

GRAZING IN YOUNG PLANTATIONS OF RADIATA PINE ESTABLISHED AFTER CLEARING LOGGED AND REVERTED INDIGENOUS FOREST

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SYNOPSIS

This note describes the conditions generally encountered in establishing and tending radiata pine on sites cleared of indigenous forest on the Mamaku plateau. Cattle grazing, and tending according to a short-rotation sawlog regime, have been tried on an experimental scale, and appear to overcome many of the problems arising from more conventional treatment.

INTRODUCTION

With current management practices there are many difficulties in growing high quality crops of radiata pine on sites cleared of indigenous forest. If pruning and thinning are intended, the combination of partly burnt slash and subsequent weed growth results in difficult access and costly tending operations. Irregular growth and stocking prevent the alternative of leaving the stand unthinned to control branch size. On the volcanic plateau of central North Island the normal regrowth after clearing the indigenous forest is rapid invasion of fireweeds (*Erechtites* and *Senecio* spp.) and thistles (mainly *Cirsium vulgare*) in the first year, followed closely by grasses. Patches of bracken (*Pteridium aquilinum* var. *esculentum*) and shrub hardwoods (*Fuschia*, *Aristotelia* and *Melicytus* spp.) spread from stump mounds and slash heaps.

With good planting stock and care in planting, mortality of seedlings after one year is usually less than 10%, but after five years it is commonly between 40 and 50%. On the Mamaku plateau, much of this mortality in logged tawa forest is caused by *Armellaria* and is highest in the second and third years after planting. The end result is that substantial gaps may occur, particularly around stumps, which are the main sources of infection.

As establishment costs are quite high, it is important to keep the rotation short and to obtain maximum increment on final crop trees. These aims may be achieved by introducing the short-rotation sawlog regime with its emphasis on wide spacing and reliance on pruning the stem to a height of 11 m to control knot defects over two log lengths (Fenton, 1972). This regime greatly reduces the problems of tending a patchy irregular crop, and is compatible with grazing. Cattle grazing,

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after the radiata pine is established, will control woody growth, bracken and coarse grasses, and will induce a sward of short grass, giving easy access for tending operations.

TRIALS ON THE MAMAKU PLATEAU

The short-rotation sawlog regime, with grazing, has been introduced on two trial blocks, each of two hectares, on the watershed of the Mamaku plateau. Annual rainfall is 2400 mm. One block was planted in 1966 on a site cleared by felling and burning, and the other in 1965 on a site cleared by windrowing the slash. Each block was planted with 1/0 radiata pine seedlings at 1.8×1.8 m — a stocking of 2470 stems/ha. Beef cattle were introduced in autumn 1971, before the first tending operation. Mean height of crop trees was then 3.7 m in both blocks, the plantation in the burnt block being nearly five years old, and in the windrowed block nearly six years old. Survival at this stage was 58% and 54%, respectively. Weed growth was dominated by toetoe (*Cortaderia fulvida*) up to 2 m high, the balance consisting of bracken, Yorkshire fog (*Holcus lanatus*), *Lotus* spp., flatweeds, and rushes (windrowed site only), with shrub hardwoods in poorly-burnt patches and windrows.

Angus cows at a stocking of 4/ha considerably reduced the weed growth after 160 grazing days/ha. This first grazing improved access so that walking time for pruning in the burnt block was reduced to one-third the time taken to walk through the stands before grazing. Heifers proved less suitable than in-calf cows for this initial grazing of rank growth. No significant damage was done to the crop trees. Trees damaged by pushing were mainly confined to defective stems with a tendency to topple (poorly planted with bunched roots), and to unthrifty stunted trees destined for removal in thinning. Browsing of side branches was not common, and these lower branches were in any case subsequently removed by pruning.

In the following spring the first pruning and thinning was carried out, reducing the stand from 1250 stems/ha to 500 pruned stems/ha. This allowed adequate selection for removing cull trees which included those malformed by early toppling (most of which occurred in the third year), the many smaller trees in the uneven stand grown on the windrowed site, and the few trees damaged during the first period of grazing. Pruning to a height of 2 m removed most of the branches infected by *Dothistroma pini* needle blight, which was still present despite annual sprays of copper salts over the previous three years.

