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THE EFFECT OF BORON FERTILISERS AND WEED CONTROL ON THE BORON NUTRITION OF YOUNG RADIATA PINE: RESULTS AFTER SIX YEARS

By

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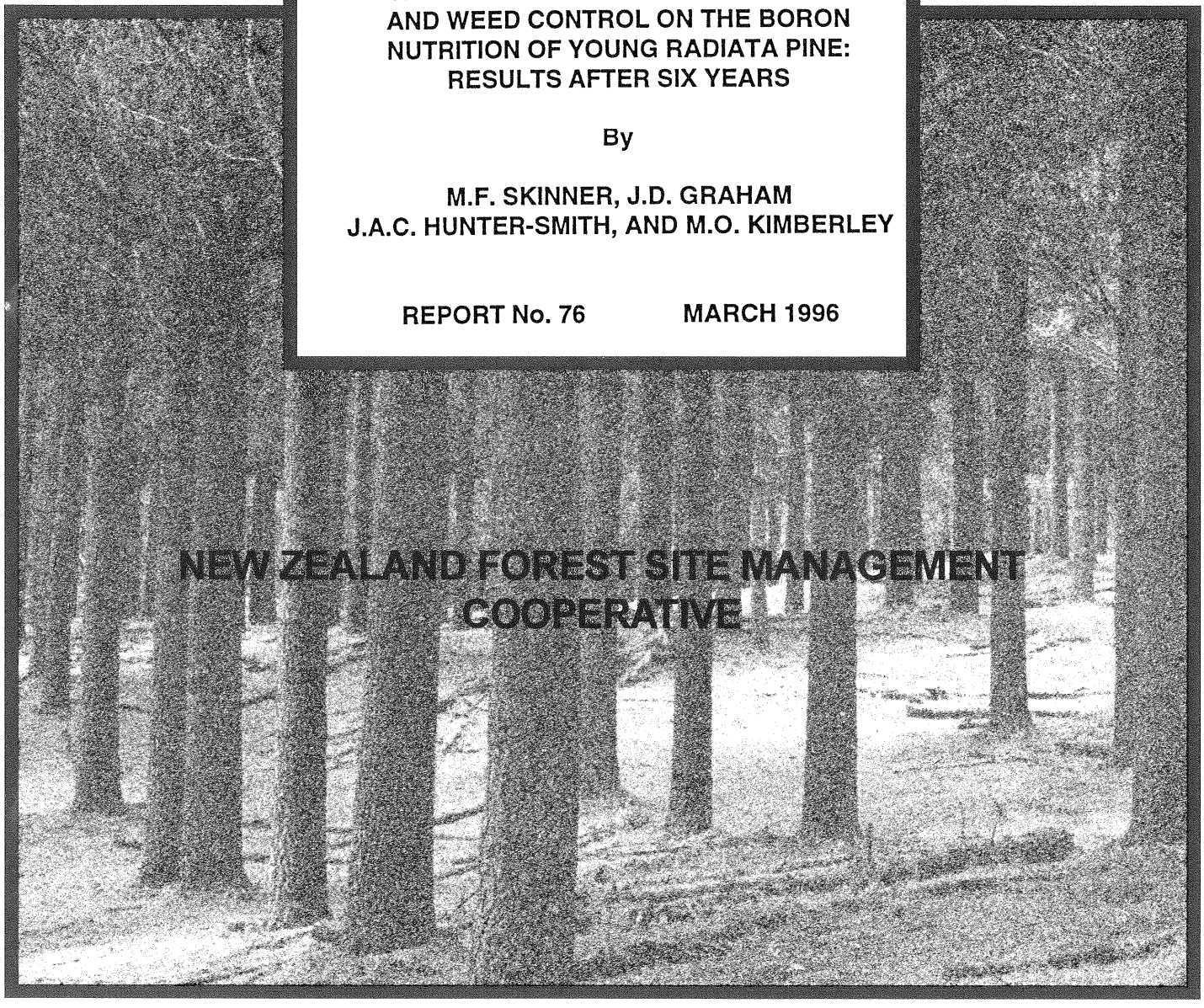

NEW ZEALAND
FOREST RESEARCH INSTITUTE
LIMITED

The effect of boron fertilisers and weed control on the boron nutrition of young radiata pine. Results after 6 years.

