THE SITE PREPARATION - TRIAL REVIVAL PROJECT: THE LONG-TERM EFFECTS OF CULTIVATION ON THE GROWTH OF PINES AT SEVERAL SITES IN THE NORTH ISLAND

PROGRESS REPORT NUMBER 1

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ABSTRACT

At 4 sites on Aupouri Pensinsula on podzolised soils, and at 2 sites in the Central North Island on pumice soils, cultivation effects on wood volume and value were minimal or absent. The lack of a cultivation effect on pine growth at the 4 northern trials may be an artefact of the nutritional status of the crop; the pines had remained nutritionally poor (nutrient imbalance) since the mid 1970's. The lack of a cultivation response for the pines on the pumice soils confirms the non-limiting soil physical properties at the 2 sites.

Site preparation - an expensive operation: matching costs with benefits is the theme of the Site Preparation Trial Revival Project

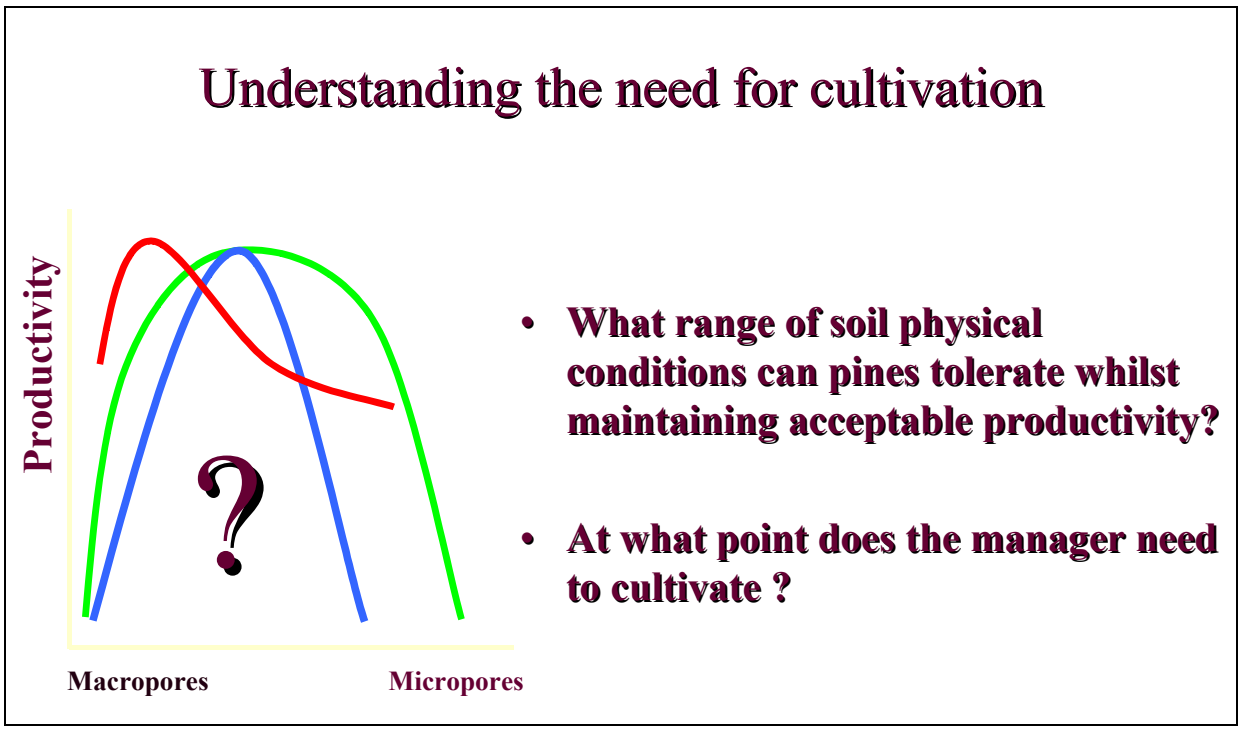
INTRODUCTION

In the early 1990's the NZ Forest Site Management Cooperative (NZFMC) initiated a field day examining site preparation techniques and the variety of stories that had developed in relation to the need for cultivation as one of a variety of site preparation techniques. As a result, the NZFMC funded 2 reports on site preparation techniques in New Zealand and overseas (Hunter-Smith, Smith and Graham, 1996, and Smith, Hunter-Smith and Graham, 1996).

