A COMPARISON OF OLDER PHYSIOLOGICALLY AGED CUTTINGS OF RADIATA PINE WITH JUVENILE CUTTINGS AND SEEDLINGS IN SHELTERBELTS

M. Dean

Report No. 28 November 1995

FOREST & FARM PLANTATION MANAGEMENT COOPERATIVE

EXECUTIVE SUMMARY

A COMPARISON OF OLDER PHYSIOLOGICALLY AGED CUTTINGS OF RADIATA PINE WITH 'JUVENILE' CUTTINGS AND SEEDLINGS IN SHELTERBELTS - TRIAL ESTABLISHMENT REPORT

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Report No. 28 **July 1995**

Shelter belt trials were established in August 1994 on two exposed farm sites located at Pirinoa, Wairarapa, and Brixton, Taranaki. The trials will compare tree growth and log quality of seedlings versus older physiologically aged cuttings of Pinus radiata. The plant types tested are:

- Seedlings — 1/0 Control pollinated, GF21
- "Juvenile" Cuttings — Cuttings from 3-year-old trees, GF22
- "Older" Cuttings — Cuttings from 6-year-old trees, same seedlot as the seedlings

At both sites each plant material type was planted in 12 tree plots (10 trees planted 2.5 metres apart in a single row measurement plot plus a single tree buffer at each end of the plot) replicated four times. Because of a shortage of some tree types some minor modification occured at the Taranaki site.

The plot layout and a description of each site are described.

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Establishment Report

INTRODUCTION

Analysis of an extensive series of trials in stands established in 1983/84 comparing radiata pine seedlings and cuttings has shown that on fertile farm sites 'aged' cuttings with a physiological age of 3 years or greater are less prone to topple, have straighter butt logs with higher predicted grade outturn and value (Holden *et al* 1993). However cuttings which are physiologically aged 4 years or greater often suffer a diameter loss (Klomp *et al* 1992).

While there is clearly an improvement in the butt log quality of aged cuttings it is apparent that on fertile sites and at low stockings (300 sph), the quality of the unpruned logs for seedlings and cuttings is similar but with seedlings having higher incidence of blown tops. The 1983/84 trial series is still too young to quantify such differences.

There may however be advantages in using older aged cuttings (up to 6 years) on fertile sites and in shelter belts, despite the potential loss in diameter growth, in an attempt to improve the quality of both the pruned and unpruned logs.

Earlier trials using older aged cuttings are generally established in plantations and are on sites typically less exposed to wind than most shelter belts (Holden *et al* 1994). Therefore they are not satisfactory for evaluating the unpruned log characteristics of trees grown on fertile high exposure sites.

OBJECTIVE

To establish a trial comparing the tree growth and quality of older physiologically-aged cuttings with seedlings planted in single row shelter belts on highly exposed fertile farm sites.

METHOD — GENERAL

Cutting material was collected during winter 1993, from a trial (established in 1987) at Kaingaroa Forest. This material was physiologically 6 years old at the time of collection and was set in the NZ FRI nursery. Seed from the same seedlot as the 6 year cuttings was also sown in the NZ FRI nursery in September 1993. Cuttings collected from a two year old stand (physiological age 3 years) planted in 1991 were also set in the NZ FRI nursery during the winter of 1993.

Two fertile farm sites known to be exposed to high wind runs have been selected in Wairarapa and Taranaki. The trials were established in July / August 1994 using best establishment practices. Details of each site are reported below.

Site 1

EXPT NO; FR 32/6

LOCATION: Pirinoa -Wairarapa (Appendix 1)

LAND OWNERS: Peter & Sue Warren , Cranford Farm

Site Description

The trial is located on a nominally flat alluvial outwash which is dissected by a steep sided downcut streams. The soils are heavy sandy silt loams over alluvial gravels deposited by the Ruamahanga river. This site is wet during winter but can be prone to extend dry periods during summer and Autumn. Cranford farm is less than 10 km from the south coast at Palliser Bay and is frequently exposed to strong southerly winds.
The belt is planted in an East West orientation. The plot Layout is shown in Appendix 2.

