

**PERFORMANCE OF  
POHUTUKAWA PLANTING TRIALS,  
EASTERN BAY OF PLENTY COAST**

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**2000**

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ABSTRACT

Early performance of planted pohutukawa (*Metrosideros excelsa*) along the eastern Bay of Plenty coast has been variable with poor survival in many of the planting programmes located on sandy or shingle bays within the Opotiki district. *Forest Research* and the Opotiki District Council in collaboration with local communities and iwi established trials on three sites testing a range of treatments to improve the performance of planted pohutukawa along the Eastern Bay of Plenty coast. Planting trials have been established over the last two years (1998 & 1999) investigating a range of treatments designed to improve performance.

In the 1998 trials several planting treatments including use of subsoil and mulches on the difficult sandy and shingle sites were investigated. However, survival and growth during the first year of pohutukawa planted on the sand dune site (Snells Beach) and the shingle beach site (Torere) were very poor compared to performance on subsoil derived from volcanic ash (Ohiwa). Assessment of the planting at Ohiwa 18 months after planting indicates survivals of 90% and height growth of 80 cm despite dense growth of kikuyu grass.

In 1999 a second series of trials was established investigating a range of new treatments on the sand dune and shingle beach sites. This included topped seedlings vs non-topped seedlings, a comparison of seedlings raised in different containers, use of plastic buckets for shelter, planting on raised sand dune mounds and on rotting driftwood. Assessment six months after planting indicates excellent survival of seedlings planted at the shingle site (Torere) with most seedlings looking vigorous although there has been no significant growth across all treatments at this early stage. Recent dieback of seedlings within the shelter of plastic buckets is of concern at both the Torere and Snells Beach sites. There has also been good survival of the small seedlings planted amongst rotting driftwood and good early survival and some growth of seedlings planted on mounds.

Further monitoring and new work involving both nursery and field based trials is proposed for 2000/2001.

**KEYWORDS:** pohutukawa, *Metrosideros excelsa*, fertiliser, sand dunes, establishment

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## INTRODUCTION

Early performance of planted pohutukawa (*Metrosideros excelsa*) along the eastern Bay of Plenty coast has been variable with poor survival in many of the planting programmes located on sandy or shingle bays within the Opotiki district. *Forest Research* and the Opotiki District Council in collaboration with local communities and iwi established trials on three sites testing a range of treatments to improve the performance of planted pohutukawa along the Eastern Bay of Plenty coast. This project is jointly funded by Project Crimson, Opotiki District Council and Environment BOP. Planting trials have been established over the last two years (1998 & 1999) investigating a range of treatments designed to improve performance.

Three sites were selected and a comprehensive planting trial established in September 1998 aimed at determining major factors likely to be affecting the survival and growth of planted pohutukawa seedlings (Work Plan 2102). Three sites were planted and a range of treatments evaluated. First year results are detailed in Bergin & Houghton (1999). In brief, survival and growth of pohutukawa planted on the sand dune site (Snells Beach) and the shingle beach site (Torere) were very poor compared to performance on subsoil derived from volcanic ash (Ohiwa).

On 9<sup>th</sup> August 1999, a field-based meeting between representatives of Project Crimson, Carter Holt Harvey, Environment Bay of Plenty, local community groups, Opotiki District Council and *Forest Research* was held at Opotiki. Several initiatives were discussed at this meeting and further trials were established in September/October 1999 incorporating some of these ideas aimed at increasing survival and growth of pohutukawa on sandy and shingle sites. This report describes the progress and performance of trials established in 1998 and 1999, and outlines proposed work for 2000/2001.

## OBJECTIVES

The objectives of the research were:

- To briefly survey the performance of nursery-raised seedlings of pohutukawa planted on key sites throughout the Opotiki district over the last five years.
- To determine the major factors likely to be affecting the survival and growth of planted pohutukawa seedlings.
- To design and implement joint *Forest Research*, Opotiki District Council and local community planting trials on three sites evaluating a range of planting treatments based on results of the survey.
- To maintain trials and monitor the performance of planted pohutukawa during the establishment phase.

- To produce practical guidelines for managing agencies and local community-based interest groups on establishment of pohutukawa on coastal sites.