In the 1970's and early 1980's a series of trials was established on a variety of soil types from Northland to Southland examining the effect of cultivation and fertiliser at time-of-planting. These cultivation by fertiliser experiments were installed as split-plot factorials, with the main plots as the cultivation treatments (either ripping, or ripping and bedding). The fertiliser treatments were generally slit applied doses of soluble fertiliser applied to trees on a row by row basis. Because of the short-term nature of the fertiliser treatments the trials were designed to be operative for about 6 years.

In 1998, as a result of the commissioning of the above reports, it was decided that valuable data on long-term effects of cultivation could be obtained from the trials established in the 1970's and 1980's by focussing on the growth of trees now near rotation end in the trials' main plots.

Figure 1:The overall concept behind the site preparation revival project.



The objective of the Trial Revival project was to:

- Assess the effects of cultivation over a rotation, and
- Associate changes in soil physical properties with changes in tree productivity.

To assess the effect of cultivation on long-term productivity, MARVL assessments were undertaken at each of the sites.

This report details the cultivation effects on growth collected at the Northland and the Central North Island sites during 2000. More trials are being visited and assessed in the 2001/2002 programme.

METHODS

At each of the sites in Northland and the Central North Island listed below, the crop was assessed by the MARVL procedure (Method of Assessment of the Recoverable Volume by Log-types). The assessment was based on trees located within each of the main-plots.

At the three Aupouri sand sites (AK578/1, 3, 4) cultivation was achieved by ripping to a nominal depth of 50 cm. However, to create any pan disturbance the ripper would have had to reach a depth of 1 m. The clay site (AK578/2) was mistakenly rotary hoed through contractor error. Following the rotary hoeing the contractor ripped the site, but the depth was only to 0.4 m. Penetration of the pan (to improve soil drainage) was not achieved.

At Kaingaroa Forest, the cultivation treatment at trial RO1063 was shear blading followed by bedding using ploughs developed by Egmont Land Developers Ltd, and Forest Sprayers Ltd. The shear blading treatment did result in considerable scalping of the topsoil as a result of the poor "floating" ability of the blade. At RO1964 the cultivation was deep ripping to 1 m.

Table 1. Trial identification, location, soil type, ownership and stand age

Trial identification	Location and Trial Attributes	Soil type	Current forest ownership	Stand Age
AK578/1	Aupouri Peninsula at Te Kao 4 blocks, control and rip, 26 stems/main plot	Te Kopuru sand	CHH Forests	27
AK578/2	Aupouri Peninsula at Te Kao 4 blocks, control and rip, 22 stems/main plot	Rangiuru clay	CHH Forests	27
AK578/3	Aupouri Peninsula at Te Kao 4 blocks, control and rip, 27 stems/main plot	Te Hapua complex	CHH Forests	27
AK578/4	Aupouri Peninsula at Te Kao 4 blocks, control and rip, 14 stems/main plot	Ohia sand	CHH Forests	27
RO1063	Kaingaroa Forest 2 blocks, control and bed, 26 stems/main plot	Kaingaroa loamy sand	Fletcher Challenge Forests	24
RO1964	Kaingaroa Forest 2 blocks, control and rip, 6 stems/main plot	Kaingaroa sand	Fletcher Challenge Forests	22

An analysis of variance was performed using PROC GLM (SAS, 1989) to test the effect of cultivation with the following experimental terms: site, block (block within site), cultivation, and cultivation across site, with stocking included as a covariate

RESULTS AND DISCUSSION

At all sites the experimental replication for cultivation was minimal for statistical purposes. This was recognised to be the case at the outset of this project but the effects of cultivation may still have been strong without necessarily having strong statistical significance. The AK578 series represent very early attempts at cultivation on podzolised soils. In 2 of the 4 trials there were gains to cultivation of 50 - 75 m3/ha (not statistically significant) and at the other 2 sites there were no gains at all (Figures 2-4). At the 2 Kaingaroa forest sites, cultivation had no effect on growth and no effect on harvest value (Figures 2-4).

All sites are potentially useful to contribute to the soil physics story underlying the cultivation effects. Since the project aims to define soil physical conditions favourable and unfavourable for radiata pine growth lack, of a cultivation effect is as important as a positive cultivation effect in assisting the defining of the range of soil physical properties tolerated/not tolerated by pines.