Treatments

The trial was blocked geographically with one replicate of each plant type being planted in each block. Each plot consists of 10 trees with one buffer tree of the same type at each end of the plot. A 50x 50 mm peg with the plot number is established at the beginning of each measurement plot.

The following tree stock types were planted;

1 Seedlings — 1/0 Control pollinated, Seedlot No. 6/3/86/054, GF21

2 'Juvenile' Cuttings — Cuttings from 3-year-old trees, GF22

3 'Older' Cuttings — Cuttings from 6-year-old trees, Seedlot No. 6/3/86/054, GF21)

The trial was planted by Mr Don Bell of the Wellington Regional Council on 16/8/94. The tree roots were dipped in Austrosorb gel prior to planting and were spayed with egg / resin animal repellent immediately after planting. The Radiata were planted 2.5 metres apart in a single row. A supplementary species of Pinus muricata (blue strain) was planted 2 metres to windward (South) and midway between the radiata. The treatments are laid out as follows:

Block 1	Plot 1	6 year cuttings
	Plot 2	3 year cuttings
	Plot 3	seedlings
Block 2	Plot 4	seedlings
	Plot 5	6 year cuttings
	Plot 6	3 year cuttings
Block 3	Plot 7	3 year cuttings
	Plot 8	6 year cuttings
	Plot 9	seedlings
Block 4	Plot 10	6 year cuttings
	Plot 11	3 year cuttings
	Plot 12	seedlings

Trees were spot release sprayed with Gardoprim and Gallant following planting.
Tree survival has been good (90%), however blocks 1 and 2 were severely damaged in May 1995 when sheep penetrated the fence from a neighbouring property and extensively browsed trees in plots 1 to 6. Damage was assessed in June and will be assessed again in August 1995.

Site 2

EXPT NO; FR 31/4

LOCATION: Bell Block Old New Plymouth airport site - New Plymouth(Appendix 3)

LAND OWNERS: New Plymouth City Council
Lessee Kiwi Coop Dairies Ltd
Mr Neil Luthart ph/ fax (06) 758 7164

Site Description
The trial is located on a raised beach plain of marine sediments overlayed with New Plymouth black loam soils. The area is extremely fertile dairy pasture.. This site is wet during winter. The farm is less than 1 km from the North west coast so is exposed to strong Westerly and Southerly winds.
The belt is split in two sections both planted in an East West orientation. Belt layout is shown in Appendix 4.

Treatments
The trial was blocked geographically with one replicate of each plant type being planted in each block. Each plot consists of 10 trees with one buffer tree of the same type at each end of the plot. A 50x 50 mm peg with the plot number is established at the begining of each measurement plot.

The following tree stock types were planted;

1 Seedlings — 1/0 Control pollinated, Seedlot No. 6/3/86/054, GF21
2 'Juvenile' Cuttings — Cuttings from 3-year-old trees, GF22
3 'Older' Cuttings — Cuttings from 6-year-old trees, Seedlot No. 6/3/86/054, GF21)

The trial was planted by NZFRI staff on 26/8/94. The Radiata were planted 2.5 metres apart in a single row. Because tree stocks were extremely limited the buffer trees at each end of the plots had to be GF 25 seedlings rather than the stock planted in the measurement plot. Due to insufficient stocks of GF 21 seedlings plot 12 had to be planted in Gf 26 seedlings. No supplementary species was planted.

The treatments are laid out as follows:

Block 1	Plot 1	6 year cuttings
	Plot 2	3 year cuttings
	Plot 3	GF 21 seedlings
Block 2	Plot 4	GF 21 seedlings
	Plot 5	6 year cuttings
	Plot 6	3 year cuttings
Block 3	Plot 7	3 year cuttings
	Plot 8	6 year cuttings
	Plot 9	GF 21 seedlings
Block 4	Plot 10	6 year cuttings
	Plot 11	3 year cuttings
	Plot 12	GF26 seedlings

Trees were spot release sprayed with Velpar granules, using a weed a metre with No 3 trigger, immediately following planting.
An inspection of the trial on 11/4/95 revealed that overall tree survival has been good (> 90%), with the exception of plots 8 and 11 which have been decimated by rabbits.