## TRIAL SITES

Three trials were established on representative areas of each of the main site types identified in the survey (Fig. 1). The sites were:

1. **Ohiwa** - subsoil site derived from volcanic material; slope covered in kikuyu grass (*Pennisetum clandestinum*); adjacent to a camping ground on south side of the Ohiwa Harbour.
2. **Snells Beach** - sand dune site; relatively sheltered backdune site dominated by kikuyu, pohuehue (*Muehlenbechia complexa*) and boxthorn (*Lycium ferocissinum*); within the Opotiki sewage scheme disposal site.
3. **Torere** - shingle beach site; exposed flat beach immediately landward of the foredune in rank exotic grass and patches of pohuehue; western end of Torere Beach.

All sites were either fenced off from grazing animals or were located in areas that were unlikely to be grazed.

## METHODS

### Planting treatments

#### 1998 Planting trials

Treatments were selected on the basis of the results of the survey and early results of *Forest Research* trials with pohutukawa in other regions. Treatments were:

- **Fertiliser** - a slow-release NPK fertiliser was applied to selected plants at time of planting at all sites. This involved placing a Growtab pellet beside the root ball approximately half way down the planting pit. There were unfertilised plants as controls.
- **Added material** - three types of material (subsoil, compost, mulch) was added as separate treatments to selected seedlings at time of planting at the sandy and shingle sites. This involved removal of the sand or shingle from an enlarged planting pit and placing at least two shovel-fulls of subsoil or compost into the pit to surround the root ball. The mulch treatment involved placing hay around the base of planted seedlings after planting.
- **Irrigation** - at the sandy and shingle sites, selected seedlings were watered once weekly during a 2 month dry period which occurred approximately 3 months after planting.

Treatment combinations are given in Appendix 1 for the 1998 plantings at Ohiwa.

#### 1999 planting trials

A second series of trials established in September/October 1999 investigated the following treatments:

- Comparison of planted topped seedlings vs non-topped seedlings (Snells Beach and Torere). Previous planting trials indicate that many seedlings suffer dieback of tops so removal of up to 50% of the top was tested to reduce transpiration losses after transplanting.
- Comparison of seedlings raised in small containers vs large containers (Snells Beach and Torere).
- Use of 20 litre buckets (with bases removed) to shelter individual trees planted with deep mulch and slow-release fertiliser applied at planting vs non-sheltered seedlings (Snells Beach and Torere sites). Plantings in the Auckland area indicate increased success using buckets as shelters.

