# CHAPTER 10 - UTILISATION

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Preparing 21-year-old cypress trees for sawing

## INTRODUCTION

Considerable experience has been gained in processing cypress logs.

Commercial experience has shown all cypresses are easy to saw, and there are few signs of growth stress. Saws and cutting patterns normally used for cutting radiata pine are satisfactory. Detailed research evaluations have helped understanding of the issues in cypress utilisation. These evaluation have covered a range of stand types. The following summarises four of them.

## SAWING STUDIES

### (i) Lusitanica - Whangamata

In 1988, 22 trees of 58-year-old lusitanica from Tairua Forest, near Whangamata, were selected for a timber grade study. Logs were selected on the basis of a MARVL assessment comprising 5 log types:

A. Pruned (>30 cm SED)

B. Small branches (<6 cm)

C. Medium branches (6-14 cm)

D. Small log (20-30 cm SED)

E. Large branch (>14 cm, and >30 cm SED)

The weight to volume conversion factor for logs averaged 1.122m$^3$/tonne, and 75% of volume was heartwood. Eighty-four logs were recovered, and overall sawn conversion was 58%.

Pruned logs were sawn to 25 and 40 mm thickness, and unpruned logs predominantly sawn to 54 mm for structural timber, or later re-sawing to 25 mm boards.

Yields from the pruned logs (A) were good, 78% of sawn boards graded to NZS 3631 1988 were Select B or better, including No. 1 cuttings (Premium). Yields from log types B and C were a little disappointing as appearance grades (B and C, 46% and 32% Premium respectively) due to high incidence of dead/or decayed knots; however, grade outturn as structural timber was better (B logs) 86% and (C logs) 41% No.1 framing). Small logs (D) sawed well as either appearance (62% premium) or structural grades (58% No.1 framing). Big branched logs (E) were considered marginal as sawlogs with 34% premium, or 25% No.1 framing, due to large intergrown knots.

Timber from the unpruned logs was tested for bending stiffness (MoE) as a plank and, when results were combined with earlier small clear tests on samples from the same location, indicated that the timber should perform structurally as well as 30-year-old radiata pine.

### (ii) Macrocarpa - Wanganui

In 1991, 15 trees of 27-year-old macrocarpa from Lismore Forest (near Wanganui) producing 15 pruned butt, 15 unpruned second, and 9 unpruned third logs, were sawn and graded as boards. Additionally, pulp trials were carried out on chipped mill off-cuts and pulp log samples.

Sawn conversion was 52% for butt, 49% for second and 43% for third logs. The lower conversion of the upper logs was associated with smaller size and asymmetry. Pruned butts produced 73% clears and clear cuttings of sawn timber (graded to a modified NZS 3631 1978). The corresponding values for second and third logs were 13% and 8% respectively. However, a large proportion of the remaining timber in the second and third logs made dressing grade. It was noted that 10 of the 15 trees had insect attack (mainly NZ two-tooth longhorn borer), associated with large pruned branch stubs. This attack affected 5% of sawn timber. Heartwood in logs averaged 70% butt, 64% second, and 56% for third logs.

Investigation of pulping properties indicated that macrocarpa might be used for Kraft pulp as a part mix with more favoured species, but was unlikely to be used for thermomechanical or chemithermomechanical pulp.

In 1993, an end-use study by two experienced macrocarpa timber users, assessed the 27-year-old plantation grown macrocarpa. A broad number of processing operations were assessed including sawing (crosscutting), planing, turning, sanding, nailing, gluing, staining, using clear and tight knot (<50 mm) timber. Both users agreed that this younger timber was suited to the same remanufacturing uses as older timber. No effect of tree age on the machining properties was observed, although the wider growth rings were considered less visually attractive. Of particular note was reference to the dried quality of the samples assessed. The wood was very stable during and after resawing and this was attributed to the evenness of drying of the samples.

### (iii) Macrocarpa, lusitanica and Leyland cypress - Rotorua

Pruned demonstration plots of cypress, aged 21 years and grown in Rotorua, were harvested in 2003. Twenty trees of lusitanica, seven macrocarpa, and twelve of Leyland cypress were sawn to 50 mm thickness, slowly air dried, and finally kiln dried. Sawn timber recovery was 50-60% for all log height classes and species except for butt logs of macrocarpa, attributed to fluting and taper. The trees were cut into 3-m sawlogs, sawn to 150 × 50 mm and 100 × 50 mm sizes, slowly air-dried, then kiln-dried and dressed. Lumber was graded visually as appearance and structural grades. All boards were tested for long-span bending stiffness and some were tested for bending stiffness and strength.