FUTURE MANAGEMENT

The trials will be release sprayed for a second season and when due pruned in 3 or 4 lifts to 6.5 metres. Pruning will be scheduled on DOS with the aim of having a similar DOS (18cm) for both seedlings and cuttings. It is anticipated that the seedlings will be pruned earlier than the cuttings. No thinning will be done.

MEASUREMENTS

Height and DBH measurements on all plot trees will be taken annually from tree age 3 until pruning treatments have all been applied. Beyond this DBH and height will be measured biennially until harvest. Measurements of pruned height, DOS, DOS height, maximum branch and the number of whorls removed will be taken at the time of each pruning lift. Following the final pruning lift stem straightness of the butt log will be measured using a straightedge. Prior to harvest upper log branches , stem straightness and relevant form characteristics will be measured. A sample of upper stem diameter and bark thickness measurements will also be taken to calculate taper and under bark volume.

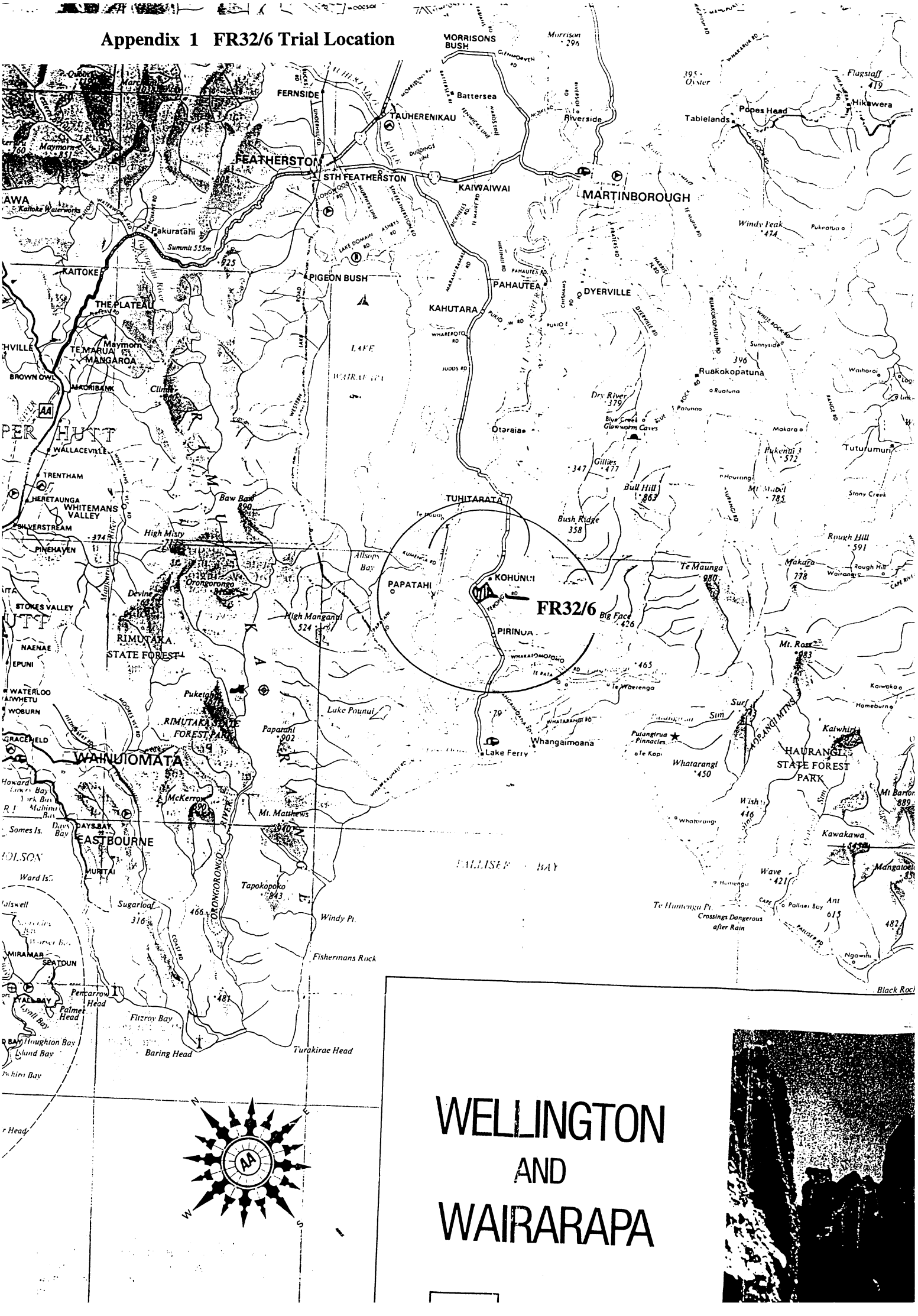
REFERENCES

Klomp, B.K.; Holden, D.G.; Hong, S.O.; Menzies, M.I. (1992). Growth and survival of Radiata pine cuttings, plantlets, and seedlings on ten North Island sites. Stand Management Cooperative Report No. 29

Holden, D.G.; Klomp, B.K.; Hong, S.O. (1993). Pruned butt log quality of Radiata pine cuttings, plantlets, and seedlings on eight North Island sites. Stand Management Cooperative Report No. 34

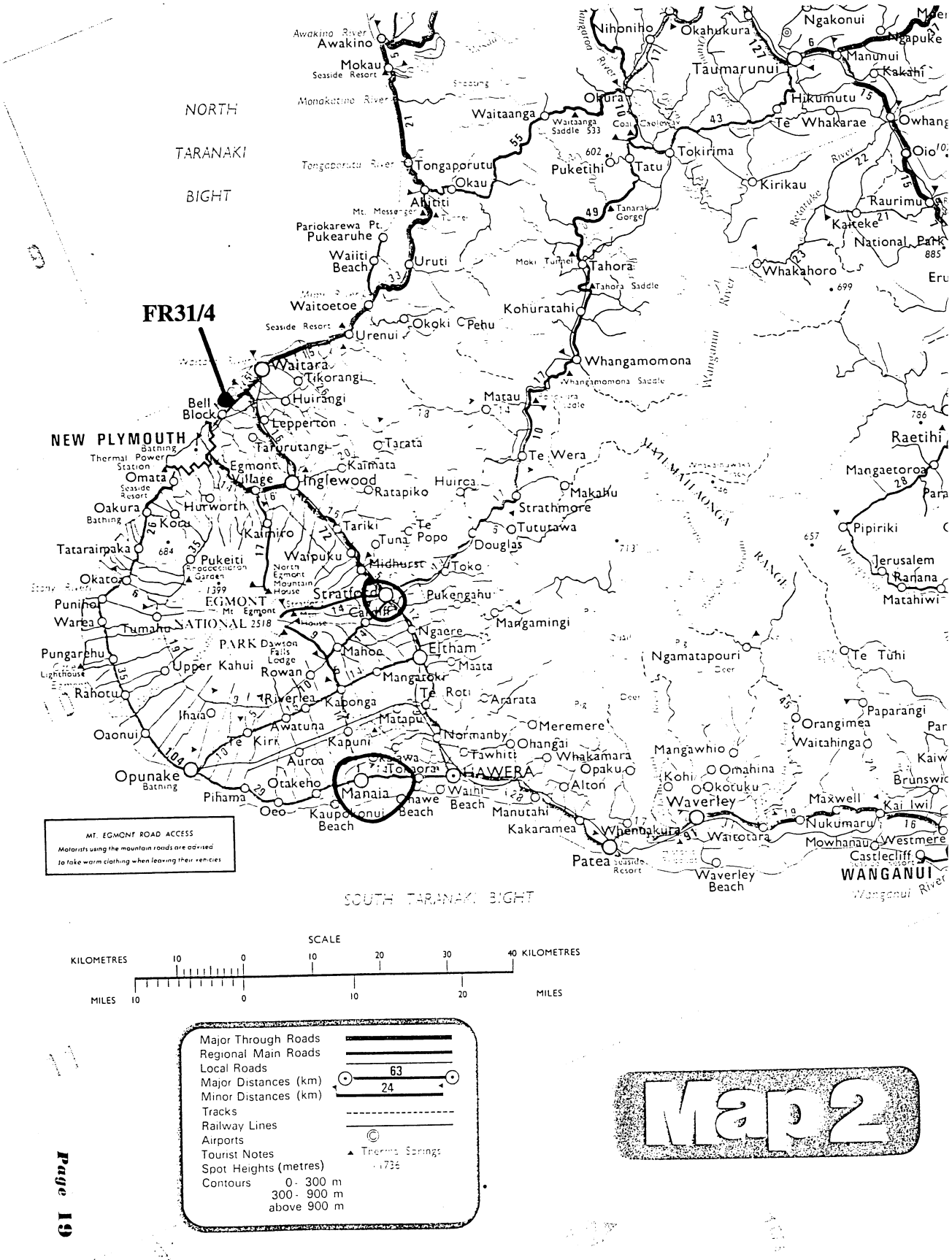
Holden, D.G.; Klomp, B.K.; Tombleson, J. D. (1994). The effect of physiological age of cuttings on unpruned log quality - Establishment report. Forest & Farm Plantation Management Cooperative Report No. 5

