

Analysis of growth and yield from three Kaingaroa thinning experiments

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ABSTRACT

This paper examines net basal area/ha and mean dbhob development in three replicated radiata pine thinning experiments in Kaingaroa Forest. Stockings represented range from 200 to 1300 stems/ha. The analysis here is focussed, however, on lower stockings (200, 300 and 400/ha), primarily because of the interest of forest managers in the reliability of yield forecasts for low stocking regimes. By age 24 years in the oldest of the three trials, it was evident that whereas basal area trends for stockings of 300/ha and above were similar and logically related one to the other, the 200/ha stockings had a noticeably lower growth trajectory path. The same consistent trends were demonstrated in the younger trials. Mean dbhob of the top 200 in stockings of 200, 300 and 400/ha were not as different as might have been expected. Pruning schedules imposed on two of the trials are difficult to analyse adequately, because of inadequate replication. It is important to continue measurement in these experiments for at least another ten years.

It is now over 20 years ago that Fenton and Sutton (1968) proposed a tending regime for *Pinus radiata* in New Zealand, which, at the time, represented a radical departure from the then conventional silviculture. In essence, the regime recommended heavy early thinning to waste, with pruning in three lifts, to shorten rotations to 25-26 years, and to concentrate growth on the pruned butt log so as to produce sawlogs with average dbhob estimated to be around 58 cm. In a later contribution, Sutton (1976) gave estimates of 63.7 m²/ha of basal area and a mean diameter of 64.5 cm at age 26, achievable in stands thinned to 198 stems/ha when top-height is 10.7 m for a site index of about 29 m.

At the time, the amount of long-term mensurational data available to support these yield estimates was scant. Accordingly, between 1969 and 1973 Messrs J.W. Shirley and D.A. Elliott, then of the New Zealand Forest Service, established four well-replicated thinning experiments in different compartments of Kaingaroa State Forest. These trials are now between 19 and 24 years old with up to 18 annual remeasurements; they provide a rare opportunity to study growth development of various thinning regimes, obtained from extensive and reliable data. What we have done, and now report here, is an analysis of basal area and dbhob development in three of those trials. The comparisons were of considerable interest to us and are likely to be also to forest managers today; emphasis here is placed on presentation of the major results to date, without full details of statistical analyses.

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EXPERIMENTAL DATA

Trial R695

Established 1971, in Compartment 84, altitude 439 m, in a stand of second-crop *Pinus radiata* primarily from regeneration in 1964. Reduced to 2500-3500 stems/ha, when top-height reached 1.5 m. Stocking in the trial area of 6 ha was reduced to 1000-1500 stems/ha in 1971; plots of 0.2 ha were formed, with inner 0.1 ha measurement plots. Four replications of the following residual stockings in stems/ha were represented:

200, 300, 400, 500, 600, 700, and 'unthinned'.

All trees in the measurement plots were pruned to a schedule of:

0 to 2.2 m (1971)
2.2 to 4.2 m (1972)
4.2 to 6.0 m (1973)

The dbhob of all trees and the heights of a sample of 12 to 15 trees per 0.1 ha inner plot were remeasured at least once each year up to age 20, and then at two-yearly intervals to age 24. Non-sampled heights were estimated through the Petterson equation (Schmidt, 1967).

Trial R696

Established late 1971, in Compartment 375, altitude 448 m, in a stand of second-crop *Pinus radiata* cutover in 1966. Thinned to about 2700 stems/ha in 1969, then to the experimental stockings in 1971. The following residual stockings (stems/ha), were imposed with the number of replications given in parenthesis.

200 (4), 400 (8), 600 (8), 800 (4)

All trees in the measurement plots were pruned to one of the following schedules:

- for 200 and 800/ha stockings, 0 to 2.1 m (1971)
- for 400 and 600/ha stockings,

| Replications | Lifts |
|--------------|--------------------|
| 2 | unpruned |
| 4 | 0 to 2.1m (1971) |
| 2 | 0 to 1.8m (1971) |
| | 1.8 to 4.2m (1973) |
| | 4.2 to 6.0m (1975) |

Measurement and other trial details are essentially as for Trial R695.

Trial R699

Established 1973, in Compartment 128, altitude 454 m, in a stand of second-crop *Pinus radiata* cutover in 1969. Thinned to