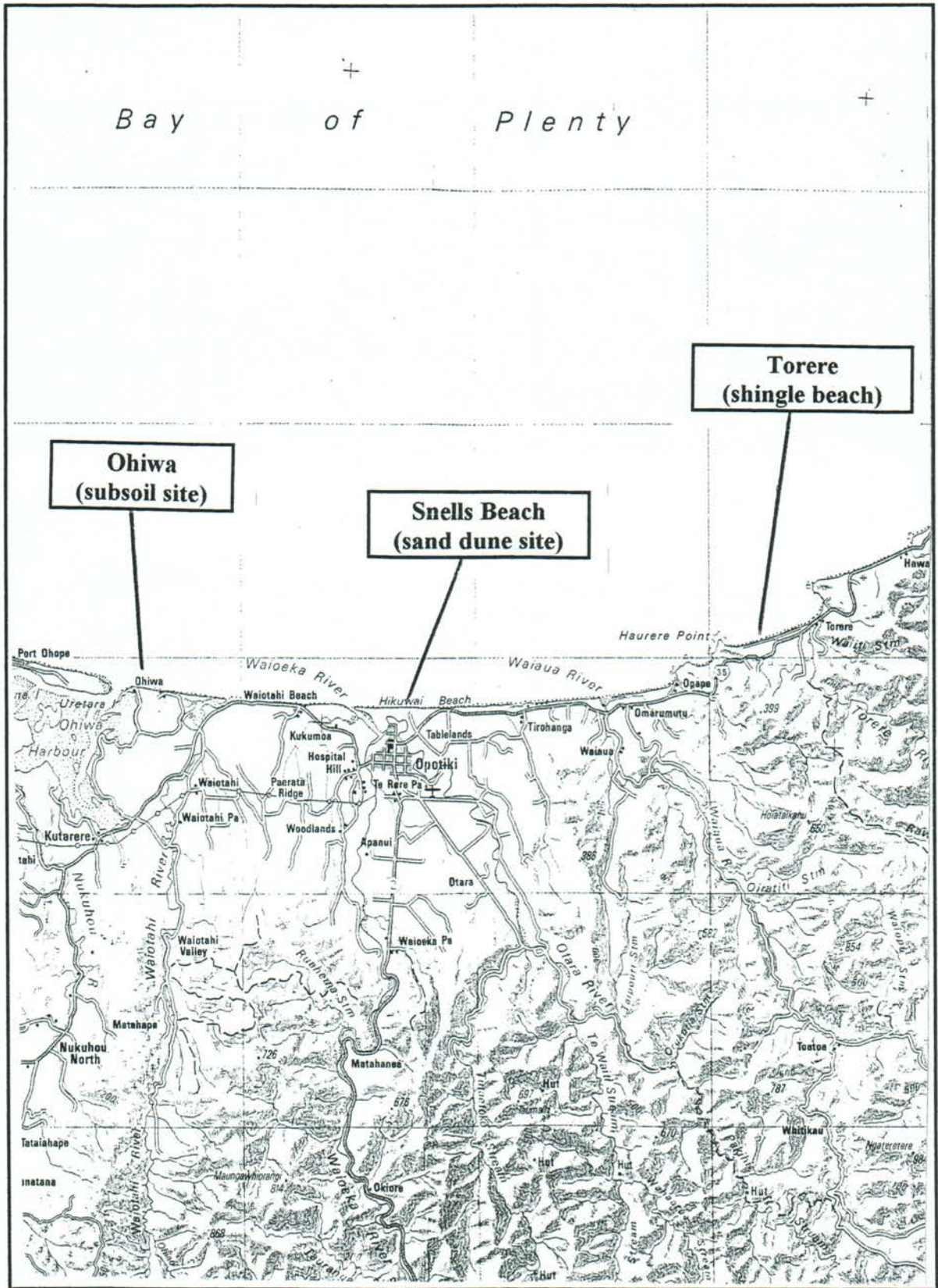


Figure 1 - Location of the three pohutukawa planting trials, Eastern Bay of Plenty.



*Plate 1: One treatment involved the removing the top 50% of pohutukawa seedlings immediately after planting to reduce transpiration as seedling become established. Previous trials indicate that the tops of pohutukawa dieback within a few months of planting. Although no growth was recorded six months after planting, topped and untopped seedlings have high survival and remain vigorous.*



*Plate 2: Planting of small pohutukawa seedlings within rotting driftwood at the shingle beach at Torere, eastern Bay of Plenty. The aim is to mimic natural establishment of pohutukawa on driftwood that is occurring along this beach. Many seedlings were still surviving six months after planting.*

- Planting of pohutukawa amongst naturally regenerating pohuehue on raised sand dune mounds vs planting on lower lying frost-prone sites (Snells Beach).
- A small pilot trial involving planting small seedlings on rotting driftwood to mimic natural processes (Torere).

Treatment combinations for 1999 plantings are given in Appendix 2 for Snells Beach and Torere.

### **Trial design and data analysis**

The trials were a Randomised Complete Block design with up to five at each site. Each replicate was located on a relatively uniform site with 5 or 6 tree plots assigned a single treatment combination. Numbered wooden pegs to enable assessment of seedlings on an individual basis identified all plots.

Plant height, cover (width x breadth of the live crown of each plant) and vigour (subjective assessment of plant health and vigour with scores ranging from 1 = poor to 5 = good) were measured for all seedlings soon after planting (October 1999). Sites were inspected regularly during the first year.

Performance was assessed 21 months after planting (June 1999) for the 1998 plantings and 6 months after planting for the 1999 plantings. This included survival, plant height, plant spread or cover, and any comments affecting plant condition (e.g. browsing, disturbance by beach users). For the analysis of plant spread, the square root of width x breadth was calculated.