Appendix 1 FR32/6 Trial Location



Appendix 2 FR32/6 Trial Layout

Appendix 3 FR31/4 Trial Location

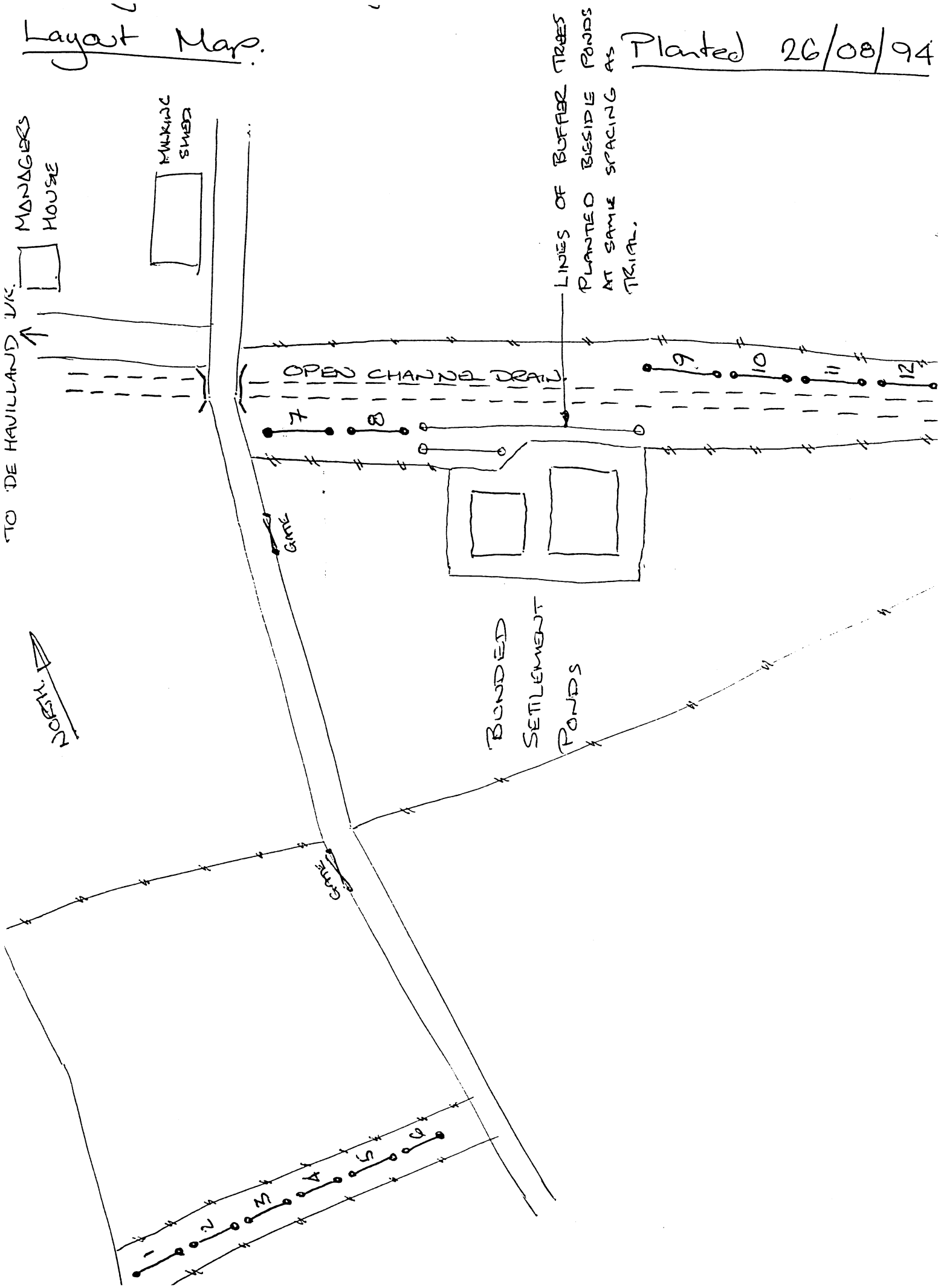


Appendix 4 FR31/4 Trial Layout

Timberbelt Trial.

Layout Map.

Planted 26/08/94



Appendix 1 Work Plan

A COMPARISON OF OLDER PHYSIOLOGICALLY AGED CUTTINGS OF RADIATA PINE WITH JUVENILE CUTTINGS AND SEEDLINGS IN SHELTER BELTS

Work Plan

BACKGROUND

Analysis of an extensive series of trials in stands established in 1983/84 comparing radiata pine seedlings and cuttings has shown that on fertile farm sites 'aged' cuttings with a physiological age of 3 years or greater are less prone to topple, have straighter butt logs with higher predicted grade outturn and value. However cuttings which are physiologically aged 4 years or greater often suffer a diameter loss.

While there is clearly an improvement in the butt log quality of aged cuttings it is apparent that on fertile sites and at low stockings (300 sph), the quality of the pruned logs for seedlings and cuttings is similar but with seedlings having higher incidence of blown tops. The 1983/84 trial series is still too young to quantify such differences.

There may however be advantages in using older aged cuttings (up to 6 years) on fertile sites and in shelter belts, despite the potential loss in diameter growth, in an attempt to improve the quality of the unpruned logs.

Earlier trials using older aged cuttings are generally established in plantations and are on sites typically less exposed to wind than most shelter belts. Therefore they are not satisfactory for evaluating the unpruned log characteristics of trees grown on fertile high exposure sites.