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ABSTRACT

At 2 sites in New Zealand, 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 provided the crop with sufficient B. Borax was also found to maintain tree B nutrition for the first 6 years at Mariri, and the first 5 years at Rerewhaikaaitu. Borax is not expected to maintain foliar B concentrations in the longer-term.

INTRODUCTION

Boron is an essential micronutrient of plants and the requirement for boron varies considerably – grass and cereal crops require little, whereas tree crops require substantially more and usually there is a narrow range between the upper limits of its requirement and the toxic level.

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 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 6 kg 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

Site and Layout and treatment installation

Sites

- Central North Island (at Rerewaikaaitu Forest, Compartment 273/1 1986 planting, Tasman Forestry Ltd)
- Nelson Region at Mariri (Harakeke) Forest, Compartment 156, (Carter Holt Harvey Forests Ltd, formerly Baigent Forests Ltd).

Both sites exhibit symptoms of B deficiency.

Layout

At both sites the plots were arranged in a randomised block design. At Rerewaikaaitu Forest the trees were 2 years old at the time of trial establishment. At Mariri Forest, the trial was established at time-of-planting.

Weed control

Rerewaikaaitu:	Galant (5l/ha) Versatile (1 l/ha) and Cropoil (2 l/ha)
Mariri:	Velpar 20G at 5 kg active/ha.

Treatment installation

At Rerewaikaaitu the fertilisers and weed control treatments were applied in September 1988.

At Mariri the fertilisers were applied in August 1987 and the weeds controlled in November 1987. At this site, and additional treatment with finely ground colemanite was included.

RESULTS AND DISCUSSION

A. Tree Nutrition

Mariri Forest

Foliar B concentrations between 1989 and 1991 were comparable between fertiliser B sources (Fig 1). From 1991 onwards the poorer performance of the coarse colemanite is apparent, although concentrations of foliar B are above the "critical" level.

Rerewaikaaitu

At this site the highly soluble nature of borax has been recorded in the high foliar B concentrations after 1 year (Fig 2). The poorer initial performance of colemanite (coarse grade) is also shown. Within 2 years, the ulexite and colemanite fertilisers are behaving comparably in terms of foliar B. Trees treated with borax show somewhat lower concentrations, although currently in the "safe" range (ie > 10 ppm).

The behaviour of the variety of B fertilisers is as expected, with the soluble B source (borax) yielding high foliar B concentrations within the first year (recorded at Rerewaikaaitu) 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. At the Mariri site, fine ground colemanite showed increased B release.

With time it is expected that 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. If silviculture were to take place, then it is possible that declines in B nutrition following borax application may be circumvented as B recycles through slash decay.

B. Tree Growth

At both the Mariri site and the Rerewaikaaitu site, there were no effects of B fertiliser source on tree growth - both heights and diameters.

CONCLUSIONS

At 2 sites in New Zealand, the early B nutrition of radiata pine was tested with 3 sources of boron, from highly soluble (borax) to less soluble. The less soluble forms were ulexite and colemanite, both of which are boron minerals. Of the 2 minerals, ulexite has the greater solubility. Under field conditions both ulexite and colemanite adequately provide the crop with sufficient B. Borax was also found to maintain tree B nutrition for the first 6 years at Mariri, and the first 5 years at Rerewhaikaaitu.