With appearance grading, lusitanica produced the best recovery of 48% Dressing and 24% Merchantable, Leyland 38% Dressing and 44% Merchantable, and macrocarpa 33% Dressing and 21% Merchantable. Knot checking was the worst defect in lusitanica, surface checking in macrocarpa, and loose pruned branch stubs in Leyland cypress. Visual framing grades were highest for Leyland cypress 78% No. 1 Framing, 71% for macrocarpa, and 59% for lusitanica, the latter mainly due to warp, a major cause of degrade for this species.

Bending stiffness (MoE) of lusitanica was 4-6 GPa, while macrocarpa and Leyland cypress were 6-8 GPa. Bending strength (MoR) for the above three species was 21.3 MPa, 31.4 MPa, and 28.0 MPa respectively.

Macrocarpa and Leyland cypress had similar stiffness properties to radiata pine from forest sites (though these were from appreciably older and larger-diameter trees). Note that these figures for strength properties differ from those in Table 1, because Bier and Britton reported on data for small clears only, harvested from mature stands, compared with boards from young stands in this study.

The cypress appearance and structural lumber characteristics are expected to have improved with material from older trees benefiting from the addition of more rings of outerwood. Despite the known uniformity of wood density, wood stiffness increased strongly from pith to bark, suggesting that cypress corewood requires further evaluation.

The conclusion from the study was that there was no superior cypress for timber properties – the different taxon sampled had good and bad points.

Sawing 21-year-old cypress logs.

### (iv) Macrocarpa-Wairarapa

In 1985, 15 trees from a high-pruned woodlot in the Wairarapa were sawn. The stand was 52 years old, standing at 415 stems/ha, mean diameter at breast height of 56 cm, and a mean height of 29 m.

Fifteen trees across the quality spectrum were selected for sawing. This provided 28 pruned logs and 29 unpruned, ranging in length from 3.7 to 5.5 m. The smallest tree was 27 cm DBH and the largest 88 cm.

Overall conversion of the study was 54%, Premium grades 72%, 42% clears and 30% of select. Factory grade was 4%, Utility grade was 15%, and box or rough grade 9%.

Key silvicultural comments from this atypical stand were:

High initial stocking allowed excellent selection for form.

Delayed final thinning ensured branch size was well controlled.

Two log prunings improved the crop.

Defect cores were well controlled.

Rotation age could have been reduced, but this would have reduced heartwood percentage.

## DRYING

Macrocarpa timber from shelterbelt trees is particularly difficult to dry. It is prone to collapse and internal checking. Plantation-grown wood appears to be less susceptible to these problems. For shelterbelt trees, it is recommended that wood is initially air-dried down to around 30% moisture content (mc) in protected, evenly filleted stacks before final kiln drying. Plantation-grown macrocarpa can be kiln dried from green provided low temperatures (40-45°C) are used for the majority of the drying cycle. Because of the need for such low temperatures, dehumidification drying is recommended as the ideal method for drying. Although lusitanica and Leyland cypress are similar in drying properties to plantation macrocarpa, air drying down to 30% mc before kiln drying is still recommended to minimize any drying variability and tendency to knot check.

A 1979 drying study of lusitanica indicated knot checking was the worst defect. Slight crook and twisting did occur. The variability of drying from green in a kiln, trying a number of schedules, suggested that the wood should be air dried to below 30% mc before finishing in a kiln. Suggested kiln schedule after air drying was 60/50°C.

Two drying studies (1967 and 1969) of macrocarpa found that it was not possible to dry the timber sawn from knotty shelterbelt logs without considerable degrade whether air dried, forced air dried, or kiln dried. Air drying and forced air drying resulted in surface and end checking, and kiln drying in end and internal checking. Air drying before kiln drying eliminated internal checking but exterior degrade was just as bad. It was concluded that macrocarpa of this type would be more suitable for rough farm construction and similar uses.

A 1985 paper reviewing the drying of NZ cypress species, identified old shelterbelt macrocarpa as having excessive collapse and internal checking after kiln drying. Careful air drying, followed by mild kiln or dehumidification (less than 50°C) was recommended.

Plantation-grown macrocarpa and lusitanica could be kiln dried from green if temperatures were kept below 45°C; however, air drying before kiln drying was preferable. Lawson cypress and Leyland cypress showed generally low shrinkage and were not prone to internal checking or collapse when kiln dried from green (71/60°C schedule).