## **INTERIM RESULTS**

### ***1998 planting trials***

Results indicate that there is less than 5% survival of seedling planted on both the sand dune (Snells Beach) and shingle site (Torere). In contrast, there is about 90% survival at the volcanic derived subsoil site at Ohiwa about 18 months after planting (Figure 2). Good growth is continuing with an average height of 80 cm (Figure 3) and average spread increasing from 17 cm at planting to nearly 40 cm 18 months later (Figure 4). There are no significant differences in survival or growth between seedlings fertilised at planting and non fertilised seedlings. However, seedlings are still vulnerable to overtopping by dense kikuyu grass forming mats up to 80 cm high. Hand-releasing of plants from grass in the second year is being carried out.

### ***1999 planting trials***

Preliminary assessment indicates excellent survival (over 96%) of seedlings planted at the shingle site (Torere) with most seedlings looking vigorous (Table 1). This is contrast to the poor survival of the trial established on a similar nearby site one-year earlier. However there has been no significant growth in both height and plant spread across all treatments. All plant types remain at a similar height 6 months after planting at 30-35 cm (Fig. 5). There are no significant differences in performance including height (Fig. 6) between topped and untopped seedlings. However, there has been recent dieback of seedlings within the shelter of plastic buckets (Fig. 6) and as well as increased mortality compared to untopped seedlings that are not sheltered. There has also been good survival of the small seedlings planted amongst rotting driftwood at Torere.

Survival and growth of seedlings within bucket shelters from the 1999 planting trials at the Snells Beach site is poor. However, there high survival and some growth of the small number of seedlings planted on mounds dominated by pohuehue six months after planting.

**Table 1: Performance of pohutukawa seedlings six months after planting at Torere, eastern Bay of Plenty, in 1999.**

Seedling type or treatment	Planting Height (cm)	Planting Spread (cm)	Survival (%)	Height increment (cm)	Plant spread increment (cm)	Plant Vigour (1-5)
PB3 bags	34.22	19.77	95	0.48	1.21	3.99
PB5 bags	31.53	21.94	100	0.35	6.2	4.2
Tinus roottrainers	30.6	11.39	95	1.51	3.93	3.73
Topped seedlings	20.68	14.34	98.33	1.43	3.97	4.08
Untopped seedlings	42.21	20.88	95	0.18	3.25	3.89
Bucket shelter with untopped seedlings	43.7	22.49	75	-12.28	-6.63	2.97
All	32.28	17.86	96.54	0.76	3.58	3.98

### INTERIM CONCLUSIONS

The continued high survival and reasonable growth of pohutukawa at the Ohiwa site on volcanic derived subsoil, despite the effects of competition with dense kikuyu, is encouraging and similar to that found with operational plantings by the Opotiki District Council of pohutukawa planted on comparable sites. This performance is contrast to the almost complete failure of planted seedlings also established in 1998 on the sand and shingle beach sites.

In the 1999 planting trials, treatments comparing stock raised in three different containers and topped vs untopped seedlings have at least 95% survival and high plant vigour scores. However, this assessment was carried out only six months after planting and consequently little growth has been recorded with most seedlings. The only significant difference has been with dieback of seedlings sheltered by plastic buckets which cannot be explained.

These preliminary results indicate that planting of pohutukawa is likely to be most successful on volcanic soils associated with headlands. This raises the question as to whether pohutukawa naturally occurs on sand dunes or on shingle beaches in large quantities, and with regard to those that do occur there, how did they get established. As reported previously (Bergin & Houghton 1999), some seedlings are successfully establishing on rotting piles of driftwood and the few small seedlings planted at Torere indicate that this may be worth investigating further.

Surviving plots of pohutukawas on the sandy and shingle beaches will continued to be monitored. It is recommended that new trials be established including nursery-based trials aimed at improving planting performance. For the 2000/2001 year, it is proposed this project involve:

