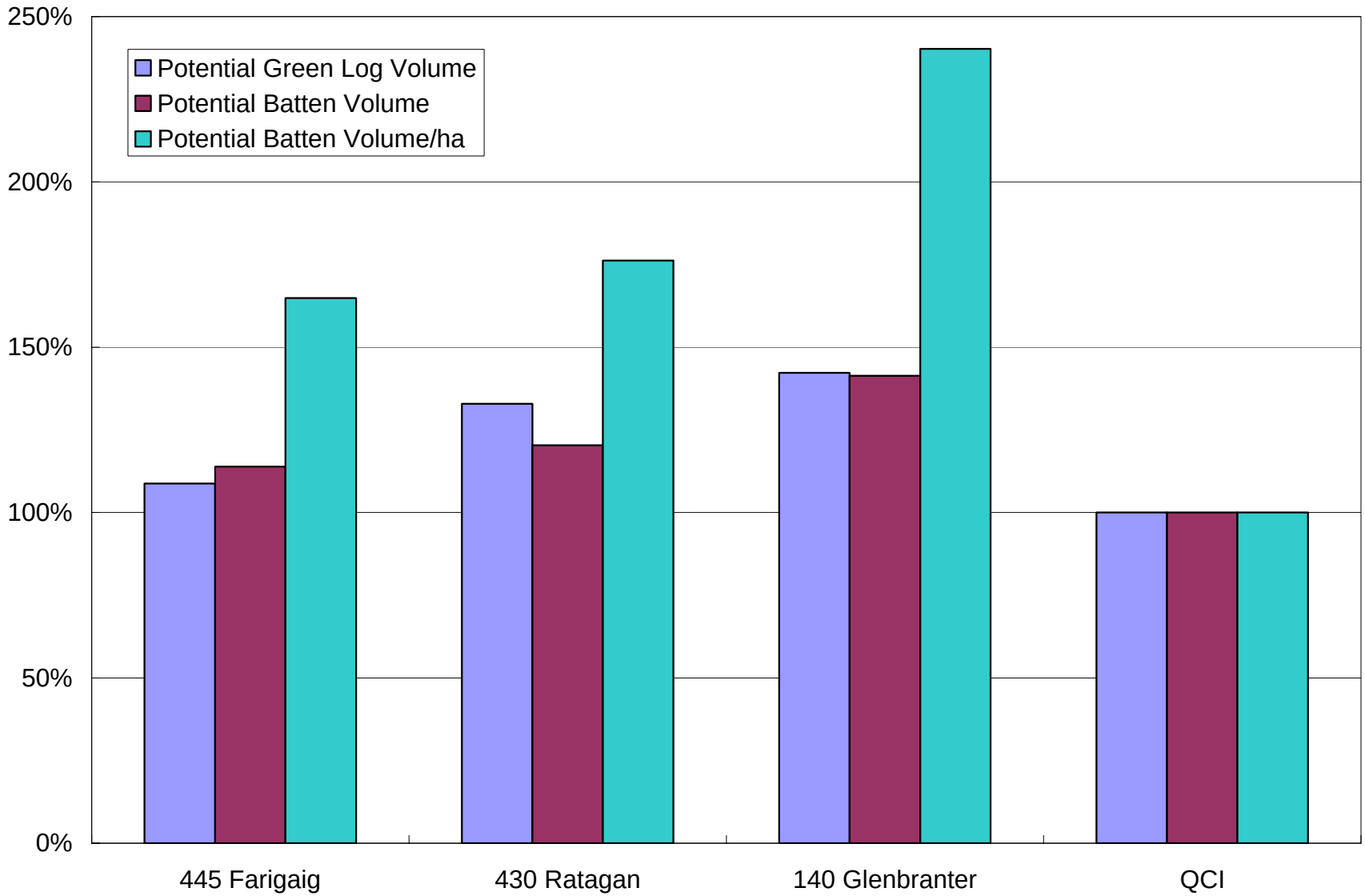
Wood and timber properties

Recent studies have looked at the wood properties and timber performance of improved Sitka spruce:

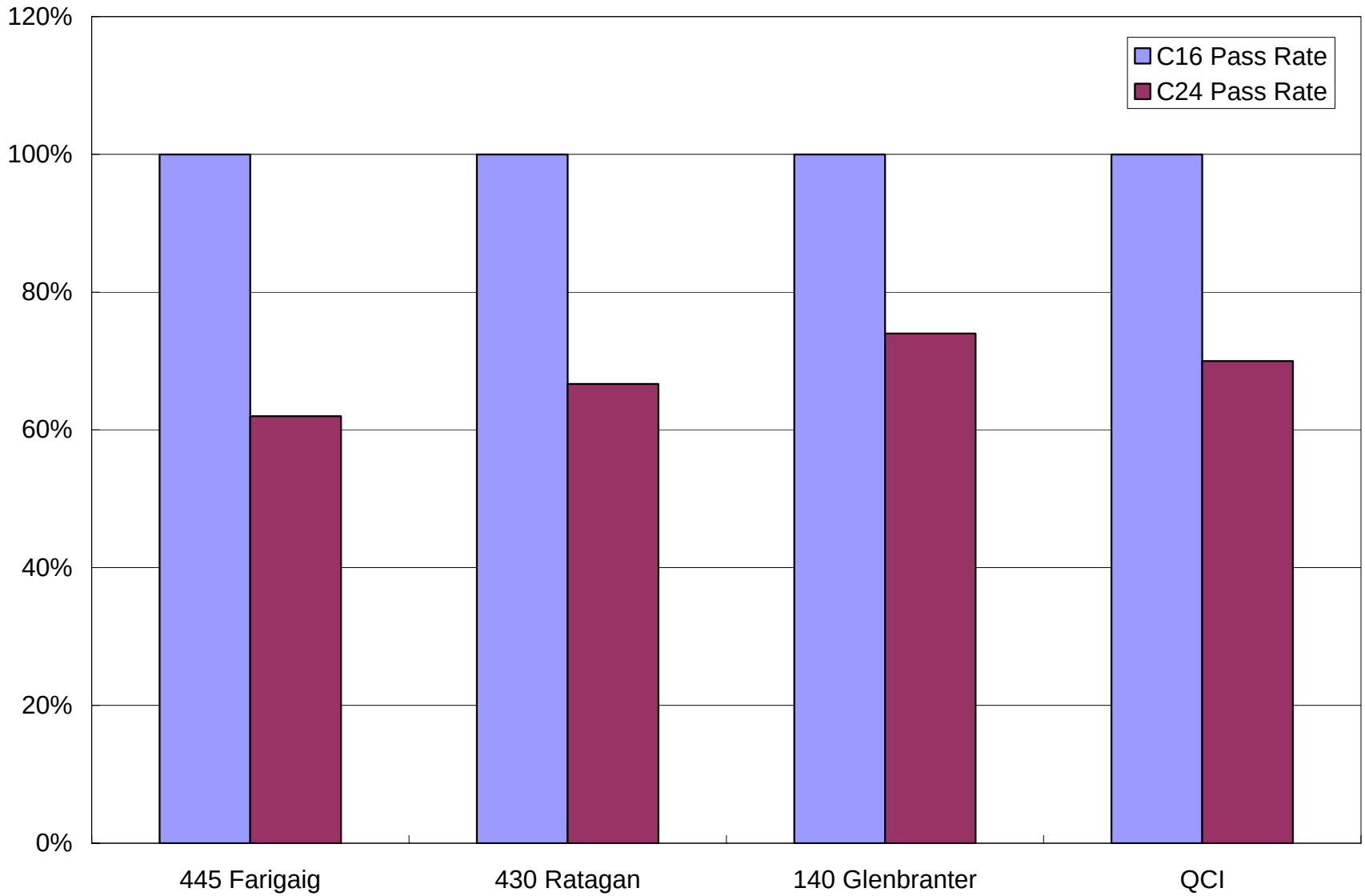
Kershope study – 38 year old half-sib progeny trial

