

**Determining the genetic
heritability of wood properties
of Sitka spruce critical to
timber strength.**

Stuart Kennedy

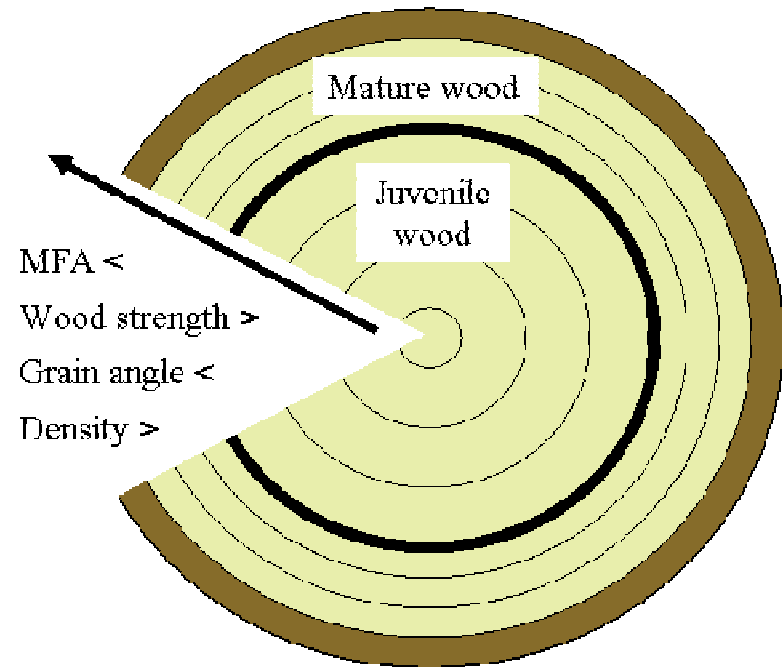
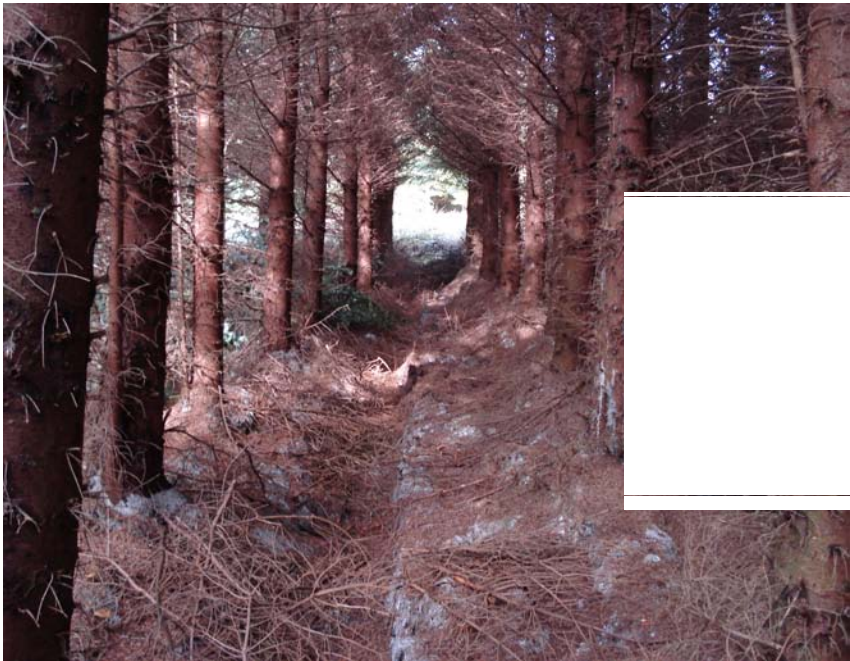
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The breeding programme

- A breeding programme for Sitka spruce of QCI origin was set up in 1963 with the aim of increasing productivity whilst improving timber quality for use in the construction industry.