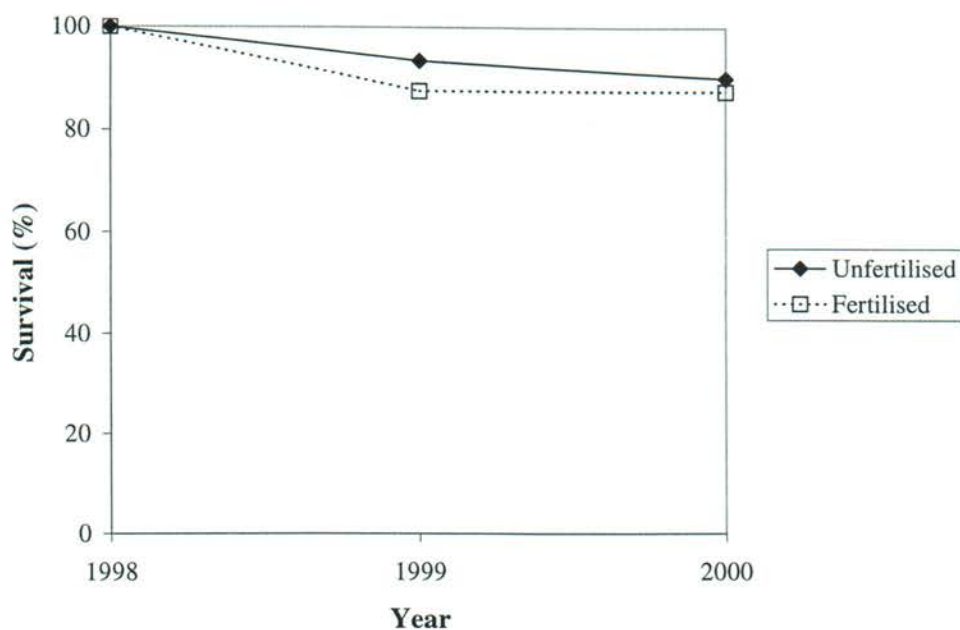
- Inspection and maintenance of the 1998 and 1999 trials at the three eastern Bay of Plenty sites.
- Establishment of further planting trials encompassing improvements from current trials.



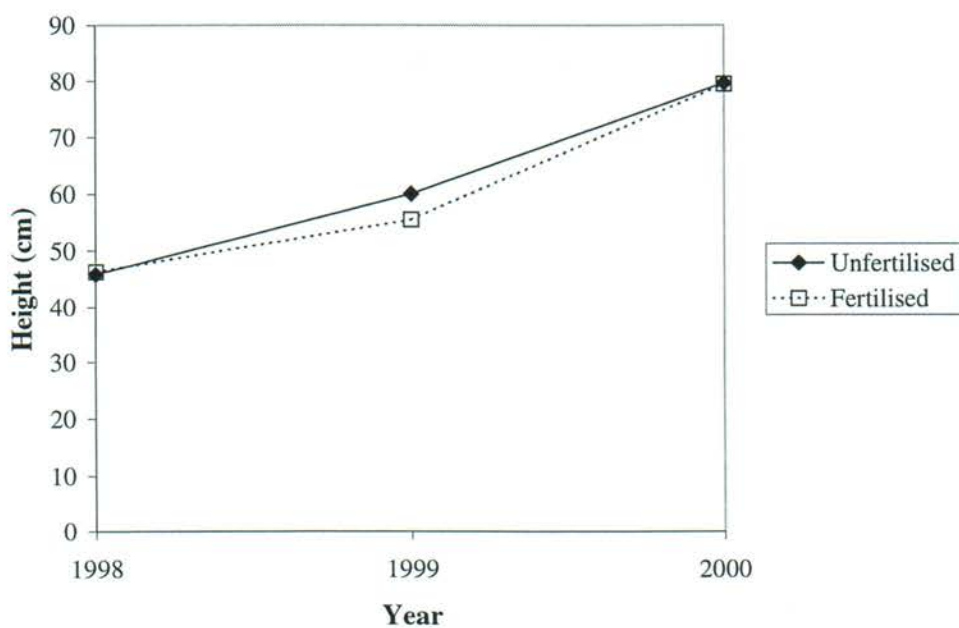
- An investigation of improved techniques for raising good quality seedlings in the nursery for difficult sites aimed at improving performance after planting.
- Planting of other local indigenous coastal species (eg., harakeke, ngaio, karo, tauhinu, taupata, houpara, akeake) on difficult sites to provide shelter before later planting of pohutukawa following natural succession processes of revegetation where appropriate.

