SIGNIFICANCE OF BORON ON BUTT-LOG STRAIGHTNESS OF RADIATA PINE

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Report No. 71 May 2000

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EXECUTIVE SUMMARY

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The effect of boron application on subsequent straightness of radiata pine pruned butt-logs was assessed in a trial located at Rerewhakaaitu Forest, Kaingaroa. Two treatments were sampled; control (no fertiliser applied) and Boron applied as Ulexite at age two years. Trees were pruned in four lifts to a height of 6.1m and thinned to waste at age five years. At age 13 years, 30 trees were randomly selected from each of the two treatments. The DBH, straightness of pruned butt-log, height of maximum sweep and pruned height of each tree were measured. Direction of sweep relative to north was also recorded. 47 butt-logs were recorded as having sweep. Statistical analysis shows that the straightness of pruned butt-logs in the Control and Boron applied plots is not significantly different ($p>0.05$). There is also a clear tendency for the sweep to be in an easterly direction. This is considered to be a result of the prevailing westerly wind.

BACKGROUND

Objective

The objective of this study was to determine if the application of Boron increased pruned butt-log straightness of radiata pine.

In recent years there has been much interest in the effects of Boron on tree growth and quality of radiata pine. This study is the third in a series of three based on a boron trial FR24/2 located near Kaiangaroa. The first study by Moore 1998 showed that boron did not improve root anchorage or root tensile strength nor did it have any influence on the incidence of resin pockets. The second study by McKinley *et al* 2000 showed that Boron had no effect on improving the wood properties of radiata pine. Boron foliar analysis was carried out prior to assessment of the wood properties study (McKinley *et al*, 2000) which showed the control to have an average of 9 ppm (range 3 ppm to 17 ppm for individual trees) compared to the Boron treated plots which contained an average of 18 ppm (range 9 ppm to 28 ppm for individual trees). These rating can be compared with the ratings shown in the following table.

Table 1- Foliar B analysis values for *Pinus radiata* (Will 1985)

Low	Marginal	Satisfactory	Confidence rating
8 ppm	8-12 ppm	12 ppm	**

** Good prediction of responsive sites in the low range but not in the marginal range

METHOD

The Rerewhakaaitu Boron trial (FR24/2) was installed in 1988 into a two-year-old stand which had been established in 1986. Trees were pruned in four lifts to a height of 6.1m and thinned to waste at age five years. Stand history is presented in Table 1. Further details are contained in Skinner *et al.* (1996).

Table 2. Stand History

Date	Operation	Stocking (stems/ha)
June 1986	Stand Established "268" clonal series	1000
Sept 1988	Fertiliser applied	
Feb 1991	Pruned to 2.1m	
Apr 1991	Waste thinned	517
Nov 1992	Pruned to 3.2m	
June 1994	Pruned to 5.4m	
May 1995	Pruned to 6.1m	

* Details provided by G.D. Young, Fletcher Challenge Forests Ltd

The following four fertiliser treatments were applied which were replicated three times:

Control - no fertiliser

Borax (sodium borate)

Colemanite

Ulexite

In addition to the fertiliser treatments, half the plots received weed control. Trial layout is shown in Appendix I. In this study, two treatments were sampled; control (no fertiliser applied) and Boron applied as Ulexite at age two years. Ulexite was identified as the most commonly used Boron in the industry and this form of Boron maintain the concentrations over the forest rotation (McKinley *et al*, 2000).

Straightness of the pruned butt-logs was quantified using an extendible height pole which acted as a straight edge. The pole was placed against the stem at right angles to the maximum stem deviation. The center of the pole was placed against the center of the stem at both the base (measured at a height of 30cm) and top of the pruned log. Straightness was subjectively assessed and categorised into one of the following sweep classes:

1. $< D/8$;
2. $< D/4$;
3. $< D/2$;
4. $> D/2$.

30 trees were randomly selected from the Control plots and 30 from the Ulexite fertilised plots. The DBH, height of maximum sweep (HSw) and pruned height of each tree were measured.

Direction of sweep relative to north was also recorded. Table 2 shows the descriptive statistics of the sampled trees.

Table 3- Descriptive Statistics of sampled trees.

Treatment	Variable	N	Min	Mean	Max	Std Deviation
Control	DBH (cm)	30	25.2	35.2	41.4	3.9
	HSw* (m)	20	1.5	3.1	4.9	1.1
	Sweepclass	30	1	1.8	3	0.7
Ulexite	DBH (cm)	30	22.5	30.8	39.3	3.8
	HSw* (m)	27	0.6	2.6	6.4	1.2
	Sweepclass	30	1	2.3	4	0.8
Combined	DBH (cm)	60	22.5	33	4.4	41.4
	HSw* (m)	47	0.6	2.8	6.4	1.2
	Sweepclass	60	1	2	4	0.8

* HSw was only measured on trees with sweep class higher than 1.

RESULTS

Sweep class

A General Linear Model was used to test the significant of difference in sweep class between the two treatments (Control vs Ulexite). DBH is also included in the model as a covariate. The following table shows the output of analysis from SAS®. Least-squares Means (LSM), or population marginal means of treatment effect for sweep class were computed. LSM shown was already adjusted for the covariate effect.

Table 4- Analysis output

Least Squares Means

TREAT	MEANSWEP LSMEAN	Std Err LSMEAN	Pr > |T| H0:LSMEAN=0	Pr > |T| H0: LSMEAN1=LSMEAN2
Control	1.80077681	0.14419328	0.0011	0.1548
Ulexite	2.26588986	0.14419328	0.0006	

The *t*-test has a *p*-value of 0.1548 which means that the null hypothesis of similar means can not be rejected at 5% test level. The means of the two treatments are not significantly different. The coefficient of determination (R^2) is 80.79%.

