

FOREST & FARM PLANTATION MANAGEMENT COOPERATIVE

EXECUTIVE SUMMARY

PRUNING OF IMPROVED RADIATA PINE BREEDS, TUMUNUI

— A PILOT STUDY

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Report No. 20

November 1995

Two *Pinus radiata* breeds were established in a pruning trial in the Rotorua region in 1985. The Growth & Form breed (GF17) is vigorous, straight and has short internodes while the Long Internode breed (LI 20) is less vigorous, has more sweep and has long internodes.

How these breeds would respond to different intensities of pruning was unknown therefore a pilot trial, as a precursor to an expanded series, was implemented based on the following three levels of Green Crown remaining: 2.5m; 4.0m; 5.5m.

The trial was based on a final crop stocking level of 100 stems per hectare.

Results show that pruning to leave 2.5m of green crown remaining is severe and produces a marked reduction in growth for both breeds when compared with the 4.0 and 5.5m treatments.

Other factors impounded on this trial to limit its potential however data from the trial will provide an important low stocking benchmark when information from the series of recently established trials based on the same breeds and pruning intensities becomes available as these cover a final crop stocking of 200, 300 and 400 stems per hectare.

**PRUNING OF IMPROVED RADIATA PINE BREEDS
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PRUNING OF IMPROVED BREEDS

A PILOT STUDY - TUMUNUI.

INTRODUCTION

The pruning of trees to provide clearwood is a common practice in New Zealand plantation forestry and many silvicultural regimes involving different intensities of pruning and thinning have been used to achieve maximum clearwood production without an adverse effect on overall stand productivity.

Also becoming common practice is access to a wide range of new radiata pine breeds through the NZ FRI genetic tree improvement programme. Each of the new breeds have traits that have been emphasised in the selection process such as : long internodes, dothistroma resistance, growth and form.

Considerable advances were made in the mid eighties in predicting the effects of silvicultural treatment on growth and quality factors. These predictions were made from a series of interactive models incorporating a wide range of silvicultural trials as a data base (West et al 1982). In general these trials have not incorporated the latest developments in genetic material. There are no guarantees that the "new breeds" will respond in the same way to the silviculture regimes applied to the earlier breeds and in order to examine the effect of pruning severity on two of these "new breeds" a pilot study was established. At the time of establishment the breeding programme was aimed at providing two quite different types of tree:

'Growth & Form' programme: Progeny tested clones selected for vigour, straightness and invariably showing a short internode branching habit (multinodal).

'Long Internode' programme: Progeny tested clones selected for long internode(uninodal), but most probably showing less vigour and more sweep than the short-internode.

TRIAL DESIGN AND TREATMENTS.

A trial was established at Tumunui Trust Farm (10kms Sth of Rotorua). The trial was based on the two breeds with three pruning severity prescriptions and five replications. The trial was established in 1985 with thirty randomised plots being planted at 500 sph. The trees were planted in groups of five in a diamond pattern around the centre tree (see Appendix 1). The seedlings represented the two breeds described above -(Growth & Form, top 20 clones, OP, GF17) and (Long Internode, top 20 clones, OP, LI20, GF10).

The regimes applied were:

Each plot was thinned from 80 trees to 45 trees at first prune lift.

45 trees to 30 trees at second prune lift.

30 trees to 15 trees at final prune lift.

Pruning severity levels were based on three different lengths of Green Crown (GC) remaining after each pruning:

2.5m GC (severe pruning);

4.0m GC (moderate pruning)

5.5m GC(light pruning).

Immediately following each pruning lift (first pruning 1991) the trees were measured for height, pruned height, DBH, DOS, and maximum branch removed. Annually, in June, all trees were measured for DBH and height.

RESULTS.

The program of treatment provided the measurement results for pruned height and DOS displayed in Table 1.