- Volume and assortments
- Structural timber performance
- Wood properties in clear wood samples

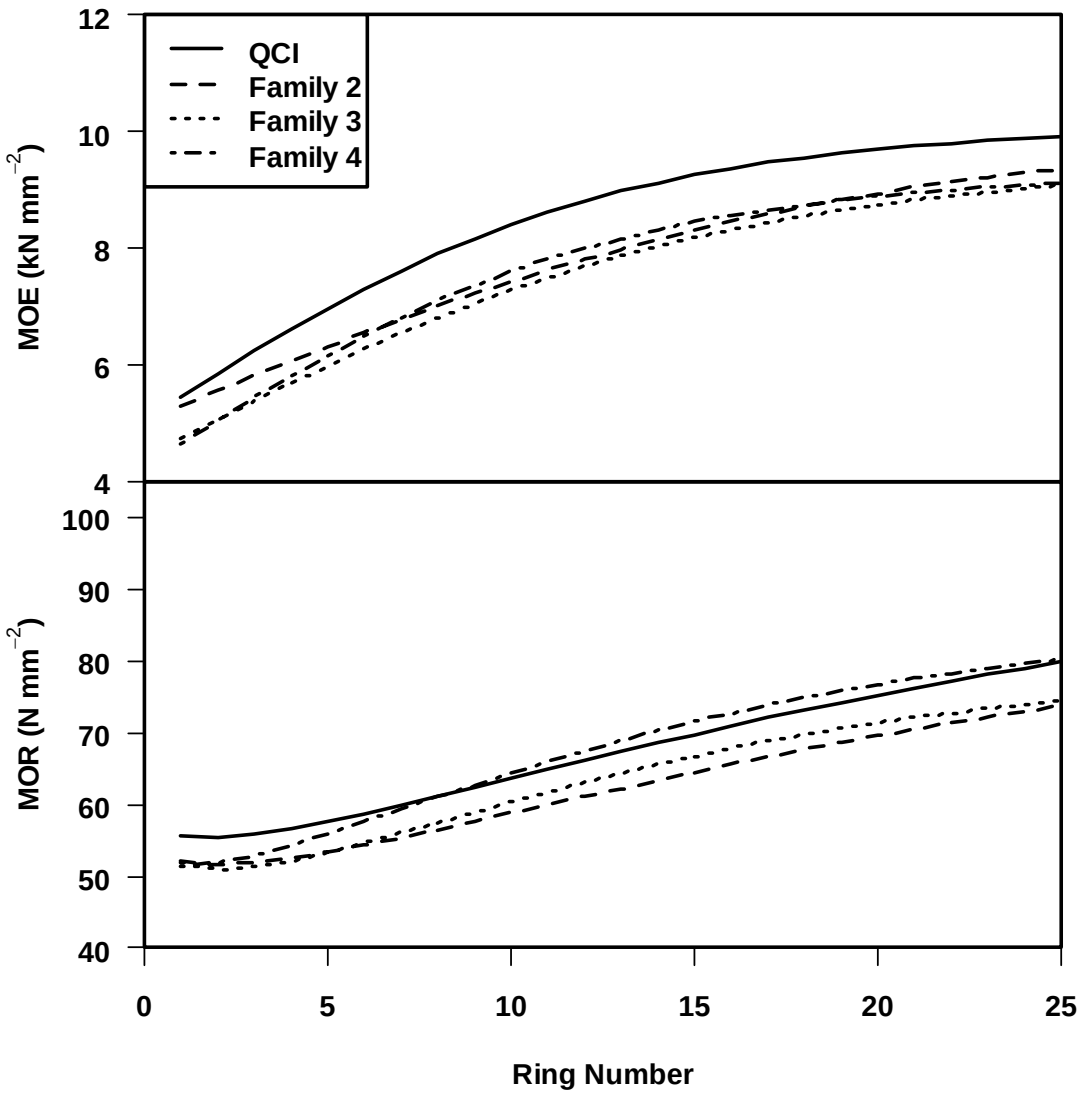
Volume Recovery



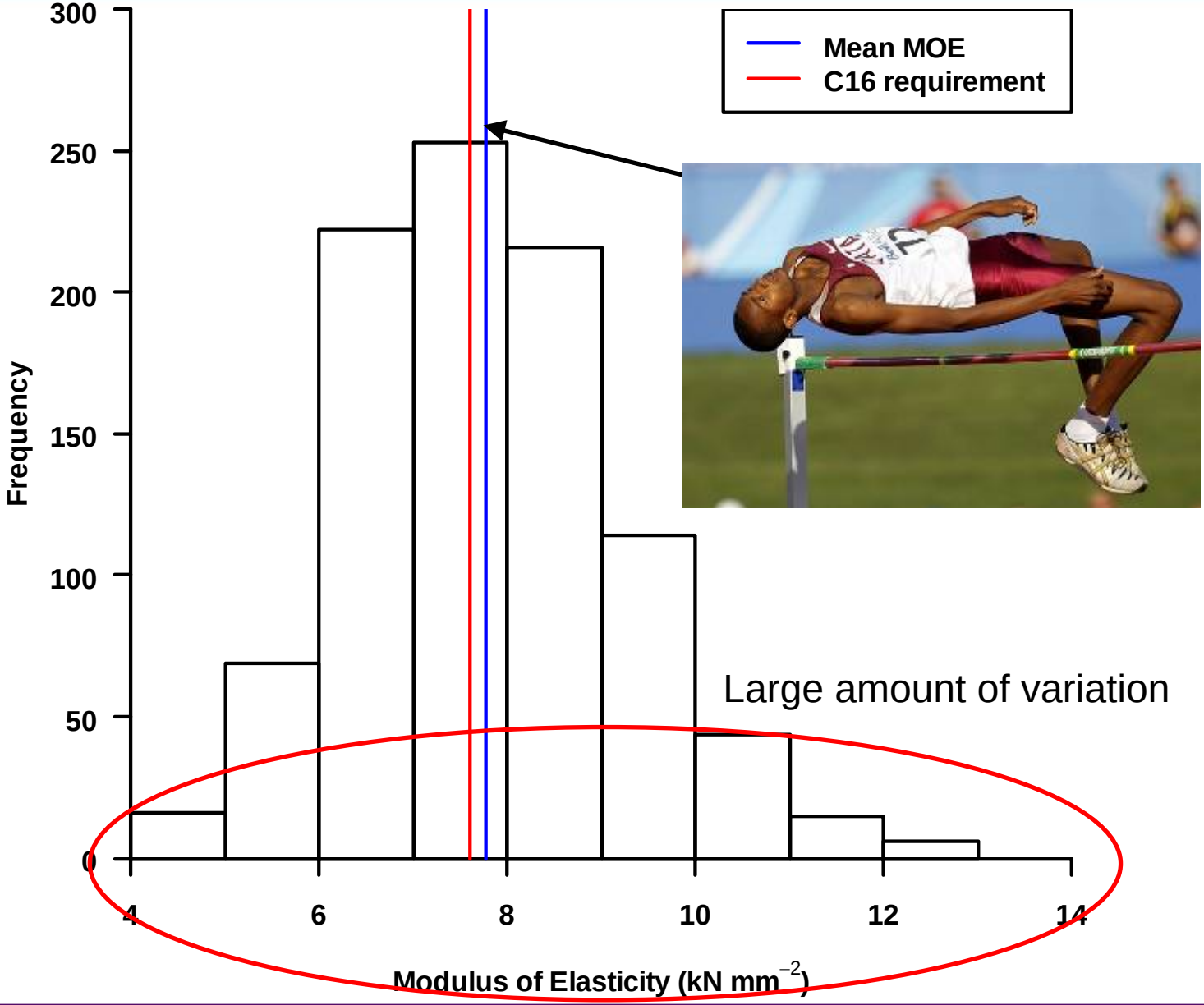
C16/C24 pass rate



Clear wood properties

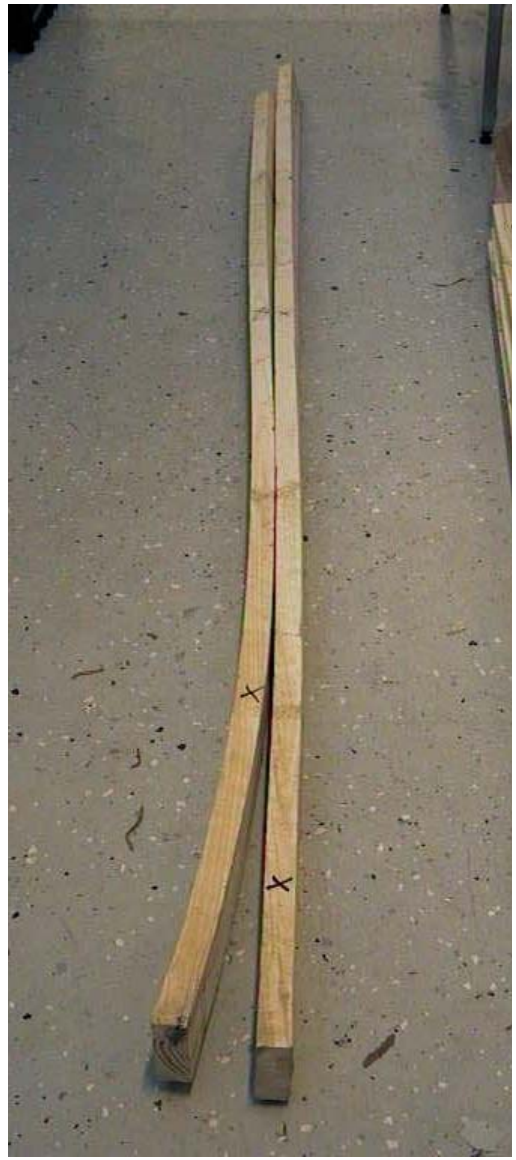


Sitka Spruce Wood Stiffness



Breeding to improve stiffness

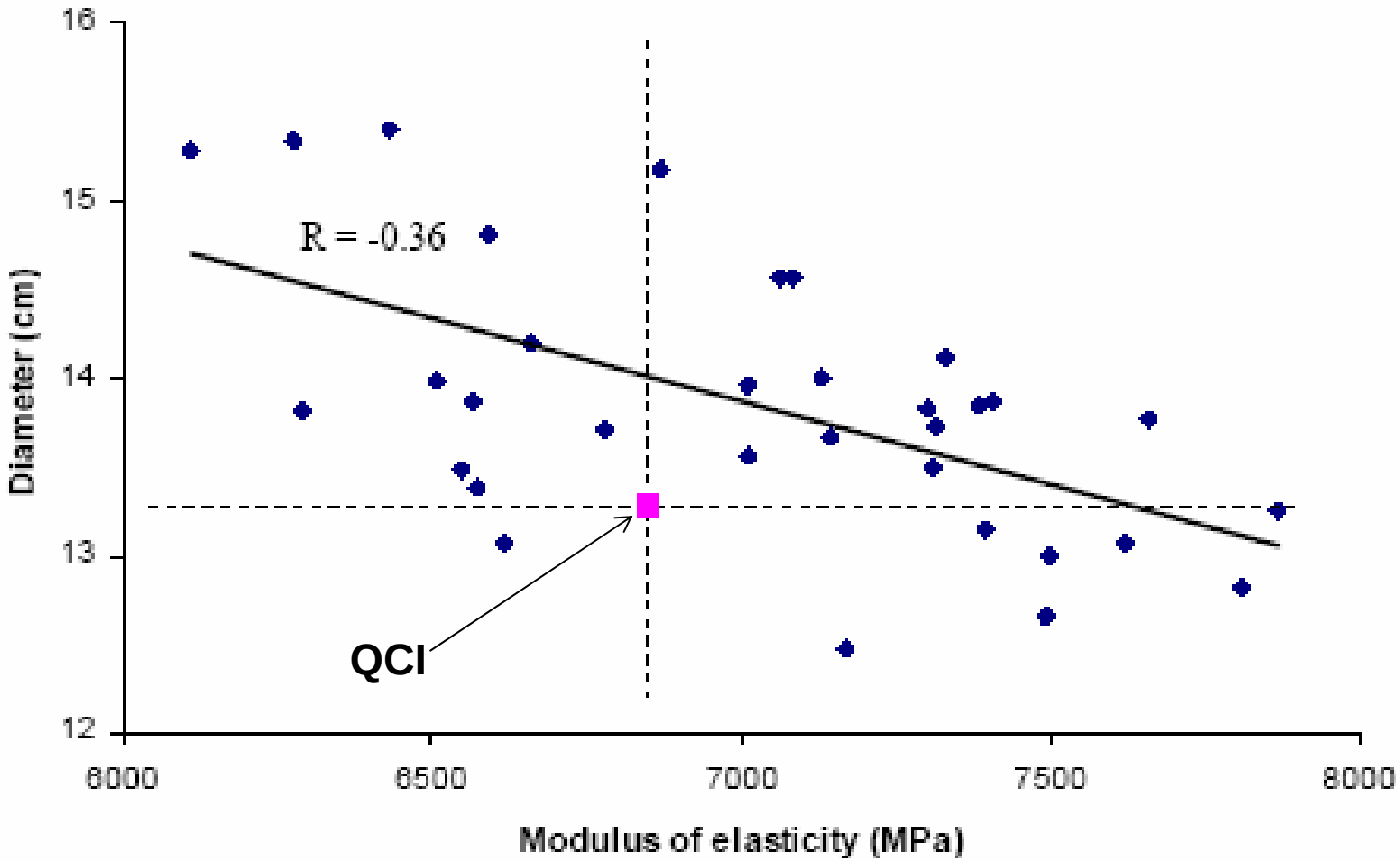
- Selecting for density alone may not safeguard mechanical properties
