GROWTH OF *EUCALYPTUS REGNANS* IN A PLOT AT ROTORUA

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ABSTRACT

At age 13 years, a 0.156-ha plot of **Eucalyptus regnans** has attained a mean height of 28.5 m, a mean diameter (at 1.4 m) of 40.7 cm, a total stand volume of 307 m³/ha, a mean annual total volume increment of 23.6 m³/ha/year, and a basal area of 30.8 m²/ha. Since the plot had no surround or buffer zone, the volume increment and basal area would be inflated.

The initial stocking of the stand was 5357 stems/ha, and was reduced to 1178 stems/ha at age 4 years and to 237 stems/ha at age 7 years.

The seed came from Mt Erica, Victoria.

INTRODUCTION

Eucalyptus regnans F. Muell. is a fast-growing species of the ash group of eucalypts. It appears to be suitable for fulfilling New Zealand's future needs for short-fibred pulp and for some types of special purpose hardwood timber.

Growth rates and yields of eucalypts in New Zealand, particularly in thinned stands, are very imperfectly known. It is therefore of interest to document the growth records of a small plot of *E. regnans* which has been managed in a way that could be suitable for sawlog production (Fig. 1).

STAND HISTORY

Seed Source

Seed was supplied by Dr K. G. Eldridge, CSIRO Division of Forest Research, Canberra, from his provenance collections from Mt Erica, Victoria (Eldridge, 1972). There were seven altitudinal provenances over the range 366-991 m, each represented in the New Zealand plot by three open-pollinated families. Parent trees were not intensively selected for superiority in stem form or size.

Establishment

The stand of 0.156 ha was planted in May 1966 in the Long Mile tree breeding area, Rotorua. The altitude of this site is 307 m, and the mean annual rainfall 1440 mm. Frosts are frequent in the winter. The soil is a well-drained sandy-loam derived from pumice. Initial spacing was 1.53 × 1.22 m, equivalent to a stocking of 5357 stems/ha. Stock was raised in polythene tubes and pit-planted by spade. No fertilisers were used.

FIG. 1—The Long Mile **E. regnans** plot in 1978 at a stocking of 237 stems/ha (J. A. Barran, FRI 36652).

The plot was originally established as a provenance test of the seven altitudinal provenances. There were four 10-tree row plots planted of each of the 21 families, in a randomised block design. Within each block, families were grouped together by provenance. No surround was planted.

Thinning History

The history of the plot from the original 840 trees planted in 1966 to the present 37 trees is traced in Table 1.

At the 1979 stocking of 237 stems/ha, the mean green crown level was 7 m with

partial or complete branch shedding to this level on all but the largest diameter edge trees.

The thinnings in 1970 and 1973 were designed to retain representatives of all provenances and families where possible.

TABLE 1—History of the Long Mile **E. regnans** plot

Year	Age	Height (m)	Treatment
1966	0	0.40	Planted at 5357 stems/ha (840 trees)
1968	2	2.2	Stocking reduced to 3784 stems/ha by frost damage (591 trees)
1970	4	7.3	Waste thinned to 1178 stems/ha (184 trees)
1973	7	15.5	Thinned for posts and firewood to 237 stems/ha (37 trees)
1976	10	21.6	Heights measured
1979	13	28.5	Heights and diameters measured. Stocking unchanged at 237 stems/ha

GROWTH RECORDS

Height v. Age

As indicated in Table 1, height is linearly related to age, with a mean annual height increment of 2.2 m. At age 13 years, the mean height of the 27 trees was 28.5 m (range of 21.0-32.9 m).

Diameter

Stem diameters were not periodically measured. At age 13 years, the mean diameter (o.b.) at 1.4 m was 40.7 cm, with a range of 25.2-52.6 cm. The total basal area of the plot was 4.805 m^2, or 30.80 m^2/ha.

Volume

The volume (o.b.) of each tree was calculated using the non-linear volume function proposed by Opie (1976). The formula is:

$$Log_{10}(D^2H/V) = 4.762 - 5613/(D+127)^2$$
$$or \quad V = D^2H \div {}_{10}\{4.767 - 5613 (D+127)^{-2}\}$$

Where D is measured in cm, H in m, and V in m^3.

The 1979 total volume of the stand was 47.92 m^3 or 307 m^3/ha, giving an estimated mean annual volume increment of 23.6 m^3/ha/yr. This figure would of course be subject to upward bias due to edge effects. Height growth rate in this plot appears to exceed that reported from Australia in natural stands and plantations (Borough et al., 1978).

PROVENANCE VARIATION

The present stand of 37 trees comprises representatives of all the original provenances and all but two of the original 27 open-pollinated families. The two provenances from above 900 m elevation have grown slower than the others. Otherwise, there is no strong altitudinal trend in the provenance means (Table 2).

TABLE 2—Growth of altitudinal provenances of **E. regnans** at Rotorua at age 13 years

Provenance	Altitude (m)	No. of trees[1]	Diameter (cm)	Ht (m)	Volume[2] (m³)
FRI 60/1351	366	4	42.9	29.0	1.4771
FRI 60/1352	488	5	37.0	28.4	1.1230
FRI 60/1353	610	6	41.1	30.7	1.4244
FRI 60/1354	701	5	43.2	29.0	1.4825
FRI 60/1355	808	7	45.3	28.1	1.5468
FRI 60/1356	915	6	33.7	26.8	0.8994
FRI 60/1357	991	4	37.0	27.5	1.0524

[1] Number of trees remaining in each provenance.
[2] Mean volume of the individual trees.

REFERENCES

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