Table 1. Pruned Heights and DOS Treatments

Breed		Long Internode			Growth & Form		
Crown Remaining (m)		2.5	4.0	5.5	2.5	4.0	5.5
Feb 1991	Pruned Ht(m)	3.5	1.9	0.0	3.8	2.4	0.0
	DOS	16.9	17.1		18.1	17.4	
Jul 1992	Pruned Ht(m)	4.8	4	2.8	5.1	4.4	5.1
	DOS	15.1	20.8	24.1	14.8	21.2	21.8
Nov 1993	Pruned Ht(m)	5.9	5.5	4.8	6.5	6.1	5.1
	DOS	16.4	22.2	24.9	15.4	20.3	23.8
Nov 1994	Pruned Ht(m)	6.6	6.7	6.2	6.7	6.6	6.4
	DOS	17.5	21.7	25.0	16.8	21.3	23.4

While the DOS between treatments has increased as expected with the green crown remaining increasing the DOS within treatments has remained relatively uniform. The 5.5m treatments have however resulted in a DOS well in excess of 20cm.

Graphs 1, 2 and 3 display the three pruning treatments effect on Mean Diameter at breast height, Mean Height, and Basal Area per Hectare for the Growth & Form breed and similarly graphs 4, 5, and 6 for the Long Internode breed. The graphs show the year of the specific measurement from the date of the first pruning treatment applied to the stand.

Results: Growth & Form.

Mean DBH (graph 1). The 2.5 GC treatment has had an immediate effect on diameter compared to the 4.0 and 5.5 GC treatments. At age 10yrs (pruned height circa 6.6m) diameter is -11% and -18% respectively compared to the 4.0 and 5.5 treatment. The 4.0 diameter at 7% lower than the 5.5 is indicating that it to has had an effect on diameter growth.

Mean Height (graph 2). Both the 2.5 and 4.0 GC treatments have had a parallel effect on height growth compared to the 5.5. This difference has steadily increased through -8%(age 7), -11%(8.6), -13%(9.6) to -14%(age 10).

Mean Basal Area (graph 3). The time of thinning dependent on when the pruning treatment could be applied has affected the interim time comparisons however at age 10 (all treatments are at final crop stocking levels - circa 100sph) the 2.5 GC treatment has provided the largest effect with the total basal area being 20% lower than the 4.0 treatment and 33% lower than the 5.5.

Mean Maximum Branch. Table 2 contains the Mean Maximum Branch diameter for each treatment.

Table 2. Mean Maximum Branch

	Green Crown Remaining		
	2.5 GC	4.0 GC	5.5 GC
Prune Lift	(m)	(m)	(m)
1st prune	4.0	3.6	6.2
2nd prune	4.2	6.2	5.7
3rd prune	4.6	5.9	6.1

The 2.5 treatment provides a greater control on branch size compared to the 4.0 and 5.5 treatments. Branch size for the 1st lift with 5.5 GC is significantly greater than for the 2.5 and 4.0 but thereafter the 4.0 and 5.5 are similar.

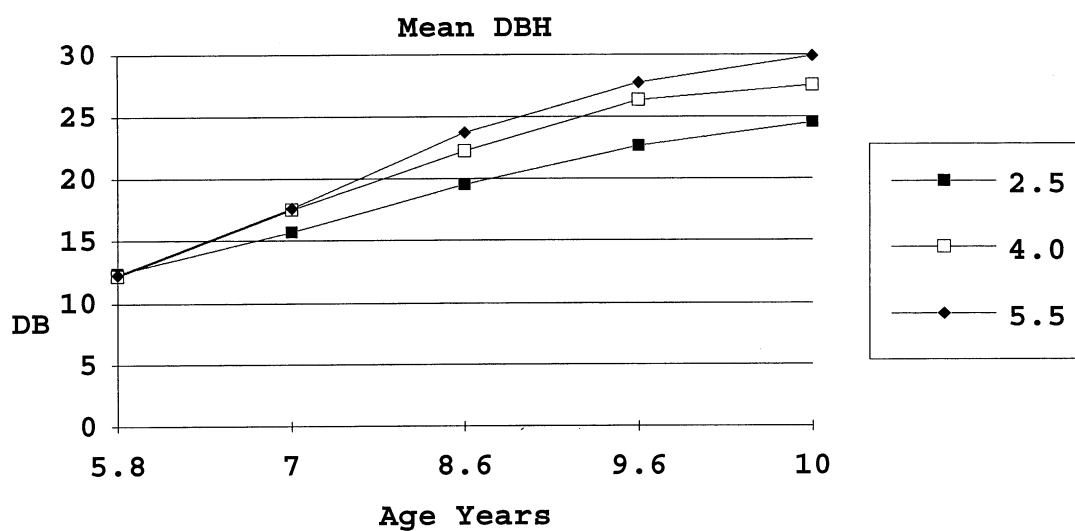
Overall - Growth & Form.