- Screening for stiffness as well as density is likely to offer greater gains in mechanical properties
- Acoustic tools offer a rapid, non-destructive method for assessing stiffness
- Drying distortion is influenced by some of the wood quality traits that determine stiffness (grain angle, microfibril angle) – improving stiffness should improve dimensional stability



Potential for improvement

- Recent PhD at Aberdeen University (Stuart Kennedy) investigated potential for improving Sitka spruce mechanical properties through selection
- Tested 20 year-old half-sib trial
- Results:
  - Wood quality traits all moderately heritable, i.e. scope for improvement through breeding
  - Negative correlation between growth rate and stiffness, strength, wood density and microfibril angle
  - BUT some families have superior growth, stem form **and** wood quality traits → breeding from these could offer gains in timber production and performance

Growth rate and stiffness



Selecting for stiffness

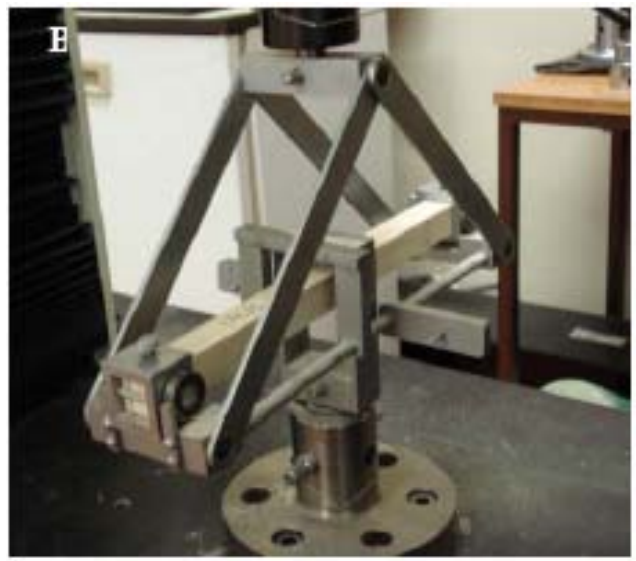
- New project with Aberdeen University
- Study sites: 26 year-old full sibling progeny trials at Strathyre (mid Scotland), Spadeadam (N. England) and Radnor (Wales)
- Includes families available in commercial breeding population
- Assess wood stiffness (acoustic tool), density (Pilodyn) and diameter

