CHAPTER 7 - PRUNING AND THINNING

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INTRODUCTION

Pruning and thinning of cypresses have been topics of considerable debate for many years. Traditional regimes have ranged from very high initial stockings to low stockings. Pruning suggestions have ranged from delayed pruning to vigorous secateur pruning.

Many people can pontificate on the merits of the best regime, but the base facts are as one leading farm forester says: “Plant trees, prune trees, thin trees and fell at end of rotation - end of story - don’t confuse the issue with too much information!”

Pruning and thinning decisions require clear objectives. Reasons for pruning are two-fold – for windproofing by removing crown area (see Chapter 3) and reducing the risk of topple, and also for clearwood production. The issue of how much to prune and how often is still being evaluated.

Make sure you visit the NZFFA web site to check for new information.

Two major silvicultural trial series have been established which provide key information for pruning and thinning decisions:

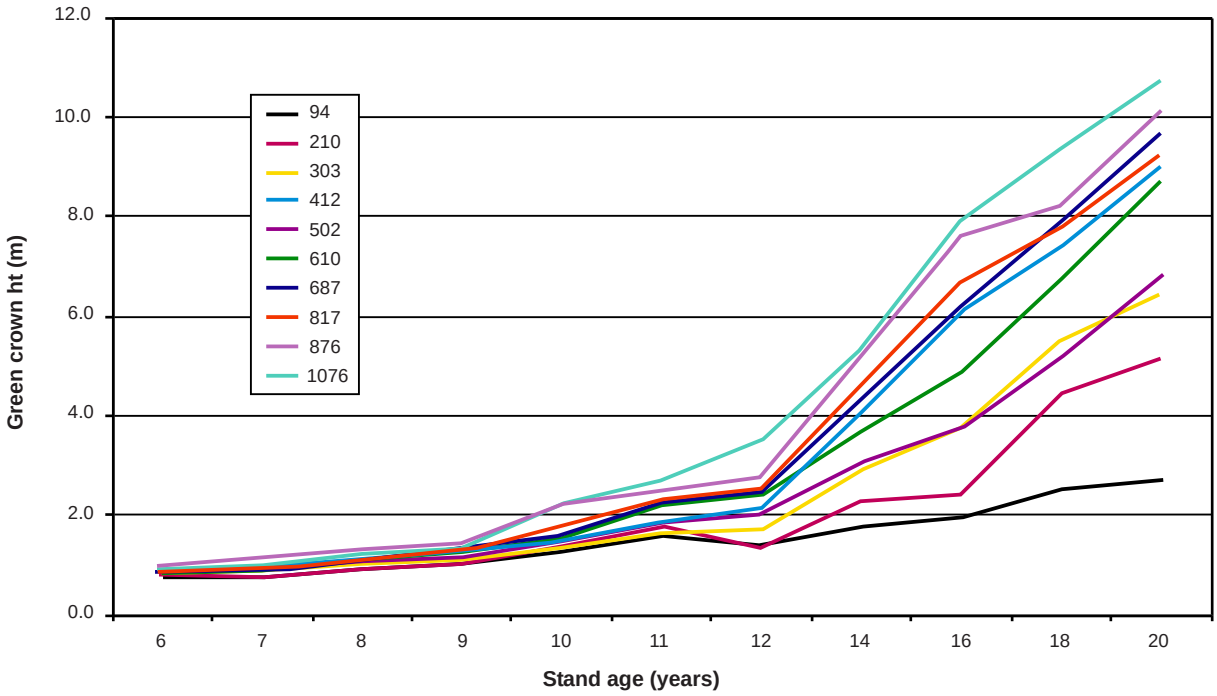
(i) Rotoehu, lusitanica spacing trial, established 1984;

(ii) Cypress regime trials in 1993-95.