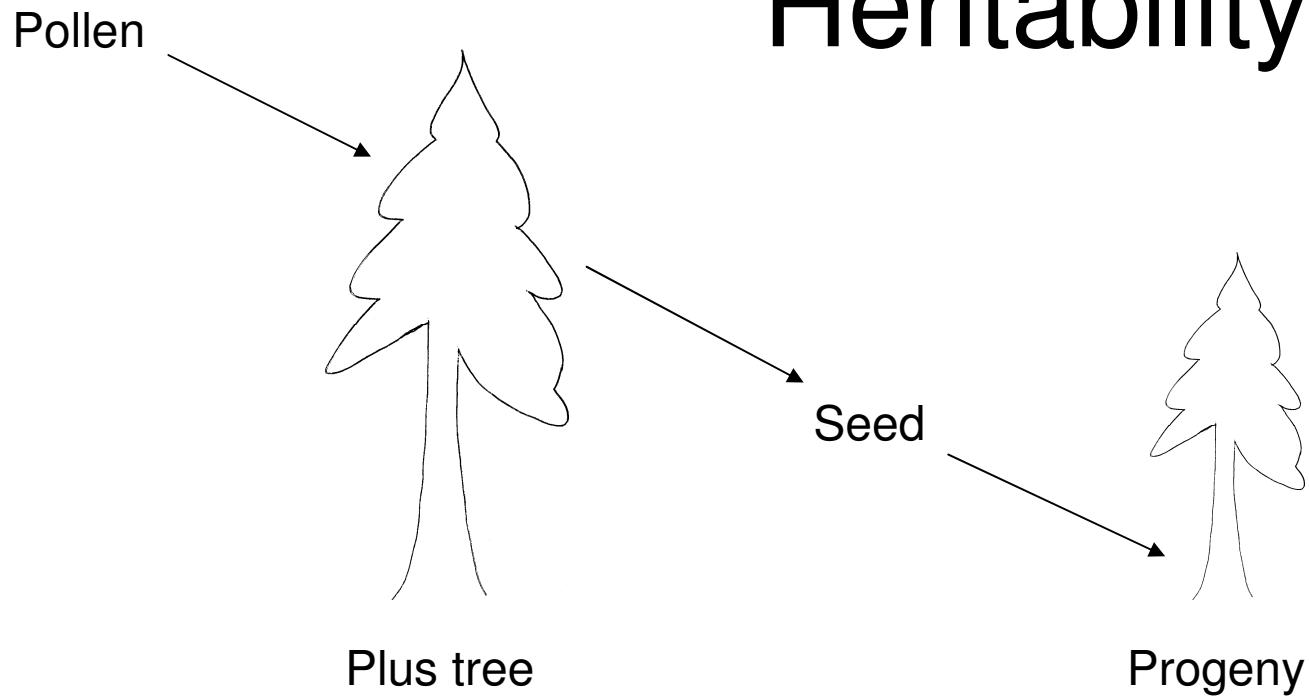
Improving timber quality



Objectives

1. Determine the genetic heritabilities of wood properties critical to spruce timber quality and strength, to aid with future developments of the breeding programme.
2. To compare direct measurements of density and MOE with more easily measured field techniques.

Heritability



Phenotype = Genotype + Environment

Heritability = ratio indicating the degree to which parents pass their characteristics on to their offspring.

Speyside 2



Sampling

525 sample trees



33 families => 3 trees
randomly selected from
each of the 5 replicates

+

30 QCI control trees

99	98	97	96	95
116	117	118	119	120

A 14x5 grid table. The second row contains the numbers 99, 98, 97, 96, 95. The third row contains the numbers 116, 117, 118, 119, 120. All other cells are empty. The table has a black border and internal grid lines.