Compared to the 5.5 GC treatment at 100 sph final crop the effect of pruning to leave 2.5 of Green Crown on this bred is to produce a smaller diameter, shorter tree with a corresponding lower basal area.

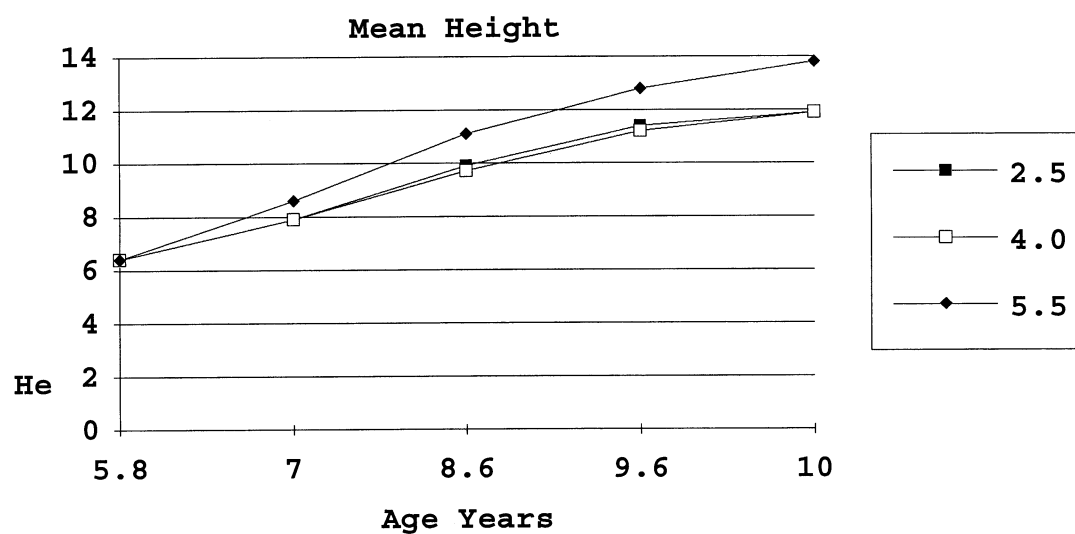
Pruning to leave 4.0m of Green Crown has a similar but less drastic effect.

New Breeds Growth & Form

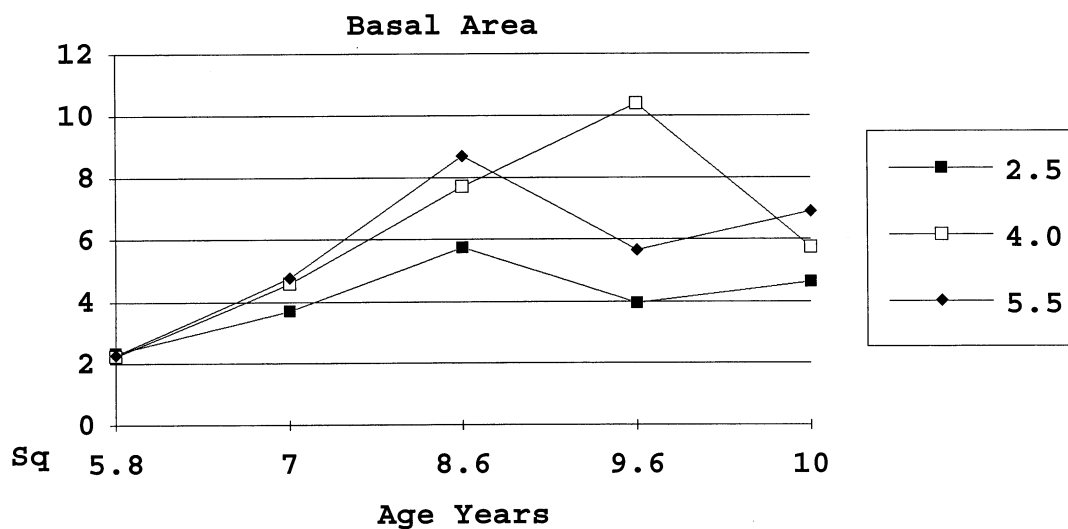
Graph 1. Growth & Form.