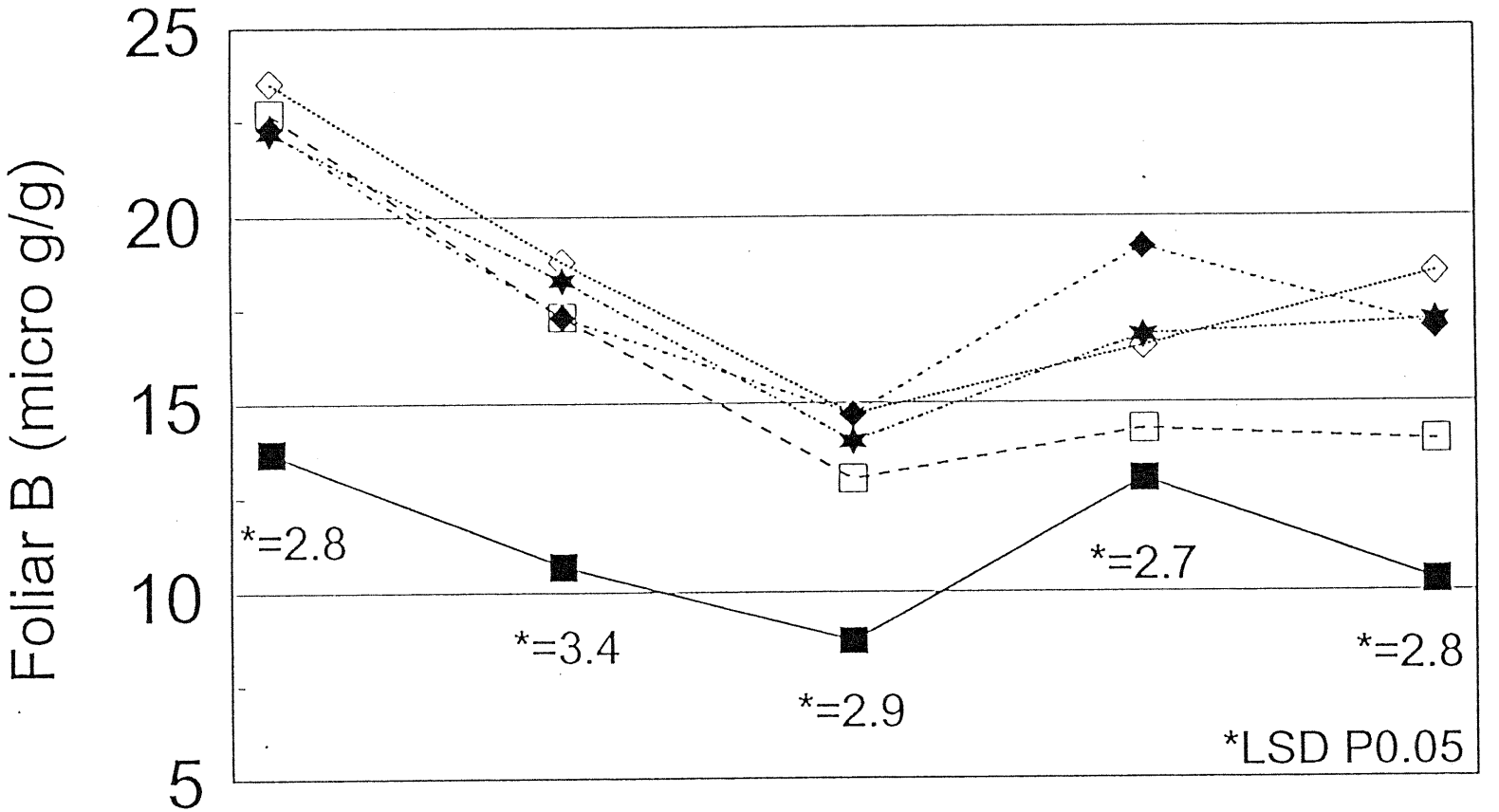
REFERENCES

Skinner, M.F., and Payn, T.W., 1993. Nutritional requirements of plantation pines in New Zealand. In "Issues challenging the fertiliser industry". Proceedings of the NZ Fertiliser Manufacturers' Research Association Conference, 1993.