Acoustic measurements

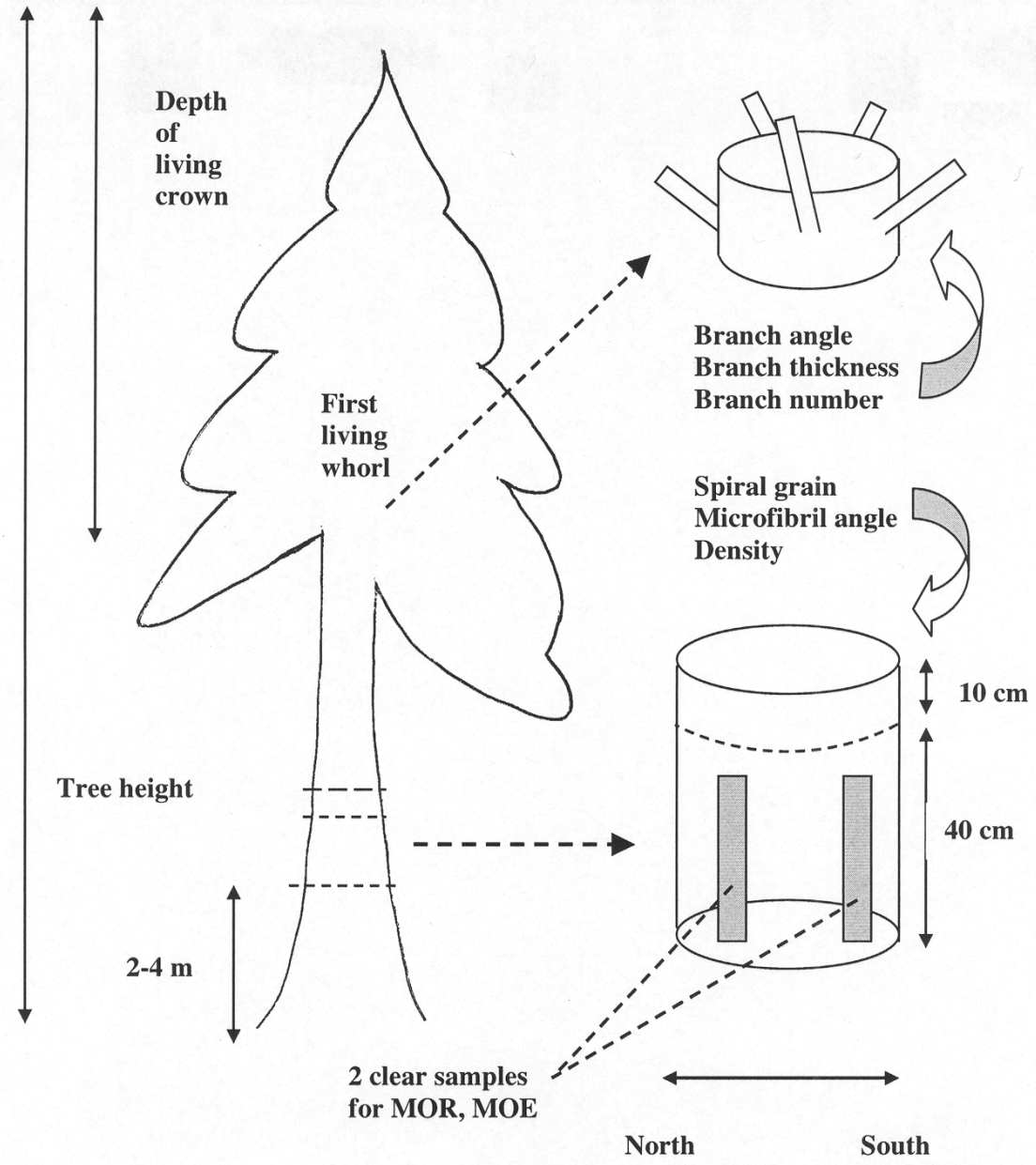
- Method for measuring MOE of standing trees