Photo courtesy of Fakopp Enterprise, Hungary

Spadeadam progeny trial

Selecting for stiffness

- Determine breeding values for wood stiffness, compared to QCI control
- Identify families with improved growth and wood stiffness
- Destructive sampling and timber testing to analyse mechanical and physical properties
- Selection for further breeding will be informed by results



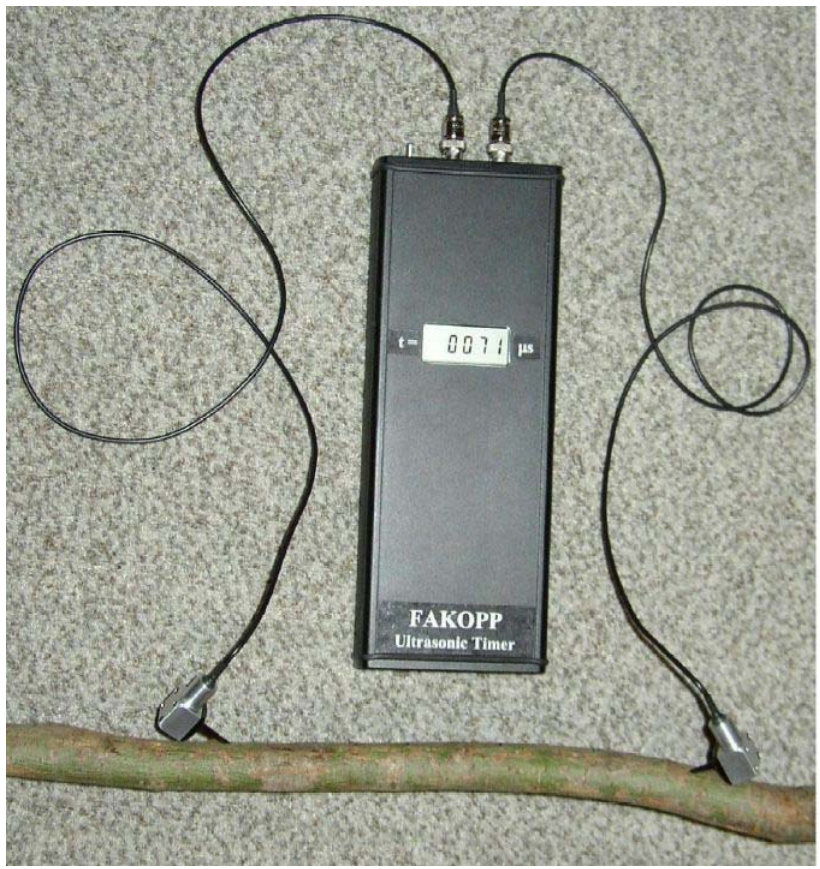
Photos courtesy of Stuart Kennedy

Early screening for wood stiffness

- Acoustic tools designed for small trees offer the opportunity for earlier screening for wood stiffness in the breeding programme

Photos courtesy of Fakopp Enterprise, Hungary

- Sapling tool will be tested and validated with Sitka spruce



Conclusions

- The Sitka spruce breeding programme has delivered gains in timber volume production, stem form and branching
- Improvements in mechanical properties (and perhaps drying distortion) could be achieved by selecting for wood stiffness as well as wood density
- Portable acoustic tools offer a means of screening for wood stiffness in young trees…
- …to inform breeding programme and achieve improvements quickly through controlled pollination and vegetative propagation