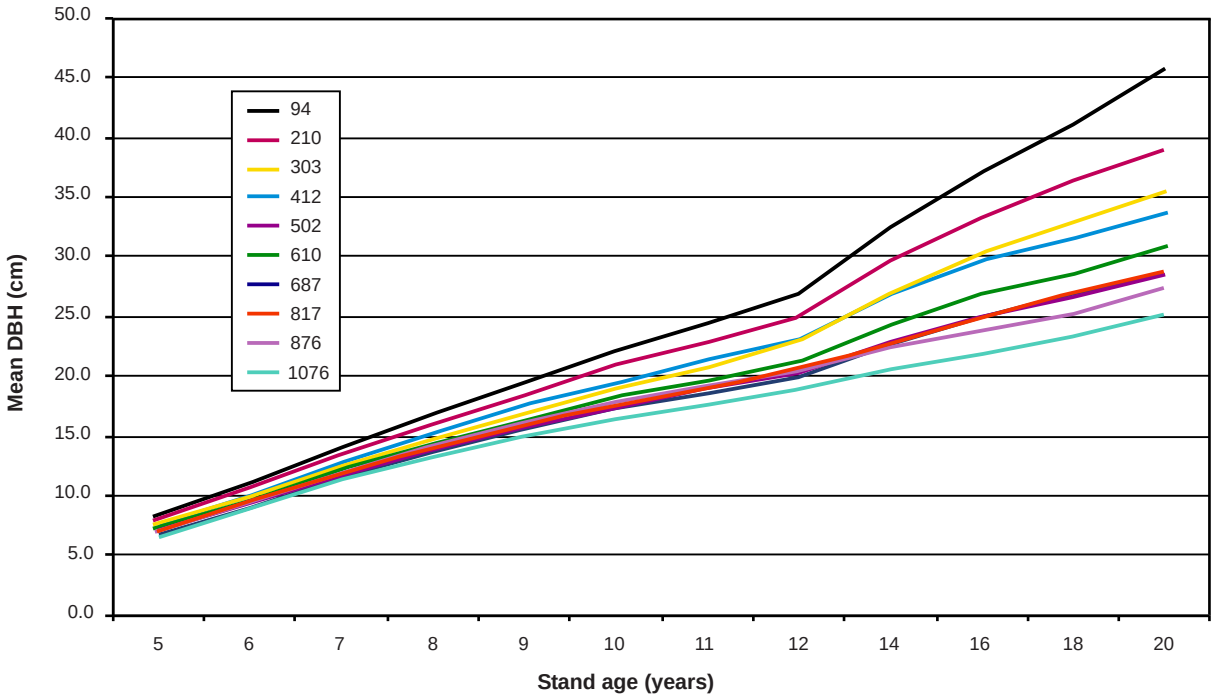
The results from these, and data collected from Permanent Sample Plots throughout the country, help in developing some guidelines for pruning and thinning.