$$MOE_d = \frac{p}{g} \times v^2$$

- Fast non destructive sampling

Picture from www.fibre-gen.com

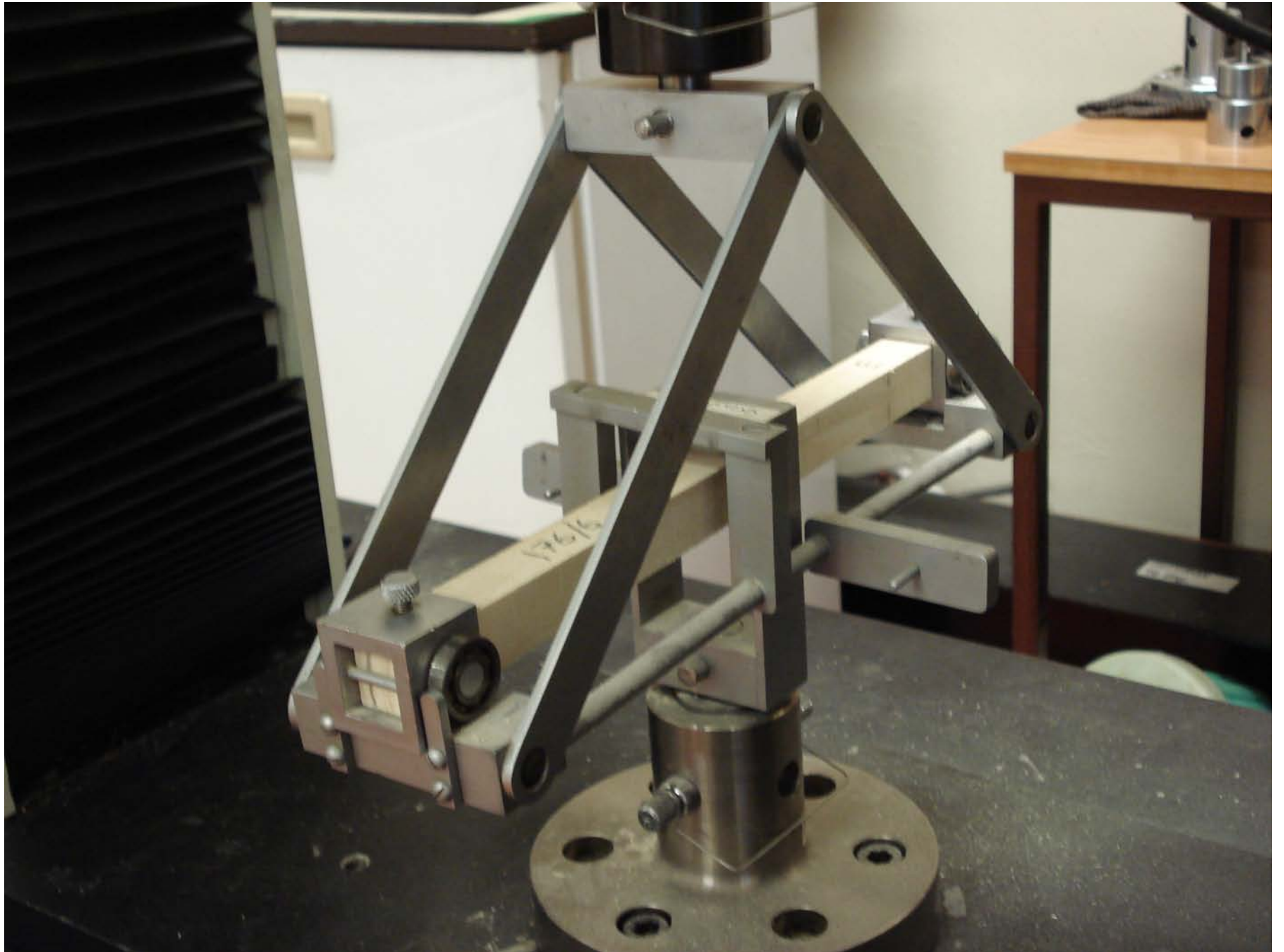


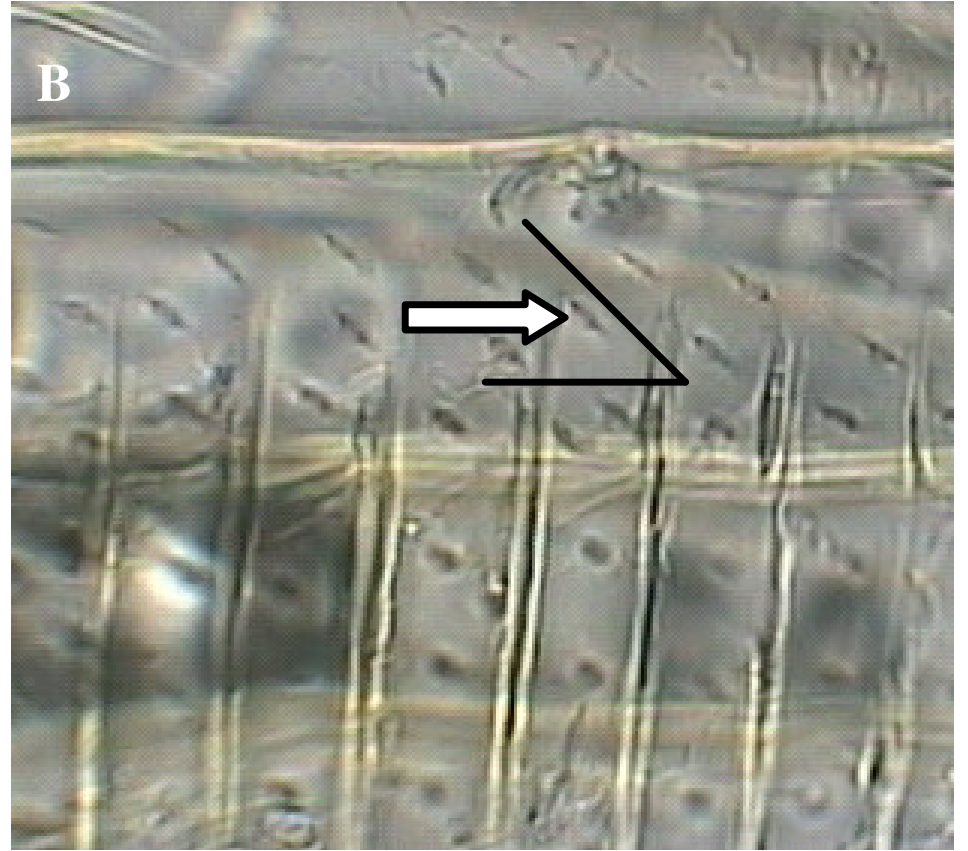
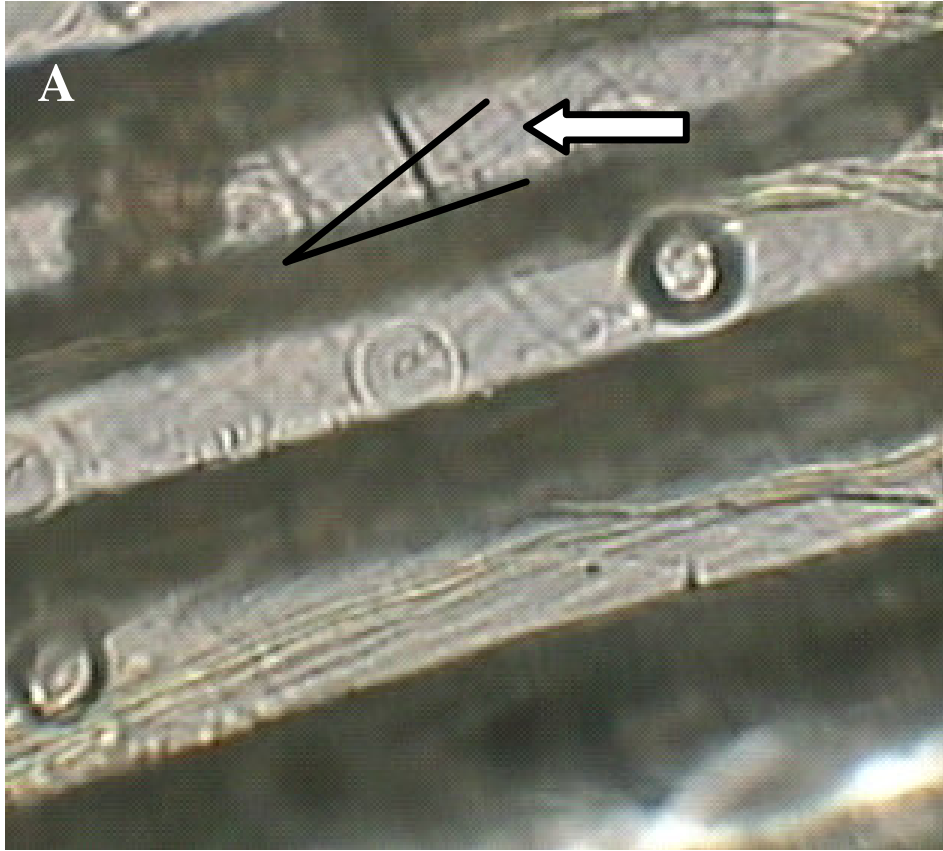