Graph 2. Growth & Form.



Graph 3. Growth & Form.



Results: - Long Internode.

Mean DBH (graph 4). The effect of pruning on diameter is very similar to that of the Growth & Form breed. The 2.5 GC treatment has had an immediate effect on diameter growth after the first pruning. At age 10 (pruned height circa 6.5m) diameter is -18% and -24% respectively compared to the 4.0 and 5.5 treatments. The 4.0 GC diameter at 6% lower than the 5.5 is indicating that it to has had an effect on diameter growth.

Mean Height (graph 5). The 2.5 and 4.0 GC treatments have had a parallel effect on height growth compared to the 5.5. This difference has flattened off after an initial -11% (age 7) to -9% at ages 8.6, 9.6, 10 (1.2m).

Mean Basal Area (graph 6). At age 10 (all treatments are at final crop stocking levels - circa 100sph) the 2.5 GC treatment has provided the largest effect with the total basal area being 32% lower than the 4.0 treatment and 41% lower than the 5.5.

Mean Maximum Branch. Table 3 contains the Mean Maximum Branch diameter for each treatment.

Table 3. Mean Maximum Branch

	Green Crown Remaining		
	2.5 GC	4.0 GC	5.5 GC
Prune Lift	(m)	(m)	(m)
1st prune	4.0	3.8	7.2
2nd prune	4.8	6.6	6.7
3rd prune	5.3	6.4	7.7

Again very similar results to the Growth & Form breed although the branch diameter in the Long Internode 5.5 treatment, at circa 7 cms, is significantly larger than its Growth & Form counterpart.

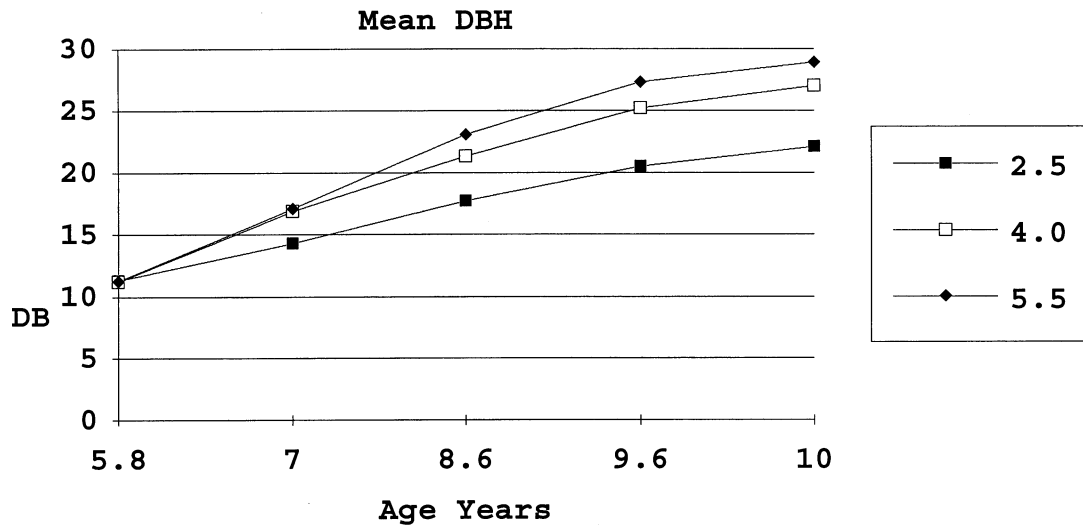
Overall - Long Internode.

