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**An Evaluation of the Production and Profitability of
Alternative Management Regimes for *Pinus radiata* on
a High Fertility Site.**

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Abstract

Keywords: STANDPAK, inventory, basal area increment, configuration, silviculture, pruning, thinning, regime.

Conversion of farmland to forestry is occurring at the rate of approximately 60,000ha/annum, much of it on hill country sheep and beef properties. The potential productivity of ex farm sites is high, mainly due to improved soil fertility but may produce trees with defects such as excessive branching, large branches and stem malformations. Adapting silvicultural practices to suit plantations on high fertility sites is necessary to effectively utilise this potential. However, many of the tools available for planning and assessing alternative silvicultural options in *Pinus radiata* stands have limitations for farm sites. This study utilises a 12.5ha stand of *Pinus radiata* established in 1973 on a Manawatu hill country sheep and beef property. Currently 'Tuapaka' has 31.3ha of *Pinus radiata* occupying land use capability class VI and VII. Of this total, 12.5ha is nearing maturity, while remaining areas are now reaching a stage where decisions on silvicultural management are necessary. The growth modelling system, STANDPAK, was used as an aid for developing and evaluating silvicultural options on Tuapaka.

Existing *Pinus radiata* growth models have been primarily derived from traditional forest site data. They can be utilised for simulating growth on ex farm sites but will generally provide more accurate predictions of growth and yield if they are configured with local growth data. The EARLY and NAPIRAD growth models are recommended for simulating the growth of *Pinus radiata* on farm sites and formed the basis for the simulation of the Tuapaka stand. Inventory data, including diameter at breast height, mean crop height, and stocking were collected from the existing 12.5ha stand and used to configure these growth models and other STANDPAK components.

Site index at Tuapaka was found to be 23m, with a high basal area increment potential. The best STANDPAK configuration combined the growth models EARLY (high +20% basal area increment) and NAPIRAD (switched at mean top height 18m). The results from this configuration predicted basal area to within 6% of the field estimate. These configurations were used to simulate and evaluate the growth of a new stand (at the 1ha level) for both clearwood and framing regimes. The combined influence of low site index and high basal area increment created problems associated with maintaining a target diameter over stubs (DOS) while utilising an

acceptable number of pruning lifts. The required number of pruning lifts to achieve a 6.0m pruned height was able to be manipulated by delaying thinning, reducing the green crown length (CRL) at the first and second lifts, and maintaining a high ratio of unpruned trees through to thinning.

Net present value (NPV) was primarily used as the selection criteria to determine the best regimes, because it reflects the final harvest revenues and associated silvicultural costs. The most profitable regime required a 3 lift pruning schedule. This regime provided the best compromise between final harvest value and silvicultural costs and was achieved by severe early pruning (CRL of 2.0m and 2.2m), delayed thinning, and maintaining a high ratio of unpruned to pruned trees. Clearwood regimes were more profitable than the framing regimes because of a higher average timber value which more than compensated for increased silvicultural costs and reduced log volume. The clearwood regime produced a final merchantable volume of 698m³/ha, of which 37% graded in the higher value pruned log class. This regime had a pre tax net revenue of \$39,500/ha and an NPV of \$2,681/ha (8% discount rate). In contrast, the best framing regime produced a merchantable volume of 787m³/ha, a net revenue of \$18,800/ha, and a NPV of \$1,100/ha.

The best clearwood and framing regime were subjected to economic analysis at the estate level (31.3ha) to determine the best silvicultural options for existing and future stands on Tuapaka. The clearwood regime was the most profitable, having a pre tax IRR of 9.1%, compared with 7.6% for the framing regime. These returns are likely to exceed the potential returns from farming, particularly on steep hill country.

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