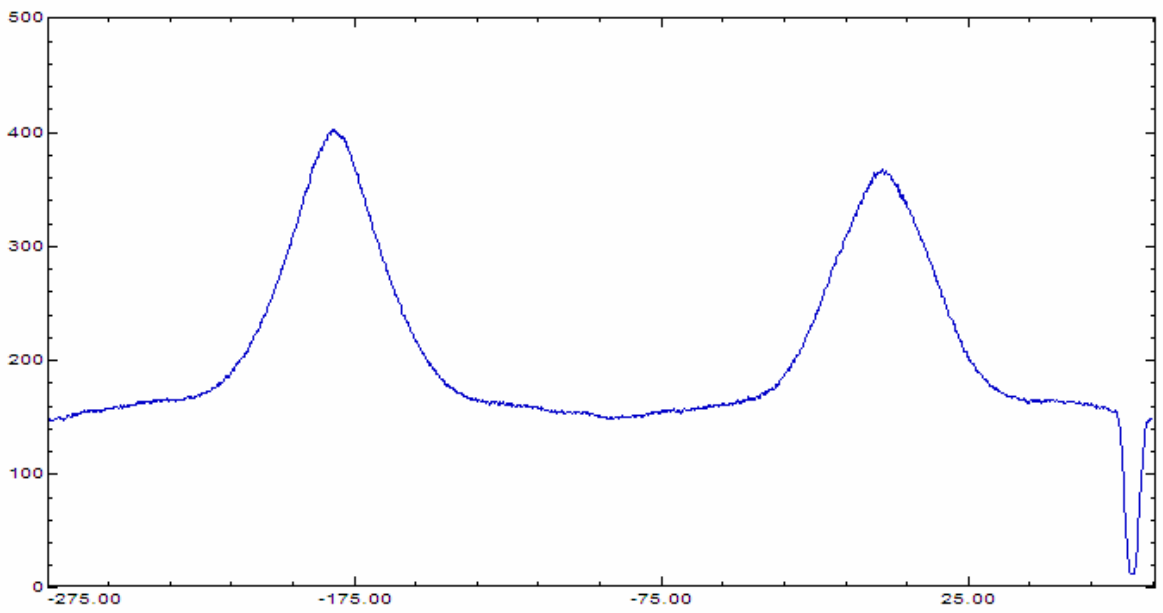
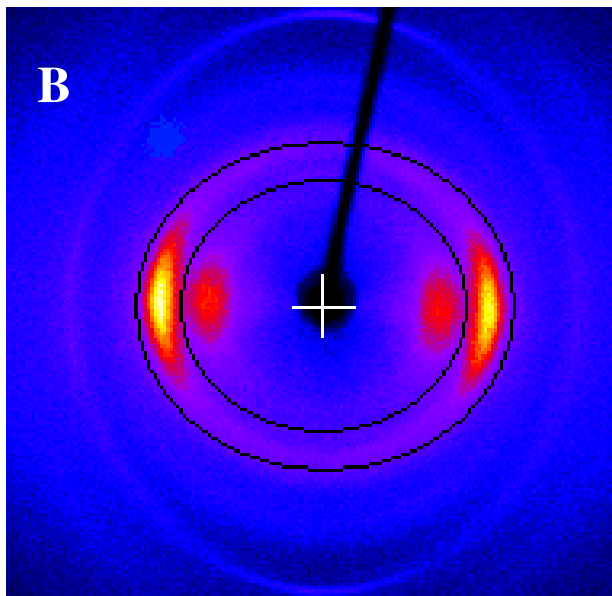
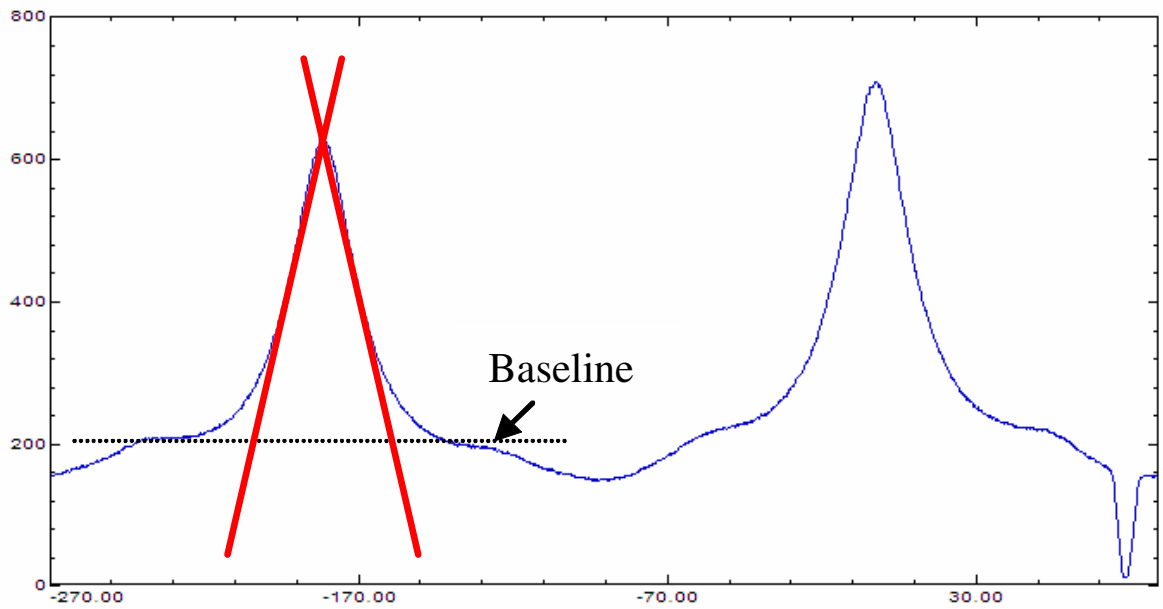
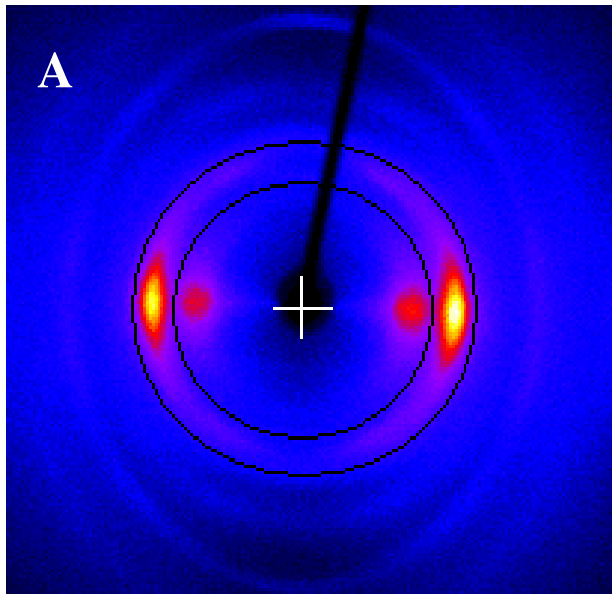