Same as for the Growth & Form breed. That is:

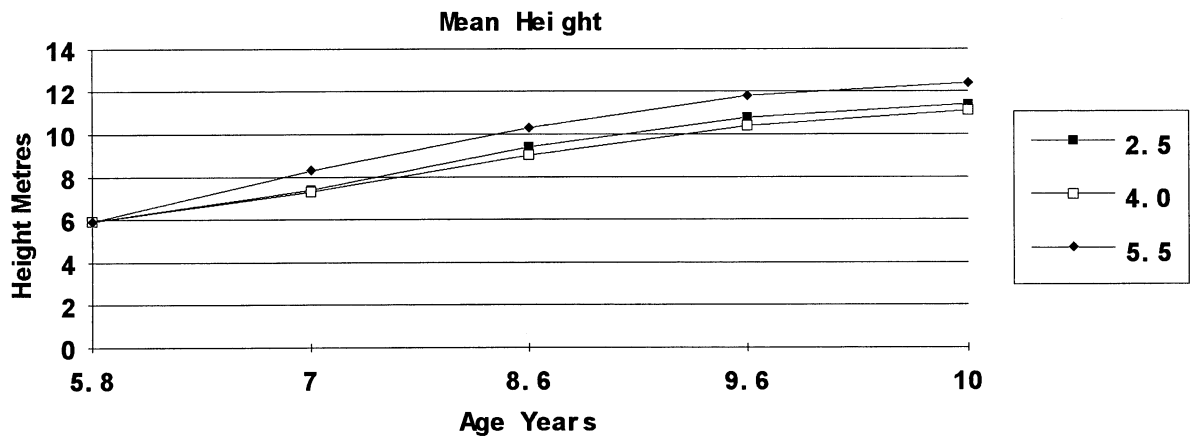
Pruning to leave 2.5 of Green Crown produces a smaller diameter, shorter tree with a similar but less drastic effect for the 4.0 Green Crown treatment.

New Breeds Long Internode

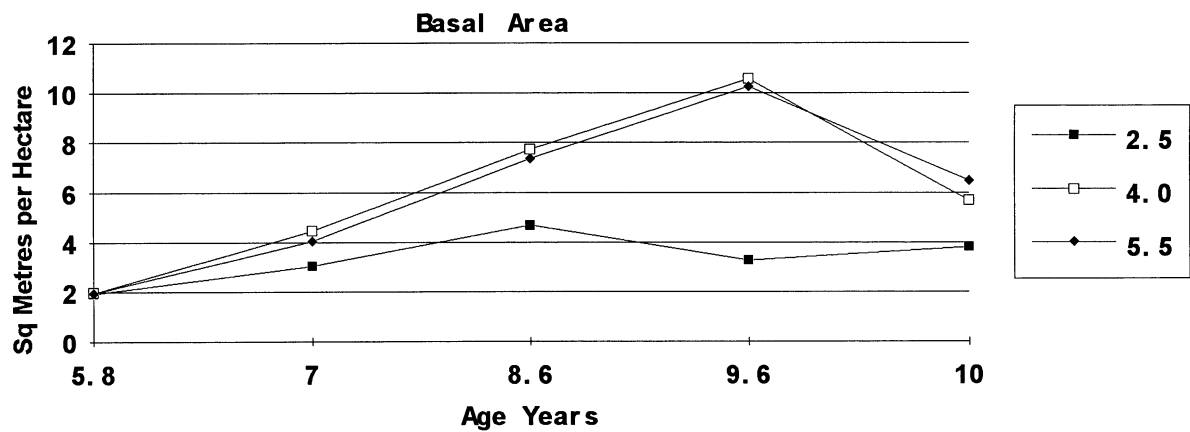
Graph 4. Long Internode



Graph 5. Long Internode



Graph 6. Long Internode



COMMENT

As defined earlier the Growth & Form breed was expected to show more vigour than the Long Internode breed. The results confirm that this is indeed the case with Long Internode having a larger diameter and height than Growth & Form at all stages of the regime.

