PASTURE MANAGEMENT AND THE ESTABLISHMENT OF A FOREST FARM

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Abstract

The problems of managing pasture while establishing a stand of trees in both developed and developing sward are outlined. In particular, the two basic means of pasture control-animals and machines-are examined. Examples of pasture management control and utilization cover the planting, releasing, early thinning and pruning phases up to year 5 at Pouto. Particular reference is made to fertilizing practices, the problems of Kikuyu grass pasture and summer drought conditions.

INTRODUCTION

THE PROBLEM of both pasture management and tree establishment is unique to the forest farmer. A suitable environment must be created before trees can be planted, and during the first few years after planting restrictions on animal stocking are required to prevent excessive tree damage. Additionally, the quality of an established pasture may deteriorate following the establishment of trees. Although not recommended by most researchers, the establishment of trees simultaneously with the pasture sward can be advantageous as grass competition may be reduced. Recent experiences have shown that there are a number of methods the forest farmer can use to maximize his land use during this period. Comments in this article relate to work done with *Pinus radiata* only but may be applicable to other species.

THE PLANTING ENVIRONMENT

The planting of trees in an undeveloped sward is particularly suited to areas where machine planting is possible. For instance, heath country can be planted and rotoslashing can be used to develop "natural" pasture. Undersowing grass seed is also a possibility in this type of environment.

The planting of trees in a developed sward can be more complicated. The usual method has been to remove a turf from an area (0.4 m') before planting, and later release the trees from grass competition. Knowles et *al.* (1973) outline a method for the

chemical spraying and preparation of pastures prior to planting. Further work associated with a particular pasture species has been undertaken by Farnsworth and Male (1975b). Kikuyu grass *(Pennisetum clandestinum)* is a root-bound grass which gives fierce competition to young trees, particularly in dry summer periods. To overcome this, a rotary hoe dish was used to break up the mat and also create shelter for the young tree. The results of experiments comparing hand planting, chemically prepared plots and rotary hoe dishes are summarized in Table 1. Fuller details and the effects of fertilizer are given in Table 2, and will be discussed later. It is possible that the dish technique could bc used with other root-bound pastures such as paspalum *(Paspalum dilatatum)*.

Costs per hectare of these methods and cf machine planting are shown in Table 3. Costs of chemical preparation have been converted from data given by Knowles *et al.* (1973); the other

TABLE 1: PLANTING TECHNIQUES

Method	*Survival (%)*	*Height Gain (cm)*	*Vigour (1-5)*
Hand planting	40.8	4.9	3.6
Chemical preparation	40.3	4.1	3.4
Rotary hoe dish	60.9	7.7	4.1

TABLE 2: PLANTING TECHNIQUES AND FERTILIZER APPLICATION

Method	*Fertilizer*	*Survival (%)*	*Gain (cm)*	*Vigour (1-5)*
H	—	18.5	4.2	3.6
C	—	82.3	4.3	3.6
RHD	—	92.5	7.2	4.2
H	N	28.8	5.4	4.0
C	P	88.8	9.3	4.4
RHD	P	2.5	1.0	3.0
H	N & P	1.2	5.0	3.0
C	N & P	33.8	6.9	3.5
RHD	N & P			

H-Hand planting. C-Chemical preparation. RHD-Rotary hoe dish. N—Urea. P—Superphosphate.

TABLE 3: COSTS OF PLANTING TECHNIQUES

Method	*Costs ($/ha)*
Machine	31.45
Hand	46.76
Rotary hoe dish	57.63
Chemical preparation	67.501

'Knowles *et al. (1973).*

three methods are based on 1975 estimates and on average costs of these have increased $12.50/ha in the past year. Figures have been adjusted to planting at 1250 stems/ha.

If hand releasing were required, this cost would need to be added to make the data comparable over the first year. This would apply to hand planting as opposed to chemical planting. If machine releasing could be used, the additional cost could be reduced.

FERTILIZING

Table 4 summarizes fertilizer effects recorded in an experiment conducted by the writers at Pouto. The blood and bone experiment was undertaken in a different area and only the rotary hoe dish planting method used, so only broad comparisons can be made.

An examination of Tables 2 and 4 shows that the addition of fertilizer at the time of planting does not enhance either survival or rate of growth. Rather, in some instances, the effect of application is disastrous. The nitrogen was applied to the side of the seedling as urea (26% N) at a rate of 30 g per tree. Superphosphate (9% P) at SO g per tree was applied similarly. The blood and bone was placed in the base of the hole before the seedling was planted.

TABLE 4: FERTILIZER APPLICATION AND TREE GROWTH

Fertilizer	*Survivtrl (%)*	*Gain (cm)*	*Vigour (1-5)*
Nitrogen	12.1	6.3	3.7
No nitrogen	82.6	5.8	3.8
Phosphate	46.6	6.2	3.7
No phosphate	48.1	5.5	3.8
Blood and bone	76.0	—	3.8
No blood and bone	90.0	—	3.9

There is a significant variation in the results and it is apparent that nitrogen in particular, but also phosphate, is unsuitable for stimulating tree growth in environments similar to that of Pouto. A farmer should therefore carefully examine any fertilizer programme prior to planting.