ACKNOWLEDGMENTS

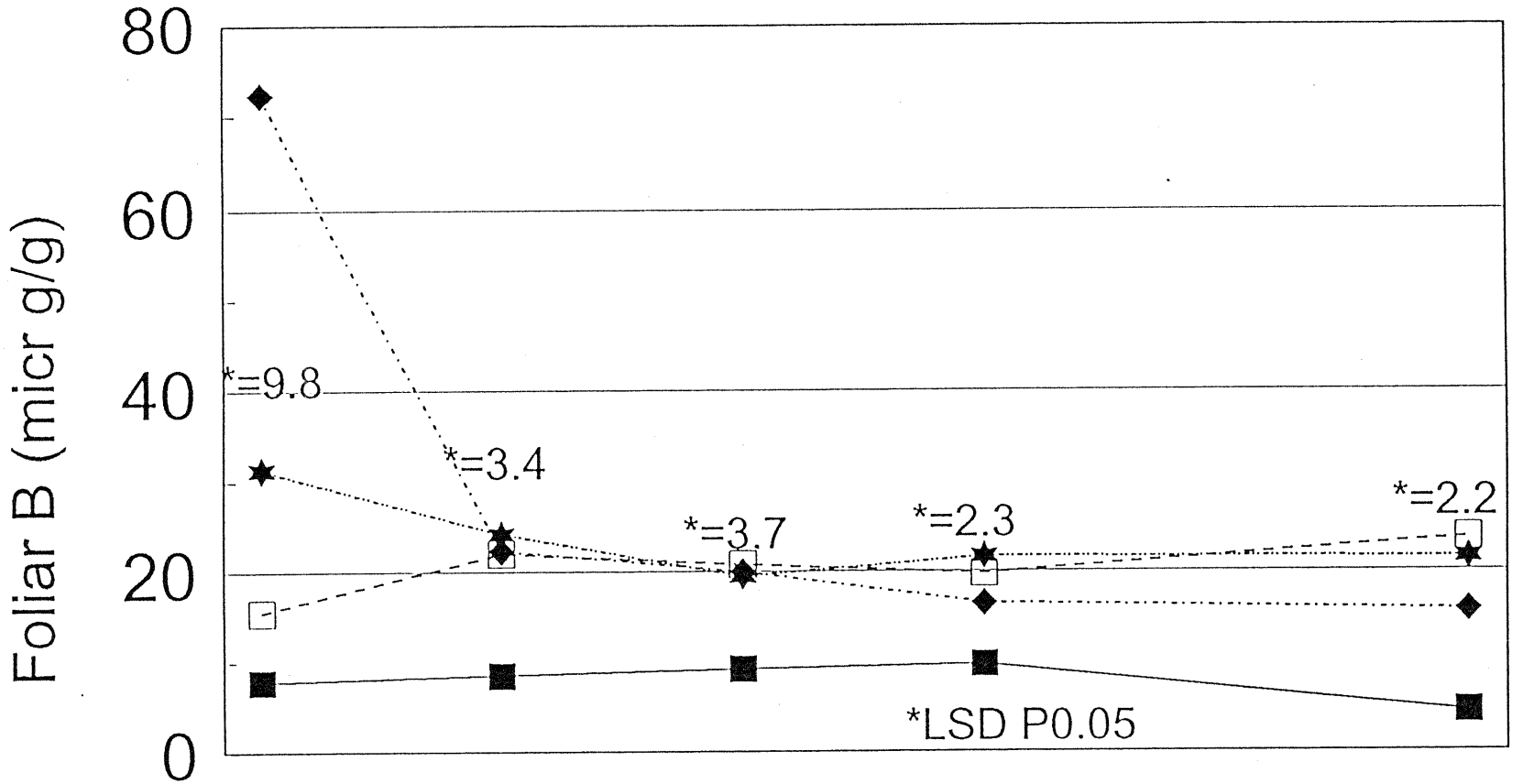
The authors thank Tasman Forestry Ltd help with the installation of the site at Rerewaikaaitu and the ongoing maintenance for weed control, and Baigents Forests Ltd (now CHH Forests) for assistance at the Mariri site.

Figure 1. The effect of boron source on foliar B concentrations at Marirl Forest



	1989	1990	1991	1992	1993
control	13.7	10.7	8.7	13.0	10.3
borax	22.3	17.3	14.7	19.2	17.0
ulexite	22.2	18.3	14.0	16.8	17.2
colemanite (Co)	22.7	17.3	13.0	14.3	14.0
colemanite (Fl)	23.5	18.8	14.7	16.5	18.5

Figure 2. The effect of boron source on follar B concentrations at Rerewalkaaltu Forest



	1989	1990	1991	1992	1993	1994
control	7.8	8.5	9.2	9.7		4.5
borax	72.3	22.3	20.0	16.5		15.7
ulexite	31.3	24.2	19.5	21.7		21.5
colemanite	15.5	22.0	20.8	19.8		23.7