Lusitanica spacing trial results

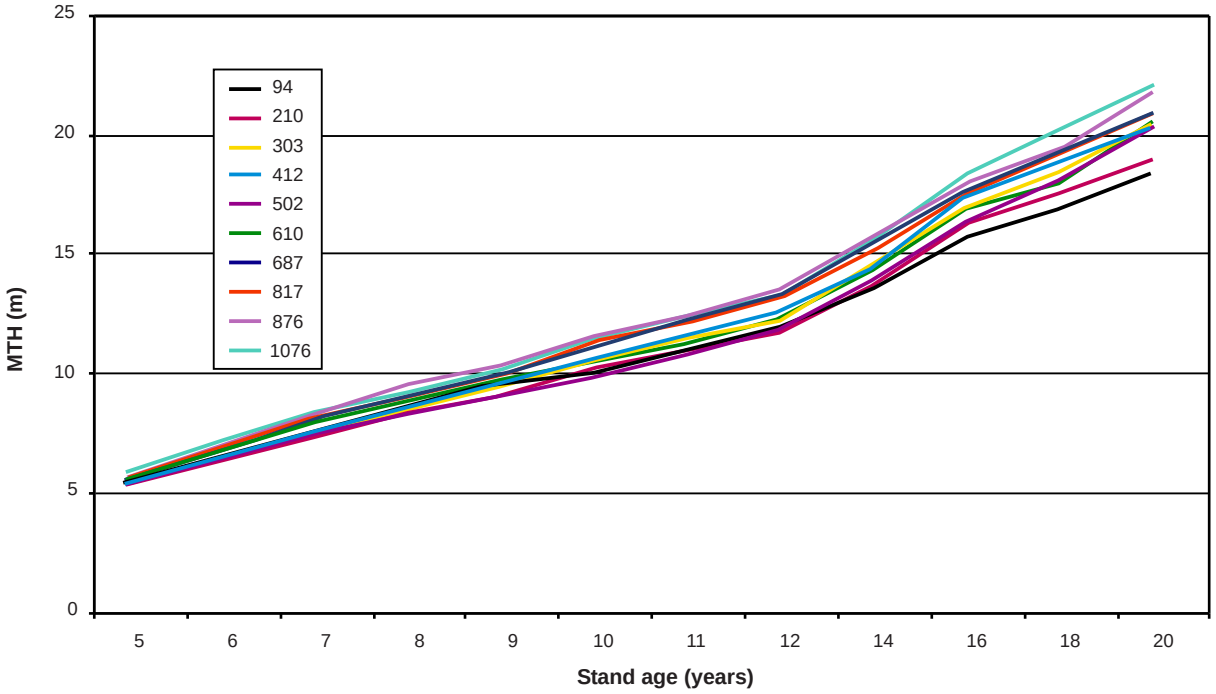
The cypress spacing trial in Rotoehu Forest provides data, from one site, which help in understanding the effect of stocking on average green crown height, mean diameter (mean DBH), mean top height (MTH), basal area (BA,) and live standing volume. The following age 20 lusitanica data from the Rotoehu trial illustrate the differences and relationships between stand parameters, with age and stocking.



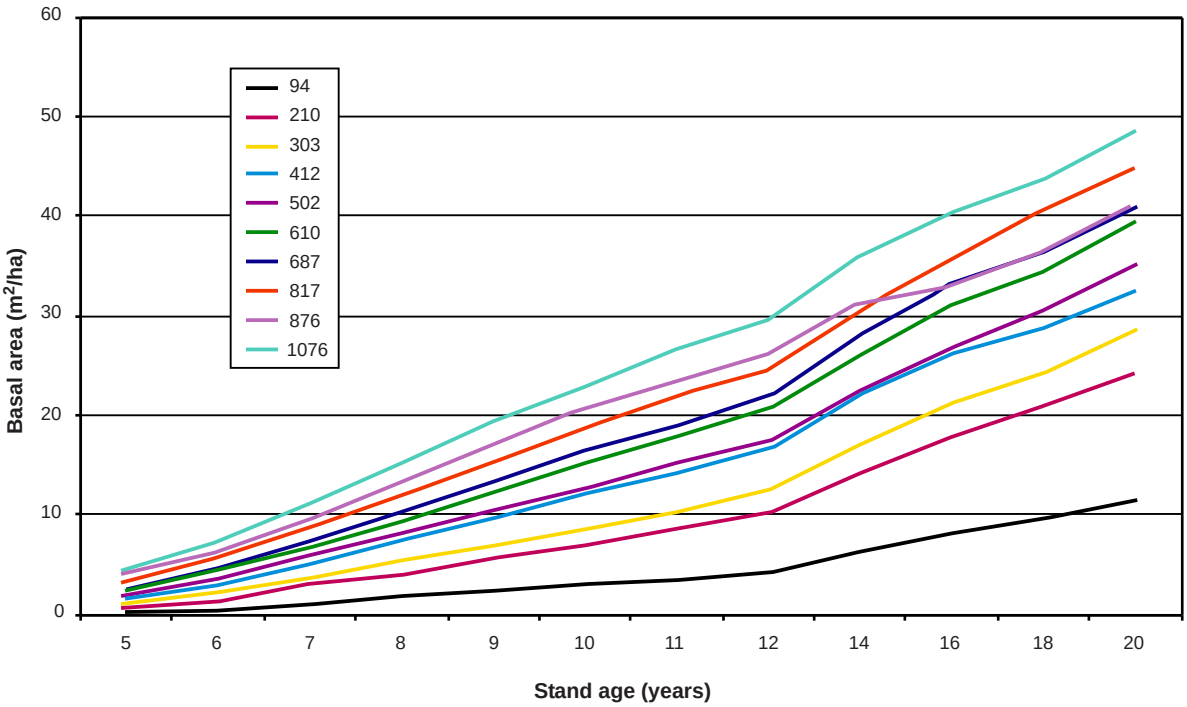
Green crown height trends for different stockings (stems/ha at age 5) for stand age 6-20 years.