PASTURE MANAGEMENT

The control of grass competition with the young trees during the establishment phase is all-important if this phase is not to be extended and thus prolong the time before the paddock can be returned to the grazing cycle. Management techniques available during this period are limited by topographical features and the type of land cover. Efforts to utilize and maintain pasture can include the use of animals, machines and manpower.

No one method can be recommended before another because economic factors are not the only ones to be considered. For example, scrub cutting may be required on steep slopes where pastures are poorly developed and competition may be such that scrub species tend to dominate after tree planting. Spraying weeds may be difficult owing to the susceptibility of trees to drifting spray and hand methods may be the only option available. Soil type can also limit operations. Sheep are not used at Pouto for releasing purposes as the sandy parent material would soon be exposed on the steep lee slopes of the stabilized dunes. It is apparent that, although generalizations can be made, each site must be assessed individually.

The different systems used during the establishment phase are discussed below.

ANIMALS

During the first 18 months to 2 years, grazing is restricted to sheep. Generally, no stock are introduced until the trees are 1 m in height. Olsen (1974) suggests that grazing in the spring, following bud burst, is undesirable during the establishment phase. Browsing of leaders usually results in the height increment being reduced, The best times for introducing sheep into the plantation appear to be the winter following planting (Knowles, 1974), the late spring/early summer period, and autumn. Romneys appear to be better than Perendales or Border Leicesters at the earlier stages. The earliest age cattle are introduced is as weaner calves, into l&month-old plantations where trees are over 2 m high.

I. P. M. McQueen (pers. comm.) suggests that, by leaving pasture to become rank, tree damage can be greater than if regular grazing had occurred. Experience has shown that with both sheep and cattle it is preferable to have the stock in good condition before introducing them to the young plantation and, if possible, the stock should have had experience grazing under an older stand.

Management requires good judgement during this phase which should be beneficial to the trees rather than supplying large quantities of feed for stock. The maintenance of a productive sward for subsequent seasons is all-important and rank pasture leads to unpalatable pasture of low digestibility which tends to become open and suffer from the smothering of clovers.

After three years the paddock is usually ready to return to the regular farm grazing programme.

MACHINERY

In some cases it may be more advisable or advantageous to use machinery rather than animals in the establishment phase. Although it has been noted that mowing has a place, there may be aggravation of local problems, such as grass grub and weeds, through the long spelling of pasture (I. P. M. McQueen, pers. comm.).

Machinery is limited by contour but can be of use both for releasing and for pasture development or maintenance, particularly in an environment such as at Pouto where there is a limitation with sheep. The use of rotoslashing is not limited to releasing, but can also assist with the breakdown of the first thinnings and prunings.

The distance between rows is all-important when machinery is to be used and this can be more critical when areas are utilized for silage, rather than rotoslashing to waste. It was found at Pouto that considerable benefit was gained from heavily grazing pastures during the late summer and then undersowing with 'Grasslands Tama' Westerwolds ryegrass, 'Grasslands Ruanui' perennial ryegrass, 'Grasslands Huia' white clover, and 'Grasslands Turoa' red clover. Used in conjunction with rotary hoe strip or dish techniques with interrow distances of 4.9 m, the cutting of silage was successful.

HAND/CHEMICAL RELEASING

These methods are both expensive and time-consuming. With Kikuyu grass pasture, it has been found that, if the root mat is

not completely removed at planting, competition the following summer can be too severe for the trees. The necessity for such a programme appears to be related to the occurrence of cold winter temperatures and whether Kikuyu grass becomes dormant or not.

The comparative economics of the different techniques are near impossible to outline. First, individual differences in areas are reflected in different rates of tree growth and of pasture production and utilization. Secondly, the values of such items as silage or hay are difficult to assess owing to variations in quality. Thirdly, often different schemes cannot be compared, such as on the steep lee slopes of sand dunes where only hand or chemical releasing can apply.

THE LIGHT PROBLEM

Comparative economics also become impracticable owing to the variations of the climate within a plantation that result from the earliest stages of growth and alter with the vertical displacemen of the canopy (Farnsworth and Male, 1975a). For this reason the productivity of the pasture of a site varies as the tree grows; as tree growth rates vary there is therefore variation in productivity at the same tree age from place to place. A true comparison of a site is therefore related to the conversion factor of grass to weight gain and/or wool production.

Insolation is the major factor in the alteration of the climatic environment and work on this is being conducted at Pouto. Table 5 outlines the value of the pastures at Pouto as a percentage of the unplanted pasture areas as related to approximate beast performance. Work is continuing with different tree ages, tree densities, thinning and pruning regimes, and grass species (Farnsworth et al., 1975).

TABLE 5: PASTURE VALUE DURING THE ESTABLISHMENT PHASE

Year	% Value of Pasture	Knowles[1] et al. (1973)
1	45	20
2		
3	100 55	40 60-80
4	100	60-80
5	100	60-80

[1]Based on % area grazed.

CONCLUSION

The maximization of land use while establishing trees, yet maintaining or establishing pasture, requires that each site be treated in the most appropriate manner. The aim should be to restrict tree damage as much as possible during the establishment phase while at the same time keeping or developing pasture to a productive level until animals can be reintroduced into the area.

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