



Figure 7 Part of the totara whakatupuianga, Maketu marae, three years after planting (21 October 1993). Young trees average nearly 2 m in height.

branches (Figure 8). This seems to relate to strengthening of the trunk because the latest annual increment is generally flexible and irregularly shaped, and lacks significant side foliage. As this development of the side branches continues, the space between trees diminishes. Eventually the canopies of adjacent trees will merge, and intervening vegetation will be largely eliminated, except in places where tree loss has been concentrated.



Figure 8 A totara 2.53 m tall, with well-developed trunk and densely leafy side-branches, 21 October 1993.

5. DISCUSSION

I once visited a marae on which a number of totara had been recently planted. All were dead and they had died because they had been:

- Dug up out of the bush instead of being grown-on in nurseries
- Were from a habitat very different from that into which they had been planted (montane versus coastal lowland)
- They had not been looked after since planting

The demise of these trees was not only a sad loss of the trees themselves, an unnecessary disturbance to the original bush, and a blow to the restoration programme of the marae, but it was also a psychological injury to the young people who had laboured hard to achieve a desired objective. They had been wrongly advised, and it was they who suffered the consequences, because failure is an adverse stimulus.

The success to date of the Maketu marae planting is due mainly to the dedication of local people who look after the planted trees. Had it not been for John Keepa, Nick Smith and their workers, very few young totara would now survive because they would have been swamped by overgrowing vegetation. The first principle for a tree-planting project is: identify a committed person to be in charge of ongoing maintenance.

A second reason for the success of the project is that it was well-planned and had several levels of respected support - the Maori Queen, the Minister of Maori Affairs, the Marae Committee chairperson, kuia and kaumatua of the iwi and the marae, and staff of the Department of Conservation (at Head Office, regional and district levels). It would not be practicable, or necessary, to have this level and degree of support for every planting occasion, but in this case, in the establishment of a high profile pilot, such support was important.

Third, the planting was carried out in the right way, beginning with karakia, involving a wide range of visiting and local people, and having the welcome support of the marae for materials, food and comfort. Planting trees is as much a social and emotional phenomenon as a technical task, and success depends on local support.

Technically the planting was carried out adequately too. The plants were of good quality, the organic fertilizer liberally supplied and the individual sites well prepared, assisted by advance clearance of blackberry. It would have been better to have grown the totara trees in a nursery especially for the project, so that they were of local origin (Bergin and Kimberley, 1990). The 2-4 years of preparation that this approach requires would have enabled better site development (e.g., spot kikuyu clearance) and the use of stakes to mark each tree. Had these matters occurred the loss of trees would have been minimal. It has not been desirable, in this instance, to fill in gaps and this illustrates that it can be difficult to revisit the whole planning procedure once the project is in train.

It has been important that technical advice has been maintained annually, providing the local people with encouragement that the right actions are taking place. Ongoing

monitoring reveals numerous events and experiences that can be applied to other totara or marae plantings elsewhere.

5.1 Future management needs

While there may be a few trees that will benefit from releasing, the vast majority are now above the height where they can be smothered. An emerging task, now that seedlings have grown into small trees, is pruning. A small proportion have two leaders, or a main leader that is growing irregularly. Unwanted leaders should be removed, and sprawling leaders should be staked and tied so that vertical growth is possible. There may be a few trees that benefit from additional trimming of side branches, but overall, branch pruning will not be needed for several years. Thick side branches will help reduce the growth of surrounding vegetation and should only be removed once the canopy closes.

Leaf yellowing may signal a nutrient shortage and require some form of fertilizer. Soil testing should be undertaken if yellowing persists. Mid-crown yellowing in *Pinus radiata* has been related to possible magnesium deficiency (Beets *et al.* 1993).

As the trees increase in height they may become more exposed to salt spray generated by southerly wind. A border of dense vegetation such as pohutukawa along the coast would significantly protect the trees.

6. CONCLUSION

1. Totara seedlings planted July 1989 at Maketu marae have grown in height 0.3 m per year for three years subsequently, and are beginning to form densely leaved side branches, and sturdy straight trunks.
2. 60% of the seedlings have survived, with smothering by kikuyu, blackberry, bracken and *Convolvulus* the main cause of death.
3. Release cutting has been essential, but the main reason for success has been close maintenance by dedicated local people. Staking would have assisted survival.
4. Although further releasing is not required, monitoring for nutrient deficiencies, or insect damage is needed, and pruning and staking to encourage a single leader in a small proportion of trees will be valuable. Significant pruning of side branches should await canopy closure in about five years time.

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