Direction of sweep relative to north

47 butt-logs were recorded as having sweep. The direction of sweep relative to North for Control and Boron treated plots is shown in Figure 1 and 2. There is a tendency for the sweep to be in an easterly direction. This is considered to be a result of the prevailing westerly wind.

Figure 1- Direction of sweep with respect to North in Control plots

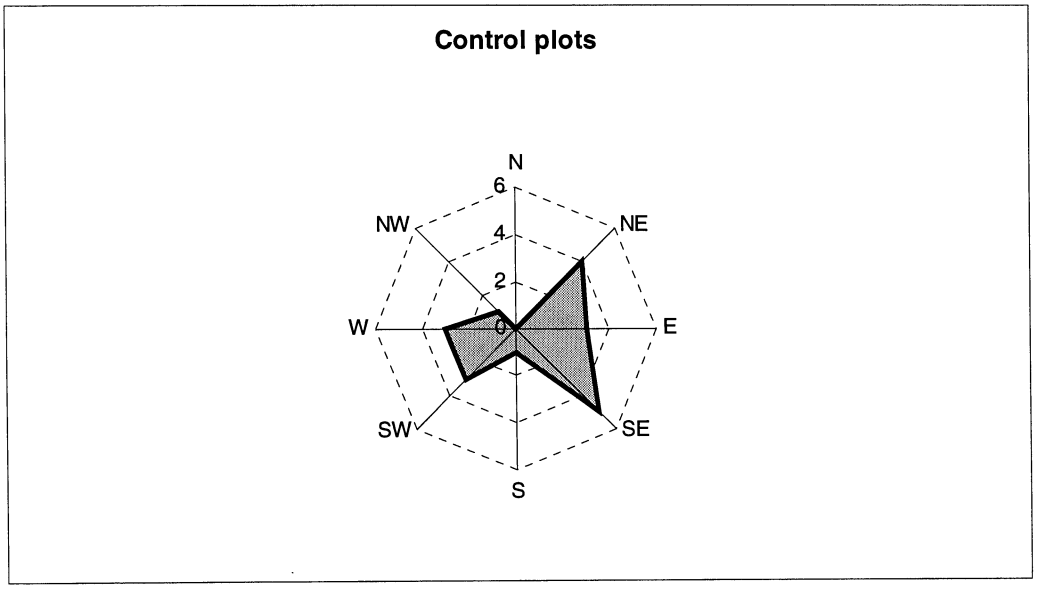
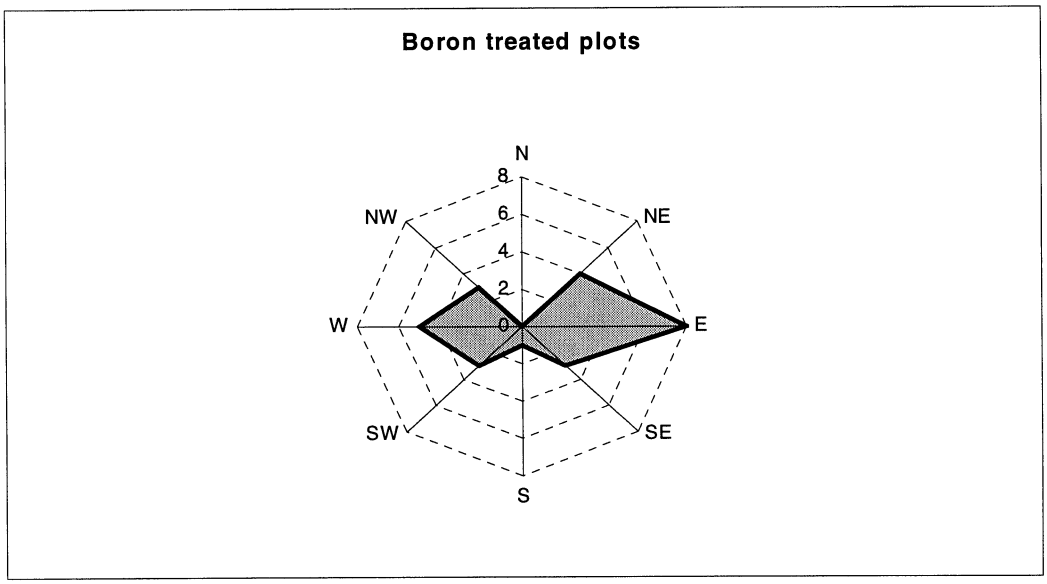


Figure 2- Direction of sweep with respect to North in Boron treated plots



REFERENCES

McKinley, R., McConchie, D., McConchie, M. 2000. An investigation into the effects of boron fertiliser on wood properties and clearwood defects in radiata pine. Forest & Farm Plantation Management Cooperative Report No 69. Unpublished

Moore, R.J., 1998: Effects of boron deficency on root anchorage and incidence of resin pockets in Pinus radiata. Forest & Farm Plantation Management Cooperative Report No 48. Unpublished

Skinner, M.F., Graham, J.D., Hunter-Smith, J.A.C. and Kimberley, M.O. 1996: The effect of boron fertilisers and weed control on the boron nutrition of young radiata pine. Results after 6 years. NZ Forest Research Institute. Project Record No. 4709, Unpublished.