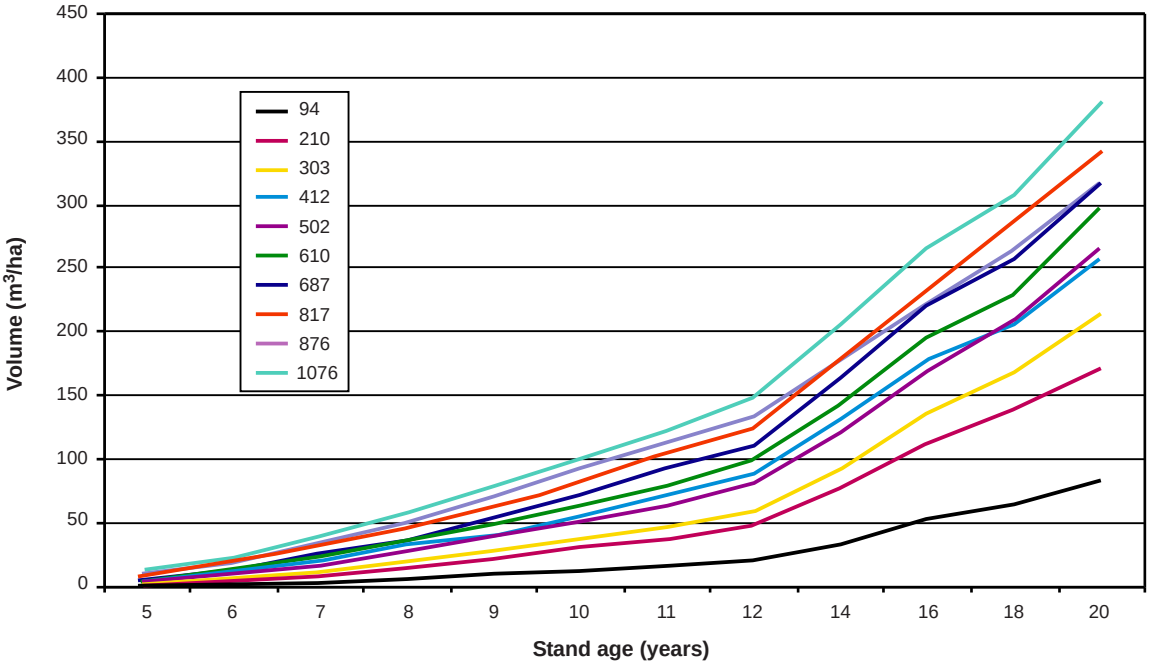
Mean DBH trends for different stockings (stems/ha at age 5) for stand age 5-20 years.



Mean top height trends for different stockings (stems/ha at age 5) for stand age 5-20 years.



Mean basal area trends for different stockings (stems/ha at age 5) for stand age 5-20 years.



Total volume trends for different stockings (stems/ha at age 5) for stand age 5-20 years.