For all cypresses in general, preliminary air drying to 30% mc followed by kiln drying will give best results.

Lawson cypress is not so prone to collapse or internal checking and can be kiln dried from green. Timber that is 50 mm thick is reported to take 4-5 days at 70/60°C, including 6 hours of final conditioning for drying stress relief at 75/74°C. The more even the final drying moisture content to the equilibrium moisture content, the more stable the wood will be.

## DURABILITY AND PRESERVATION

The cypress species, macrocarpa, lusitanica and Lawson cypress all have heartwood in Australasian durability Class 3, i.e., in testing of ground contact 50 x 50 mm stakes, they have been shown to have an average life of 5-15 years. The average life is towards the upper end of this range but a few early failures occurred in the tests. The sapwoods are all perishable but can be treated by boron diffusion, although in practice timber containing sapwood is confined to interior use only.

No information is available for NZ-grown Leyland cypress timber, but overseas reports indicate it is likely to be as durable as the others.

Away from ground contact but fully exposed to the weather the average life of 50-mm-thick cypress heartwood is 15-25 years. This is similar to the durability that could be expected from timber treated to the H3.1 specification with light organic solvent preservatives (LOSP), although there is usually more variability in naturally durable timber than in treated radiata pine sapwood. Horizontal, upward facing surfaces, end grain, and joint areas where water can be trapped are most susceptible to decay. If the surfaces are only partly exposed to the weather, are vertical or steeply sloping, and not end grain, the chances of decay are relatively low and service life will be considerably longer.

Large dimension components are likely to have a much longer service life than 50-mm -thick timber, e.g., 100-mm-thick timber could be expected to have approximately twice the service life of 50-mm-thick material. Any decay that develops will be progressive so the effective dimension of components may diminish with time. If components are carrying a heavy load, or are in a critical structural situation, then they may need to be replaced in a shorter time.

Cypress heartwood is resistant to preservative penetration (refractory species) and there is little to be gained by putting it through a preservative treatment process. The sapwood is not durable and poor penetration is likely when conventional pressure processes are used. It can be treated when freshly sawn using boron and diffusion processes, but this type of treatment is unsuitable for components that are exposed to the weather.

There are brush-on preservative products available which may extend the life of untreated wood in low-to-moderate decay-hazard situations. Products containing water repellents and wood preservative chemicals are the most effective, but they should be regarded as providing relatively short term, surface protection only. Our testing indicates that the service life of sapwood or some less durable heartwood can be extended by regular coating. The effect of preservative/water repellent mixtures on moderately durable heartwood is less clear and regular use may do little more than reduce variability.

The pale colour of Lawson cypress heartwood makes it difficult to differentiate between heartwood and sapwood in finished products. Pieces containing sapwood should be segregated out immediately after sawing if timber is to be used in external situations.

In Table 2A of NZS 3602:2003 “Timber and wood-based products for use in building”, dressing heart grade macrocarpa (*Cupressus macrocarpa*), Mexican cypress (*C. lusitanica*) and Lawson cypress are listed as suitable for external weatherboards without preservative treatment. In clause 111.2.5 of the Standard these same species are also listed as suitable for use in the “no finish” or “stained finish” condition.

Outdoor cypress furniture

## MACHINING

All cypresses machine as well as radiata pine with the same knife settings. They are reported to have slightly higher blunting properties than radiata and extractives can build up on knives.

### Reported working properties:

Sawing – no problems.

Planing and moulding – good finish, even in areas of "cross grain" surrounding large knots provided knives are sharp.

Turning – turns well at higher speeds, similar tear out on end grain to radiata. Keep knives sharp and free of extractive buildup.

Boring – generally good, tendency for sides of hole to be torn if using twist drill.

Chiselling – some difficulty with lower density wood. The soft wood tends to compress rather than cut, sharp chisels are essential.

Sanding – Generally sands well, with little clogging. Care with sanding lower density wood. Lawson can irritate the mucous membrane.

Screwing and nailing – Recommended to predrill to avoid tendency to split.

Gluing – A variety of wood glues may be used.

Bending - The cypresses are reported to have poor steam bending properties.

## Key Points

- No major utilisation problems
- Heartwood percentage related to age
- Sawing conversions range from 40-60%
- Drying schedules available

## Suggested reading:

NZS 3602:2003

Haslett 1986

Haslett *et al.* 1985

Clifton 1990

Park and Smith 1987

Somerville 1993

Low *et al.* 2005

http://www.scionresearch.com/nzjfs+articles+to+download.aspx.