#### REFERENCE

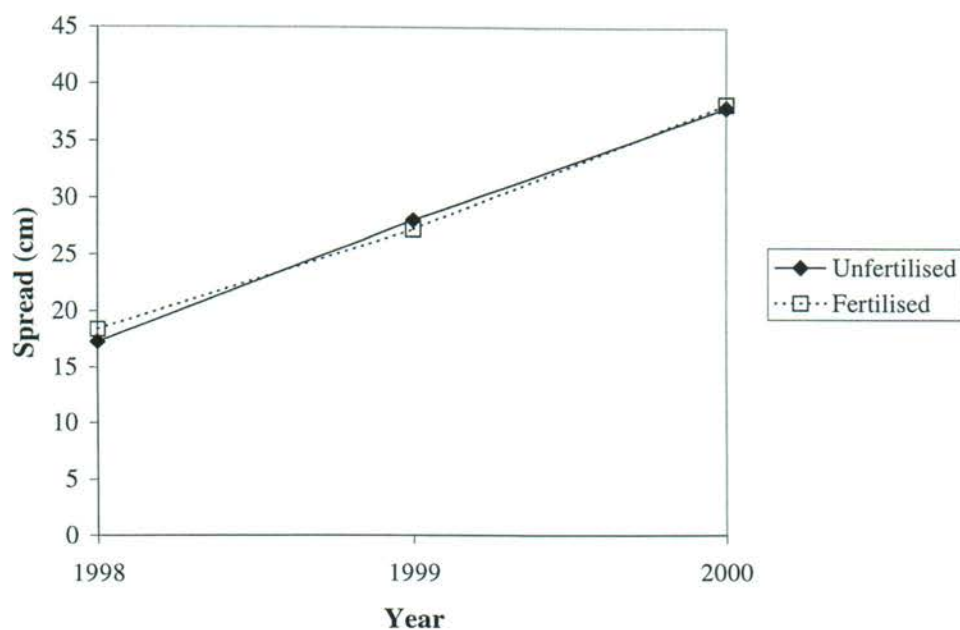
Bergin, D.O.; Houghton, M. 1999: First year performance of planted pohutukawa, eastern Bay of Plenty coast. *Forest Research* report (Unpubl.). 13p.



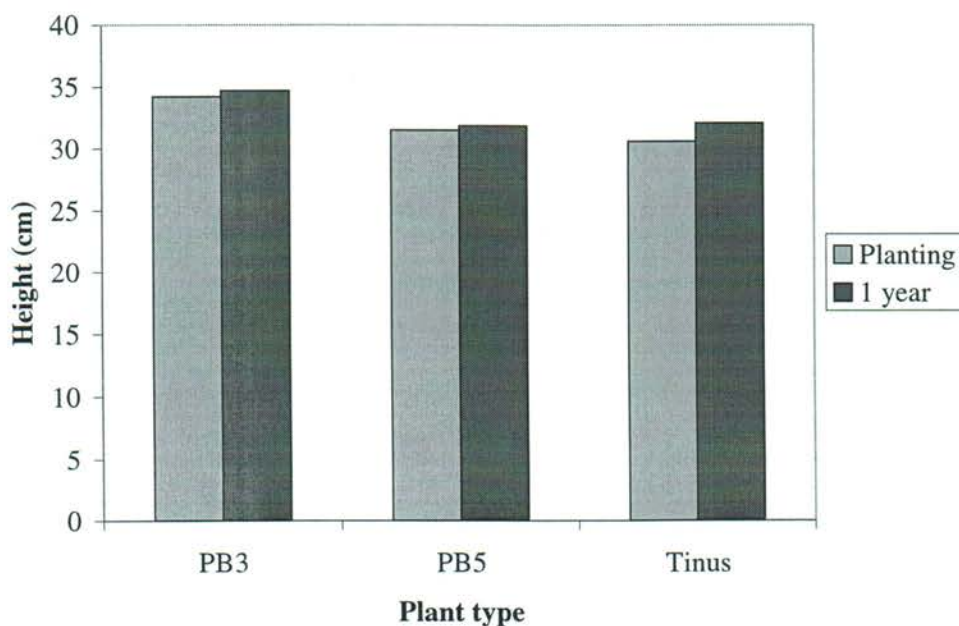
**Figure 2: Survival of pohutukawa over two year since planting at Ohiwa, eastern Bay of Plenty. Slow-release Magamp fertiliser was applied to fertilised seedlings at planting.**



