THE EFFECT OF BORON FERTILISERS AND WEED CONTROL ON THE BORON NUTRITION OF YOUNG RADIATA PINE.

RESULTS AFTER 12 YEARS.

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Report No. 113 December 2000

NZ FOREST SITE MANAGEMENT COOPERATIVE

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ABSTRACT

At Rerewhakaaitu Forest (Central North Island), the early B nutrition of radiata pine was tested with 3 sources of boron, from highly soluble borax to the less soluble boron minerals - ulexite (sodium calcium borate) and colemanite (calcium borate). Under field conditions both boron minerals adequately ensured foliar B nutrition was maintained Borax was also found to maintain tree B nutrition above the "critical" level for first 12 years.

INTRODUCTION

Within the soil, boron is very mobile and only weakly held by organic matter. This nutrient is passively absorbed by roots, and in times of summer drought when soil moisture may be low, little boron is available for uptake through the transpiration stream. Since boron is thought to be highly immobile within the tree, any interruption of supply to the growing tip can seriously affect cell division. Under conditions of summer drought B supply to the apex can be restricted enough to cause death of the apical meristem. If this occurs early in the life of the tree crop, the butt log is deformed.

Limited experience with the behaviour of boron minerals at forest sites (Kaingaroa and Ashley), and in the laboratory shows that colemanite and ulexite have potential for use in forestry. (Skinner and Payn, 1993). The aim of the project was to initiate long-term studies to assess the effectiveness (on a rotation basis) of ulexite (sodium calcium borate) and colemanite (calcium borate) chips as B fertilisers for radiata pine.

MATERIALS AND METHODS

Treatments and trial design
Boron fertilisers

- Control
- Borax (soluble B)
- Colemanite (2-5 mm chip)
- Ulexite (2-5 mm chip)

Boron was applied at a rate of 6kg B/ha; the quantity applied was dependent on the B elemental composition.

Weed Control: The effect of WC was assessed in factorial combination with fertilisers.

Trial Design: Fertilisers (4) * Weed control (2) * replication (3) = 24 plots. The plots are 40m by 40m with 10m buffers.

The trial was installed at Rerewhakaaitu Forest, Compartment 273/1 1986 planting, Tasman Forestry Ltd. Pines at the site exhibited symptoms of B deficiency.

Layout: The plots were arranged in a randomised block design; trees were 2 years old at the time of trial establishment.

Weed control: Galant (5l/ha) Versatil (1 l/ha) and Cropoil (2 l/ha)

Treatment installation: Fertilisers and weed control treatments were applied in September 1988. There was no further weed control applied to the weed control plots.

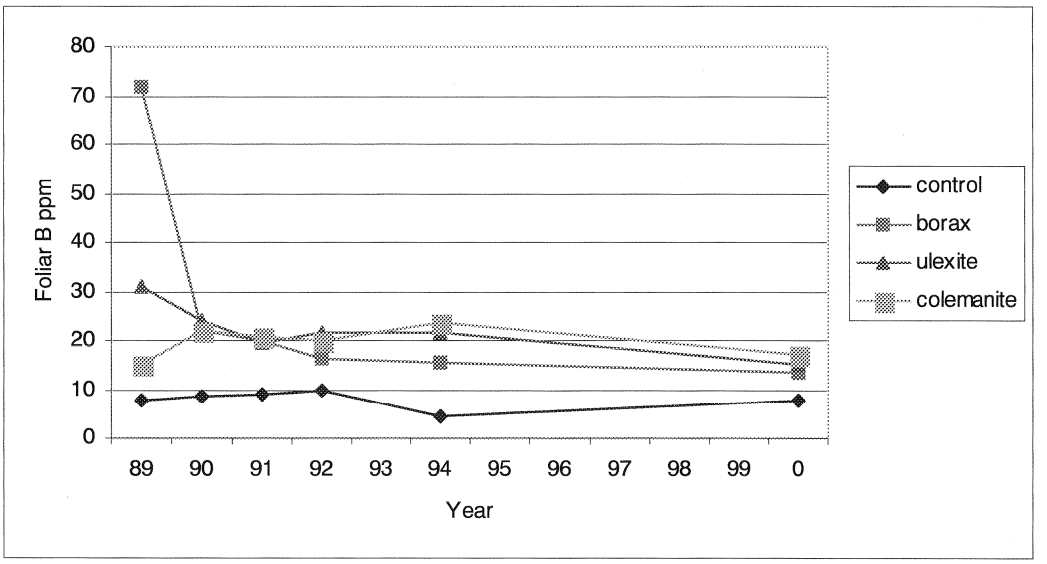
Foliage was sampled on a regular basis in late summer, and analysed according to the methods of Nicholson 1984. The statistical analysis was performed by ANOVA (SAS, 1989).

RESULTS AND DISCUSSION

A. Tree Nutrition

At this site the highly soluble nature of borax can be seen in the high foliar B concentrations (>70 ppm) after 1 year (Fig 1). The poorer initial performance of colemanite (coarse grade) is also shown. Initial weed control had no effect on B uptake (data not shown). Longer-term weed control may well have an effect. Within 2 years, the ulexite and colemanite fertilisers are behaving comparably in terms of foliar B (the ppm values are in the low 20's). Trees treated with borax show somewhat lower concentrations (foliar B at about 15 ppm) by 6 years after fertiliser application. By the year 2000 (12 years after fertiliser application) the colemanite and ulexite fertilisers were comparable in terms of their effect on foliar B (colemanite = 17.3 ppm; ulexite = 15.3 ppm; lsd (P.05) = 2.2 ppm). With borax fertiliser foliar B was at 13 ppm. Untreated trees show foliar B concentrations ranging from 5 to 10 ppm.

Figure 1. The main effect of fertiliser B treatment on foliar B concentrations



The behaviour of the variety of B fertilisers at Rerewhakaaitu is as expected, with the soluble B source (borax) yielding high foliar B concentrations within the first year and the coarse colemanite releasing B more slowly than ulexite. Colemanite is a sodium calcium borate with a lower solubility than ulexite - a sodium borate. After 2 years there was essentially little difference in the performance of the 2 boron minerals.

The expectation that with time and in the absence of thinning or pruning the borax treated trees will show declines in foliar B levels as boron is progressively leached from the rooting profile has been demonstrated. It is of interest that the soluble borax fertiliser is working suprising well compared to the control. If silviculture were to take

place, then it is possible that slow declines in B nutrition following borax application may be circumvented as B recycles through slash decay.

B. Tree Growth
No measurements on tree growth are presented as the trial was accidentally partially thinned early in the life of the trial

CONCLUSIONS

At Rerewhakaaitu Forest the early B nutrition of radiata pine was tested with 3 sources of boron, from highly soluble (borax) to less soluble B minerals, ulexite and colemanite. Of the 2 minerals, ulexite has the greater solubility. Under field conditions up to 12 years after application, both ulexite and colemanite continue to adequately provide the crop with sufficient B. Borax was also found to maintain adequate tree B nutrition for the first 12 years, although at reduced levels.

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