Since tending, summer and autumn grazing has been continued with heifers and in-calf cows at stocking rates of up to 10/ha. The first year of grazing yielded a total of 550 grazing days/ha. Toetoe and all other rank herbaceous growth has been grazed short, shrub hardwoods have been heavily browsed, and old slash, thinnings and prunings have been trampled and dispersed. With continued grazing, a palatable grass sward is forming, composed mainly of Yorkshire fog. No damage has been caused by bark-biting, but precautions



FIG. 1: *Irregular radiata pine* crop five years after planting, showing typical weed growth on the Mamaku plateau.

were taken by providing adequate water and well-distributed stock licks, and by removing stock at the first signs of feed shortage when a few small trees were ridden down and browsed. Several cases of bark damage have been recorded from other forests where forage was poor and overstocking occurred. At Mamaku, cows have remained in excellent condition when grazed in logged indigenous forest or in young exotic plantations.

Tending of these experimental plantations, together with grazing, has resulted in a healthy even crop, despite an early history of infection by *Armillaria* and *Dothistroma*. There is now good access (1972) and negligible fire risk, and little further loss is expected from windthrow or fungal attack. Mortality from *Armillaria* appears to decline sharply about the fourth year, and trees showing signs of weak root systems have generally been removed in thinning.

Figures 1 and 2 illustrate the changes in ground vegetation that have occurred over a twelve-month period of grazing. The reduced toetoe clumps, with their residue of dry leaves, have been burnt during winter in a rapid and cheap operation, and part of the area has been topdressed and sown with a mixture of ryegrass (*Lolium perenne*), timothy (*Phleum pratense*) and clovers after close grazing by sheep. It is too early to appraise the success of this attempt at pasture improvement, but sown species are well established around the burnt toetoe clumps.



FIG. 2: *The same stand twelve months later after grazing, pruning and thinning to 500 stems/ha.*

DISCUSSION

Future prescriptions on the short-rotation schedule involve further pruning and thinning to 370 stems/ha at height 8 m, and to 200 stems/ha at 11 m when the final crop stocking will be obtained (Knowles, 1972). There is thus the expectation of continued grazing in the mid-rotation period, with the possibility of improving the sward by oversowing, or by feeding hay, and grazing throughout the rotation.

In other trials on the Mamaku plateau, grazing the site for two years before clearing has greatly reduced the cost of clear-felling (by up to 50%) and has assisted the spread of grasses. Better grasses have been introduced by distributing good quality hay within the grazing block. Pasture grasses and clovers have also been sown after burning and before planting. This suppresses the usual invasion of fireweeds, thistles and coarse grasses, and allows early grazing by sheep. An

alternative method tried has been to introduce sheep in the second or third year after planting well-grown radiata pine seedlings, when leaders are above browsing level (one metre on flat ground); this reduces the rank naturally-invading grasses and weeds to short turf.

Better site preparation than was achieved in these earlier trials, and the use of higher-quality planting stock, indicate that an espacement of 3×2 m at planting would be possible. The improved growth rates obtained by these measures, and better control of *Dothistroma*, should result in a further saving of one year in the rotation, and should allow the introduction of cattle during the fourth year after planting.

The question of recovery of fencing costs could influence any decision on the most profitable of the different procedures discussed above. A reasonably stock-proof four-wire cattle fence, with five posts per 20 m, can be constructed for 50 cents per metre (labour and materials) on a tractor-cleared strip. Herd size should be limited in a young plantation to prevent excessive camping, but 60 beasts on a 16 ha block should be practicable. If two such blocks are used for a first winter grazing in the fourth or fifth year after planting, the cost of fencing at 100 m/ha could well be recovered within one year by forest grazing, particularly if the value of the farm pasture left ungrazed in winter is taken into account.

REFERENCES

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