Growth traits

	h^2_i	H^2_f
Height 20	0.57	0.69
Tree diameter	0.26	0.49
Crown depth	0.60	0.72
Branch angle	0.55	0.70
Branch diameter	0.30	0.55
Branch number	0.20	0.39

Wood quality traits

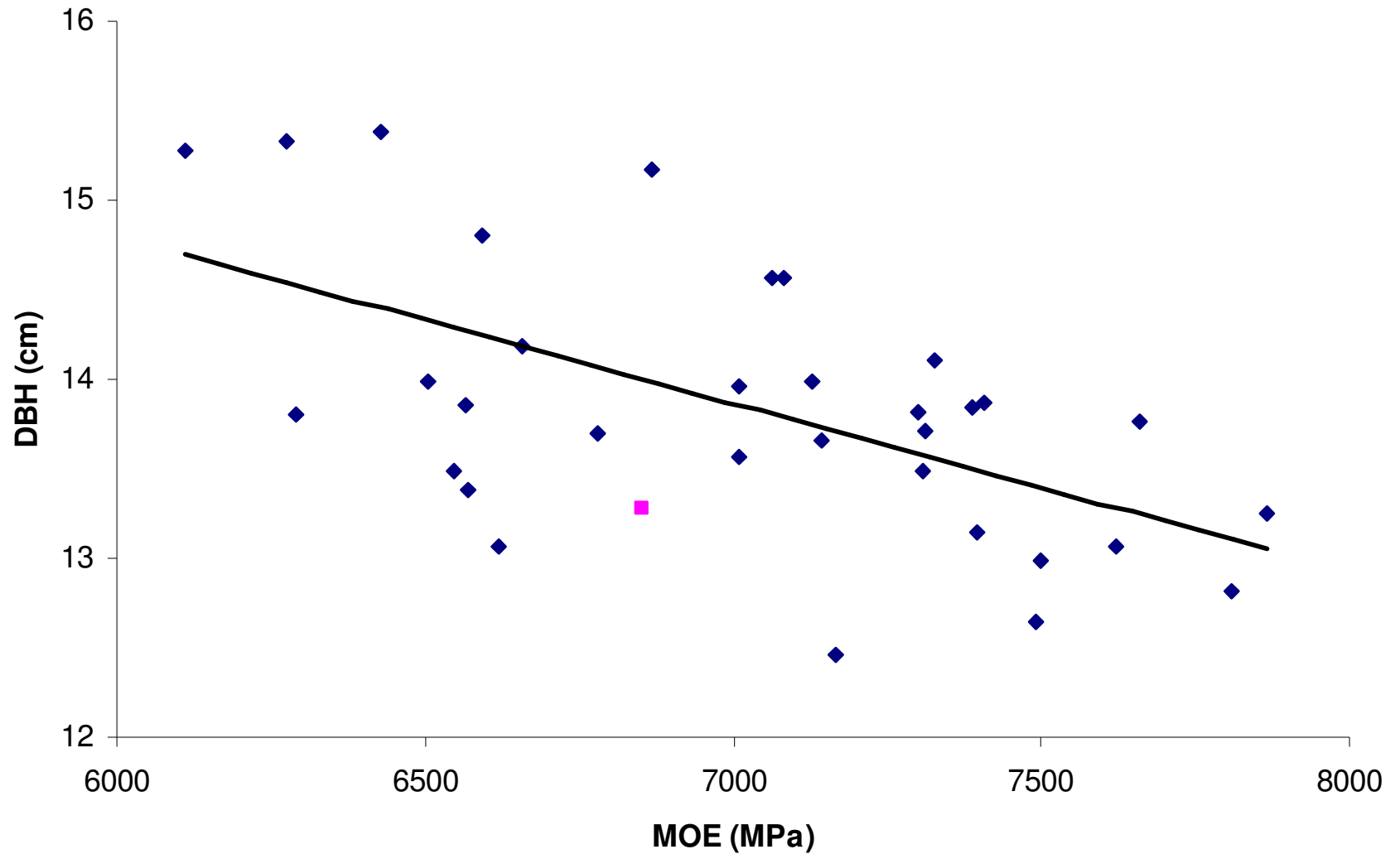
	h^2_i	H^2_f
Grain angle	0.53	0.66
Velocity	0.67	0.75
MOR	0.61	0.69
MOE	0.49	0.62
Specific gravity	0.71	0.73
Density (pilodyn)	0.62	0.67
Microfibril angle	0.52	0.47