OBJECTIVE

To establish a trial comparing the tree growth and quality of older physiologically-aged cuttings with seedlings. The trade-off between stem diameter and branch size of the older physiologically-aged cuttings will also be examined.

METHOD — GENERAL

Cutting material was collected during winter 1993, from a trial established at Kaingaroa Forest in 1987, and set in the NZ FRI nursery. Seed from the same seedlot as the cuttings was also sown in the NZ FRI nursery in September 1993. Cuttings collected from three year old trees were also set in the NZ FRI nursery during the winter of 1993.

Fertile farm sites known to be exposed to high wind runs have been selected in Wairarapa and Taranaki. The trials will be established in July 1994 using best practices. Release spraying will follow in early spring before vigorous grass growth competes with trees

TREE STOCK TYPES

Seedlings — 1/0 Control pollinated, Seedlot No. 6/3/86/054, GF21
Cuttings — Cuttings from 3-year-old trees, GF22
Cuttings — Cuttings from 6-year-old trees, Seedlot No. 6/3/86/054, GF21

TRIAL DESIGN

The trial will be established as a single row shelter belt in a randomised block design consisting of four replicates per site. Each block will contain 1 replication of each tree stock type randomly allocated. The inner (measured) plot will be ten trees long with a single tree buffer at each end of the plot. Trees will be planted 2.5 metres apart within the row and the supplementary species is to be planted midway between the Radiata trees at 2.5 metre spacing within a row but offset 2 metres to windward of the radiata.