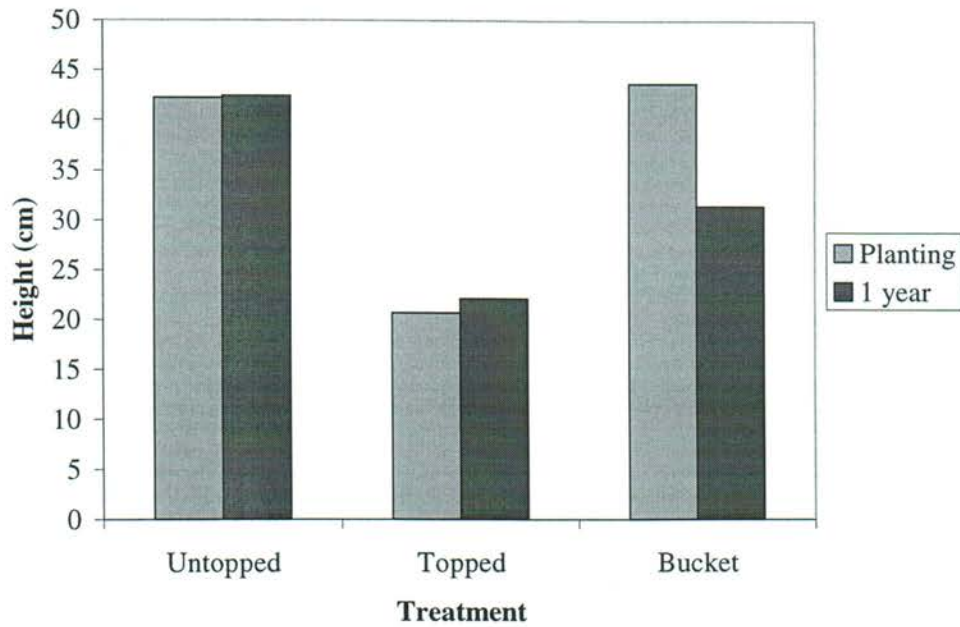
**Figure 3: Height of pohutukawa over two year since planting at Ohiwa, eastern Bay of Plenty. Slow-release Magamp fertiliser was applied to fertilised seedlings at planting.**



**Figure 4: Plant spread of pohutukawa over two year since planting at Ohiwa, eastern Bay of Plenty. Slow-release Magamp fertiliser was applied to fertilised seedlings at planting.**



**Figure 5: Height of pohutukawa raised in different container types planted six months earlier at Torere Beach, eastern Bay of Plenty. Container types were polythene planter bags (PB3 & PB5) and Tinus rootrainers.**



**Figure 6: Height of pohutukawa planted six months earlier at Torere Beach, eastern Bay of Plenty. Treatments included planting of seedlings where heights were reduced (topped) at planting, seedlings that were not cut back (untopped), and where a plastic bucket was placed around each seedling at planting.**

**APPENDIX 1 - Treatment combinations for pohutukawa planting trial established in October 1998, Ohiwa Harbour, Eastern Bay of Plenty.**

<b>Block</b>	<b>Plot</b>	<b>Material</b>	<b>Fertiliser</b>	<b>Irrigation</b>
1	1	None	Yes	No
1	2	None	No	No
2	3	None	Yes	No
2	4	None	No	No
3	5	None	Yes	No
3	6	None	No	No
4	7	None	Yes	No
4	8	None	No	No
5	9	None	Yes	No
5	10	None	No	No

**APPENDIX 2 - Treatment combinations for pohutukawa planting pilot trial established in August 1999, at Torere and Snells Beach, eastern Bay of Plenty. The trials consisted of 5 trees/plot. Four additional plots of untopped seedlings were added to each trial where plastic buckets (with bases removed) sheltered seedlings.**

Block	Plot	Seedling type	Topped
1	1	Tinus	Yes
1	2	Tinus	No
1	3	PB3	Yes
1	4	PB3	No
1	5	PB5	Yes
1	6	PB5	No
2	7	Tinus	Yes
2	8	Tinus	No
2	9	PB3	Yes
2	10	PB3	No
2	11	PB5	Yes
2	12	PB5	No
3	13	Tinus	Yes
3	14	Tinus	No
3	15	PB3	Yes
3	16	PB3	No
3	17	PB5	Yes
3	18	PB5	No
4	19	Tinus	Yes
4	20	Tinus	No
4	21	PB3	Yes
4	22	PB3	No
4	23	PB5	Yes
4	24	PB5	No