Figure 2. Effect of cultivation on dbh (cm) at 6 sites

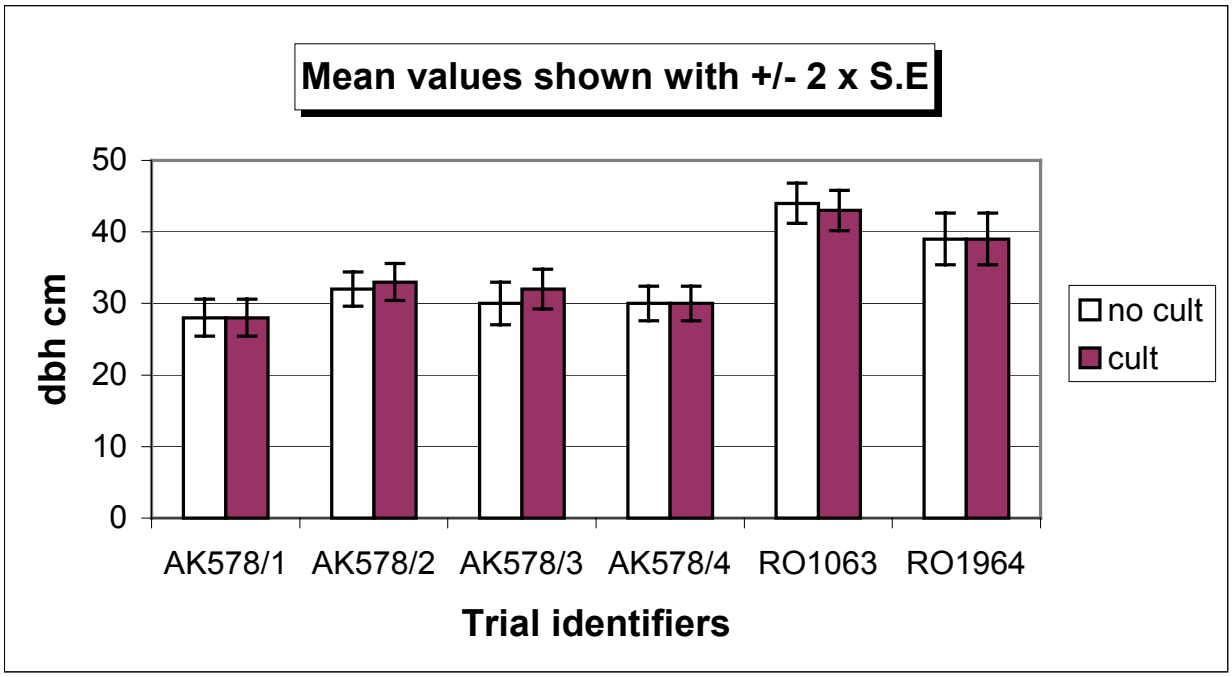


Figure 3. Effect of cultivation on volume (m3/ha) at 6 sites

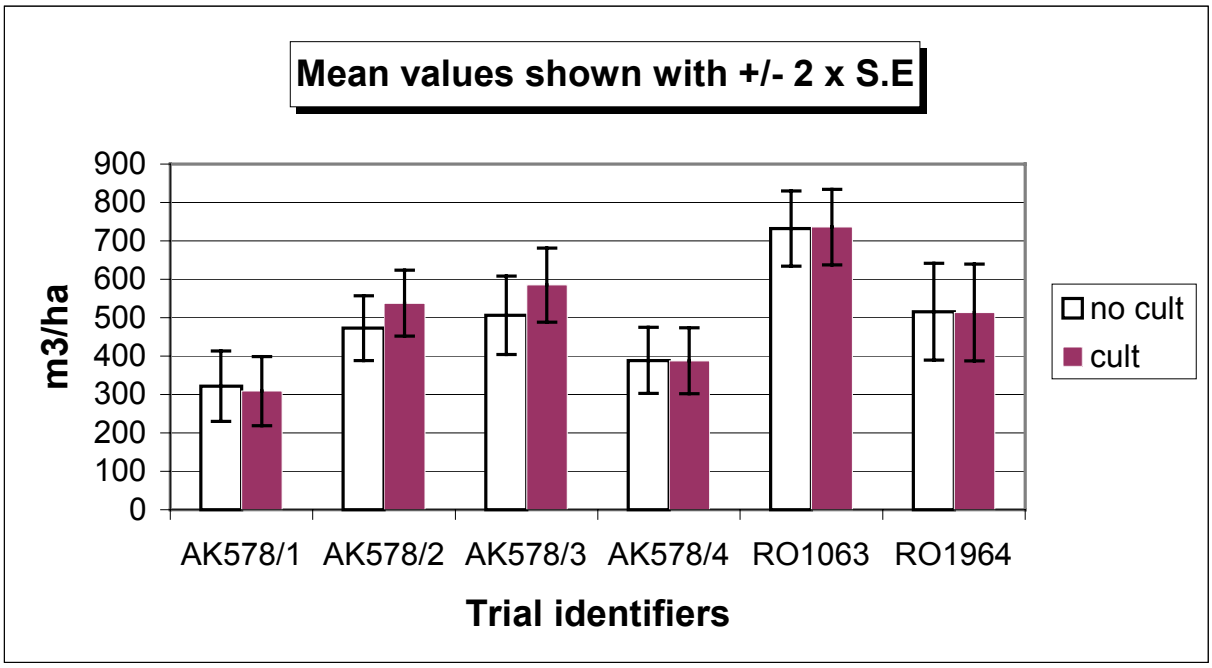
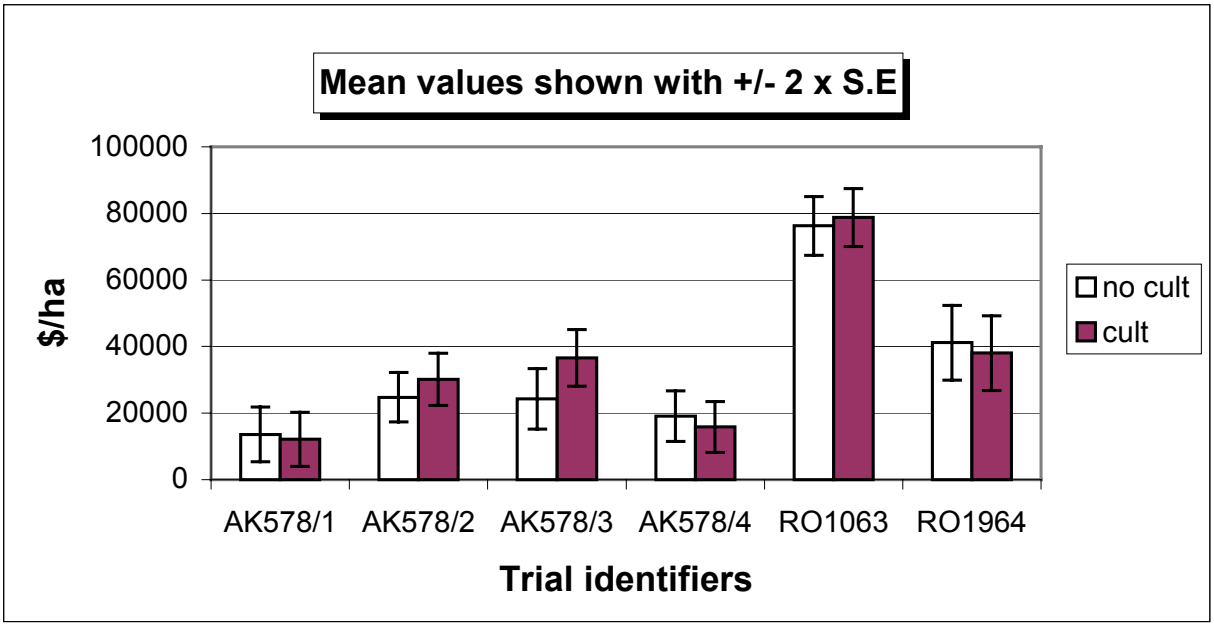


Figure 4. Effect of cultivation on value ($/ha) at 6 sites



At AK578/1, /3 and /4, the soils were podzolised sands overlying silica and iron pans at depth and at AK578/2 the site was on a clay soil without a pan. The lack of a response to cultivation is probably not surprising given that these sites would not have received any additional fertiliser since the mid-1970's. The cultivation effect has, in all likelihood, been obscured by the slower growing "uncultivated plot" pines catching up with the initially faster growing "cultivated plot" pines. The absence of a growth response at the 2 Kaingaroa sites (RO1063 and RO1964) to cultivation indicates that soil physical conditions were not limiting root exploration.

ACKNOWLEDGEMENTS

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