Low stockings result in large diameter logs and lower green crowns, but lower total standing volumes per hectare. High stockings increase the total volume production on a site, encourage height growth, stem straightness, branch size control, but have trade-offs such as smaller diameters, higher green crowns (lower branch death over time), and longer rotations than stands with lower stockings if a given minimum piece size is to be produced.

If the objective is to produce large commercial logs that maximise clearwood and have live green knots in top logs, then the results of these trials suggest that pruning to leave 5 m green crown and thinning to maintain diameter growth is the better option. This means not pushing the green crown too high, too fast, and thinning in stages to 300 stems/ha. Current recommendations are that pruning should be done below a 12 cm stem diameter (or to retain at least 5 m green crown).

Research data on pruning height are not available, but pruning above 6 m is probably warranted only on stands grown for longer rotations (approximately 40 years).

Suggestions about regimes that have short rotations, or high stockings, are not supported by the research data and/or current market signals. Short rotations will produce minimal heartwood percentage. Also small branches mean small logs, and the current premium for clearwood suggests butt log diameter should be one of the main drivers in silvicultural decisions.

There are two other significant projects that have looked at branching of lusitanica in the Rotoehu spacing trial:

Influence of stocking on the growth and mortality of lusitanica branches in New Zealand

This study by Mansikkala (2002) looked at how stocking levels influenced timber defects, in particular growth and mortality of branches. Seven trees from the stocking range of 270 – 1250 stems/ha were destructively sampled at age 17 years. Branches from stem heights ranged from 2 to 8 m above ground.

The results showed that there was a relationship between stocking and the delay between the time when a branch stops growing and the time for the branch to die. This delay averaged 6 years. Not surprisingly, the study showed that as stocking increases, the mortality of branches occurs sooner and the delay is shorter.

There was no relationship between stocking and branch size, this was attributed to the small sample of trees studied. The study also confirmed that there is no branch shedding in lusitanica.

Modelling second-log branching characteristics of lusitanica that affect log quality

This study by Sim (2002) of second-log (6-12 m) branches in 17-year-old lusitanica reported a strong linear relationship between branch size characteristics and DBH; dead branch size characteristics were also strongly related to height and stocking.

A non-linear model was developed to predict the frequency of dead branches greater than 15 mm within the second log. The diameter of the individual tree stem, and stand height and stocking were the most important parameters that related to the quality of the branch characteristics in the second log.

The size of branches within the second log linearly increased as stem diameter (DBH) increased.

The size of dead branches within the second log linearly increased if the trees were taller and/or the stocking was higher.

The report stated: “Forest managers will need to make compromises between branch diameter and the diameter and frequency of dead branches because both cannot simultaneously be minimised by stand management”.

LUSITANICA REGIME TRIAL

Lusitanica regime trial, East Coast, age 6 years.

Regime trial treatments

The eight treatments, as described in Table 3, were designed to test a range of pruning regimes. Most of these treatments were applied to trials in three North Island locations. Analysis of the most recent treatments has yet to be undertaken on some sites.

Table 3. Silvicultural treatments in main trial (Northland). Initial stocking was 1000 stems/ha.

Treatment	**Thinning: Stocking/Age** (Stems/ha Age(years)	**Pruning severity**
1	unthinned (currently 700 stems/ha)	unpruned
2	early: 700/5	unpruned
3	early: 700/5 400/9	unpruned
4	late: 700/9 400/13	unpruned
5	early: 700/5 400/9	moderate - 6 m crown
6	late: 700/9 400/13	moderate - 6 m crown
7	early: 700/5 400/9	severe - 4 m crown
8	late: 700/9 400/13	severe - 4 m crown

Preliminary results

The thinning and pruning treatments had no effect on mean tree height. However, there were significant treatment effects for DBH (diameter at breast height), stem volume, and basal area.

Table 4. Comparison of the eight treatments in Northland trial at age 13 years.