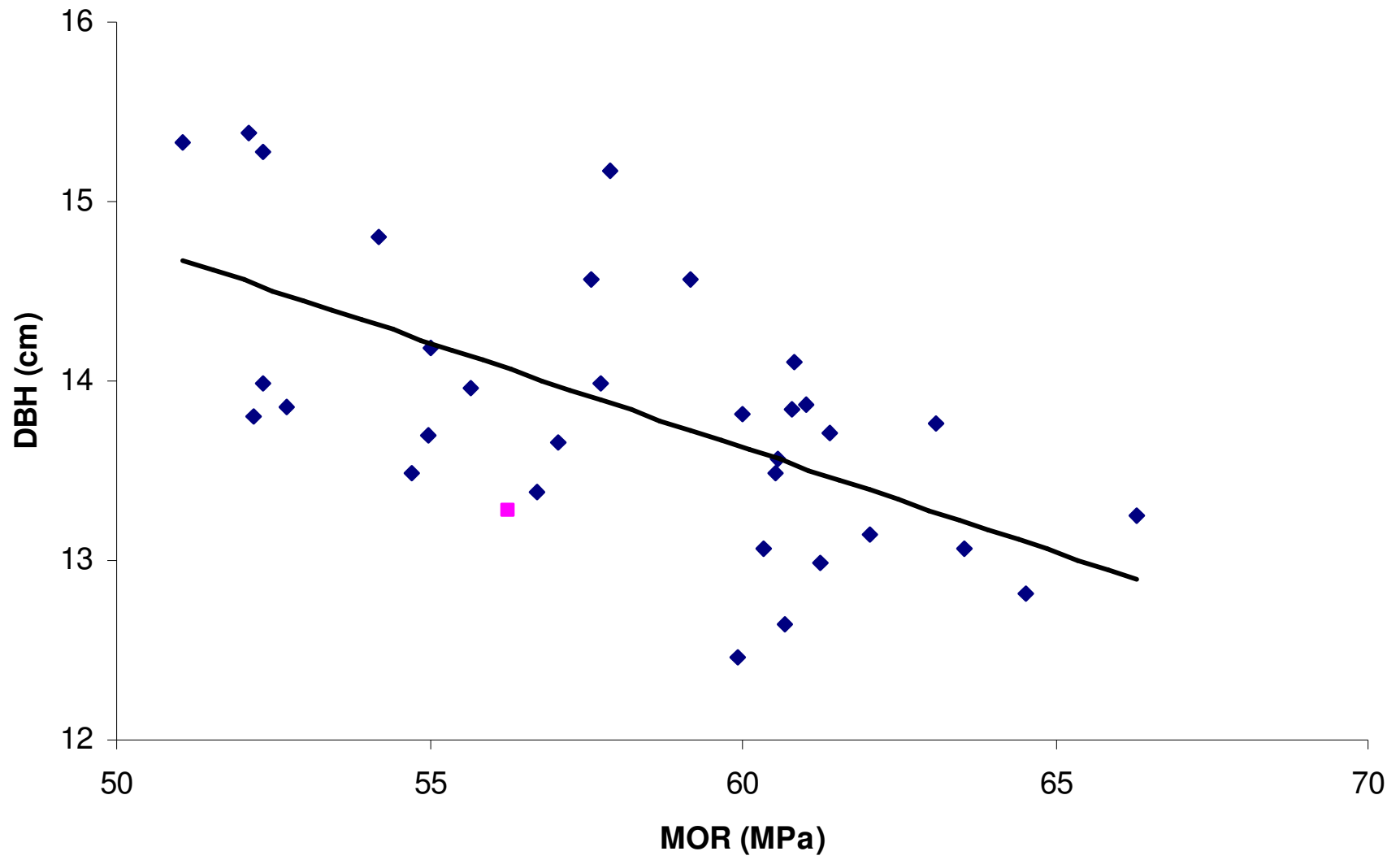
Genetic gain relative to QCI

	Gain	% Gain
MOE (MPa)	1049.43	15
MOR (MPa)	10.37	18
Specific gravity	0.038	10
MFA (°)	-2.90	-18
Grain angle (°)	-1.26	-34
Tree diameter (cm)	1.95	14

Genetic correlations

	Density	MFA	Velocity	DBH
MOE	0.86	0.79	0.81	-0.89
MOR	1.04	0.62	0.49	-0.95





Conclusion

- The ability to select trees for MOE with the use of acoustics along with the moderate inheritance of this trait should enable good improvements in the wood quality of Sitka spruce to be possible.