MANAGEMENT

The trial will be pruned in 3 or 4 lifts to 6.5 metres. Pruning will be scheduled on DOS with the aim of having a similar DOS (18cm) for both seedlings and cuttings. It is anticipated that the seedlings will be pruned earlier than the cuttings. No thinning will be done.

MEASUREMENTS

Height and DBH measurements on all plot trees will be taken annually from tree age 3 until pruning treatments have all been applied. Beyond this DBH and height will be measured biennially until harvest. Measurements of pruned height, DOS, DOS height, maximum branch and the number of whorls removed will be taken at the time of each pruning lift. Following the final pruning lift stem straightness of the butt log will be measured using a straightedge. Prior to harvest upper log branches , stem straightness and relevant form characteristics will be measured. A sample of upper stem diameter and bark thickness measurements will also be taken to calculate taper and under bark volume.

PLOT LAYOUT

Treatments to be laid out as follows:

Block 1	Plot 1	6 year cuttings
	Plot 2	3 year cuttings
	Plot 3	seedlings
Block 2	Plot 4	seedlings
	Plot 5	6 year cuttings
	Plot 6	3 year cuttings
Block 3	Plot 7	3 year cuttings
	Plot 8	6 year cuttings
	Plot 9	seedlings
Block 4	Plot 10	6 year cuttings
	Plot 11	3 year cuttings
	Plot 12	seedlings

RESPONSIBILITIES:

Trial design	NZFRI (M. Dean.)
Fencing	Land Owner
Radiata Tree stocks	NZFRI (G. Holden , J Tombleson.)
Supplementary species	Land Owner
Planting	Wellington Regional Council (D. Bell) / NZFRI
Release spraying	Land Owner
Pruning	Land Owner with NZFRI supervision
Tree measurements / data storage and analysis.	NZFRI

A COMPARISON OF OLDER PHYSIOLOGICALLY AGED CUTTINGS OF RADIATA PINE WITH JUVENILE CUTTINGS AND SEEDLINGS IN SHELTER BELTS

Site 1 Pirinoa - (Peter & Sue Warren , Cranford Farm) Wairarapa

Tree Stock Types:

1 Seedlings — 1/0 Control pollinated, Seedlot No. 6/3/86/054, GF21

2 Cuttings — Cuttings from 3-year-old trees, GF22

3 Cuttings — Cuttings from 6-year-old trees, Seedlot No. 6/3/86/054, GF21)

Each plant type to be planted in 4 x 10 tree plots with one buffer tree of the same type at each end of the plot. A 50x 50 mm peg with plot number is to be established at the begining of each measurement plot.

Trees should be planted 2.5 metres apart in a single row. P muricata supplementary species should be planted at least 1 metre to windward. The Radiata must be no closer than 2 m to any fence.

Treatments to be laid out as follows:

Block 1	Plot 1	6 year cuttings
	Plot 2	3 year cuttings
	Plot 3	seedlings
Block 2	Plot 4	seedlings
	Plot 5	6 year cuttings
	Plot 6	3 year cuttings
Block 3	Plot 7	3 year cuttings
	Plot 8	6 year cuttings
	Plot 9	seedlings
Block 4	Plot 10	6 year cuttings
	Plot 11	3 year cuttings
	Plot 12	seedlings

M Dean 18/8/94

TREE DAMAGE ASSEMENT FORM

Pirinoa

PLOT NUMBER:	DATE:

Code	Description of damage
0	undamaged
1	minor browsing < 10 % foliage removed
2	moderate browsing upto 60 % foliage removed and or terminal bud damaged
3	serious browsing > 60 % foliage removed
4	Tree dead or missing.

Tree No	Seedling Height (cm)	Damage Code	Comments
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			