Treatment	DBH (diameter) (cm)	MTH* (Mean Top Height) (m)	Stem Volume (m^3/ha)	Basal Area (m^2/ha)
1	26.2 d	17.9 a	251 a	37.4 a
2	27.4 cd	17.6 a	252 a	38.2 a
3	31.3 a	17.7 a	205 bc	30.1 b
4	29.4 b	17.8 a	187 bcd	27.8 bc
5	31.5 a	17.2 a	201 bc	31.0 b
6	31.1 a	18.1 a	207 b	30.7 b
7	28.5 bc	16.4 a	157 d	25.3 c
8	28.8 bc	18.3 a	174 cd	26.0 c

*Mean Top Height (mean height of the 100 largest-diameter stems/ha)
Values in a column followed by the same letter do not differ significantly (p = 0.05).

Preliminary conclusions from regime trials

- Moderate pruning (6 m crown remaining) had no significant effect on growth.
- Severe pruning (4 m crown remaining) significantly reduced diameter growth; however, this loss was modest, amounting to less than 2 cm , or less than 1 year's growth. This compares with radiata pine, which loses about 1.4 years of diameter growth in a typical 6 m pruning treatment.
- Delaying thinning significantly reduced crop diameter in the unpruned plots, but had no effect in the pruned plots.
- None of the silvicultural treatments (thinning/stocking/pruning) had any effect on height growth.

PRODUCTION THINNING

One of advantages of the cypresses is the flexibility they offer regarding possible harvest age. Small diameter (15-20 cm) straight logs as young as 15 to 20 years old mill well, producing stable timber right to the pith. This is in contrast to radiata pine, where there are often stability problems with timber milled from the juvenile cores of the first 10-15 growth rings. At the other extreme, cypresses 60 years old or more can produce premium logs, at an age when radiata pine will have far too much resinous heartwood to be acceptable for many uses.

The quality of young cypress logs opens the possibility of production thinning on accessible sites - the recovery and utilisation of thinned trees. Moreover, this can be repeated several times providing a useful cash flow in mid-rotation. Log prices will vary depending on sawmill preferences, log diameter, and log quality (straightness, knot size, fluting, heartwood content, etc.) but $70-100/tonne at mill door is commonly achieved.

Several production thinning regimes are possible:

- Simply removing trees with little regard to log quality to ensure optimum spacing and growth rates for remaining trees. Such a regime emphasises value at final harvest.
- Removal of the smaller, co-dominant and sub-dominant trees that are suffering increasing competition and are likely to show little diameter

growth and value addition in future years. The downside here is that these trees may be under-sized for commercial thinnings.

- Removal of the larger, more valuable, dominant trees relieving suppression of the smaller co-dominant and sub-dominant trees and allowing them to resume growth. There is a need to be realistic here and ensure that all remaining trees do have adequate green crown to ensure adequate, future growth. This regime emphasises early returns.
- Since cypresses can be grown on much longer rotations than radiata pine, there is the option of 'thinning to extinction', occasionally removing the largest trees till even the small sub-dominant trees have reached harvestable size.

With relatively shade tolerant species such as the cypresses, it may only be a short step from "thinning to extinction" to continuous cover forestry, in which selective logging and *in situ* regeneration are used in a manner similar to the sustainable management of indigenous forests. Continuous cover forestry is being advocated as an environmentally advantageous regime in some quarters.

Anyone considering production thinning needs to remember that it does require cheap, easy access and logging conditions, plus a very competent logging crew who will avoid damaging standing trees. Production thinning is, inevitably, more costly than a clearfell operation.

Key Points

- Early pruning can help reduce toppling.
- Cypresses need pruning for clearwood production.
- Prune below 12 cm stem diameter.
- Leave 5 m green crown when pruning.
- Thin to 300 stems/ha by age 10 years.
- Cypresses can offer production thinning options.

Suggested reading:

Mansikkala 2002

Sim 2002

Hay *et al.* 2005