The trial was marred by misfortune at several stages of its history:

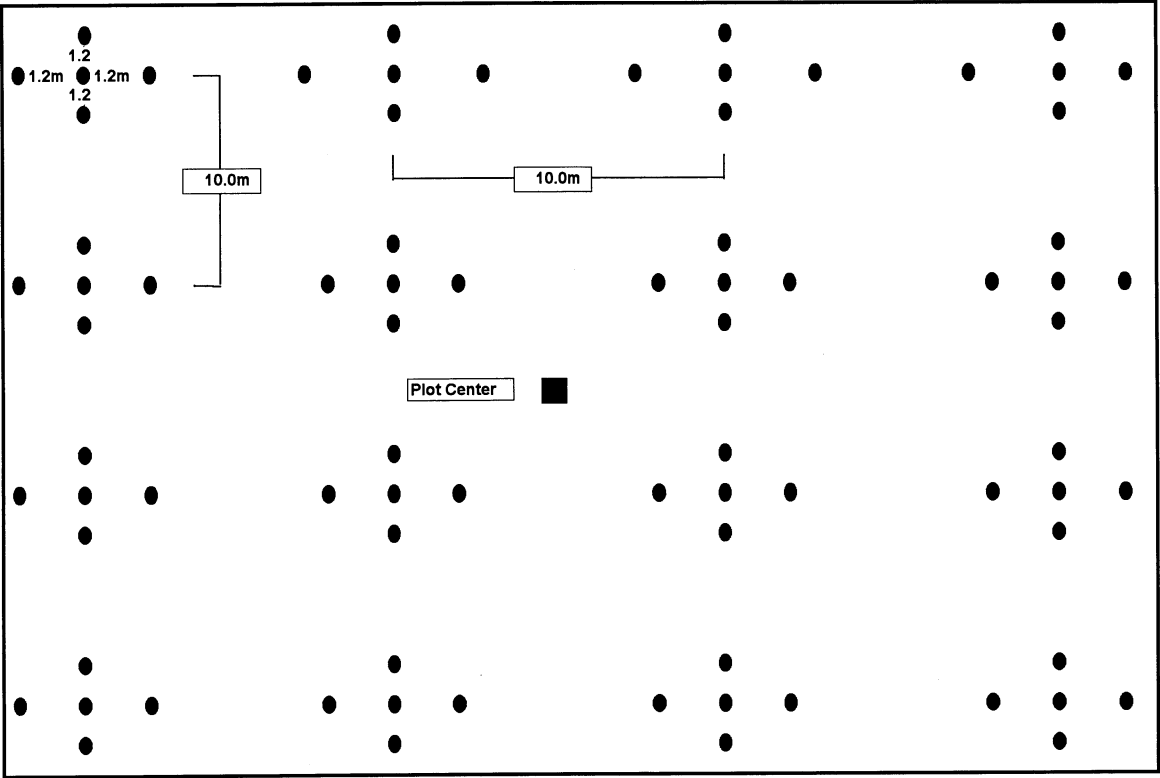
- Damage to the bottom metre of many trees occurred through goats stripping the bark. This affected tree selection for both pruning and thinning.
- Roadside scrub spraying resulted in spray drift damaging several edge trees, particularly in the buffer strip, again affecting tree selection.
- Wind damage resulted in many trees losing their tops, particularly around an exposed ridge, again affecting tree selection.
- The site has, sometime into its growth cycle, shown itself to be deficient in magnesium. This deficiency, revealed by mid-crown yellowing, has not been treated and may well have affected the results. An assessment to determine whether one or both of the breeds are affected equally may be undertaken by the soils research group in early 1996.
- The above resulted in such a reduction in trees for selection that only 11 of the 30 plots contain the target final crop of 100 sph pruned to at least 6.0m. Several plots have additional trees to the fully pruned ones to make up the spacing however a number of these are of dubious quality in terms of a final crop.

This combination of factors has made the original objectives of the trial difficult to attain and of questionable value. What the trial has provided is a set of data, for each breed, for a low stocked agroforestry site. This data set can be used as part of the predictive model development based on the more recently installed new breeds trials at Kaingaroa Forest (2nd rotation site), Te Puke highlands (high fertility farm site), and Te Toke (ripped and mounded farm site). These three trials not only include the same two breeds and three Green Crown remaining treatments but also contain three final crop stocking levels of 200, 300 and 400 sph.

CONCLUSION

Both breeds reacted similarly to the pruning regimes applied. The 2.5m of Green Crown remaining appears to reduce growth too severely to be regarded as a viable pruning option while the 5.5m of Green Crown remaining results in large diameter branches prior to pruning.

Appendix 1. Individual Plot Layout



Appendix 1. Individual Plot Layout

