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PLANTING PRODUCTIVITY IN A RANGE OF LOGGING RESIDUE TREATMENTS

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Figure 1 - Trial area showing logging residue untreated, line raked, windrowed and crushed

ABSTRACT

During 1992, three growth trials were established to assess the effect of four logging residue treatments on tree growth. A time study of manual planting of the three areas was carried out to determine the differences in planting production between the treatments.

The planting studies showed that; there were no significant differences between planting up or downhill, that clearing residue improved walking times, planting times did not vary significantly between treatments, planting times varied between soil types, gains in planting production did not cover the cost of mechanically treating logging residue. Planting quality was good under all conditions.

The difference in production between planting through untreated residue and a cleared site could be up to 30%.

INTRODUCTION

In order to assess some of the effects of harvesting and re-establishment on long term site productivity, three trials were established in different forests during the 1992 planting season. The trials were established in Otago, Nelson and the Bay of Plenty. The aim of the trials was to determine whether it is cost effective to mechanically treat logging residue by assessing the effects of three common residue treatments and the presence or absence of residue on tree growth.

Part of this study included determining what effects the logging residue and the treatment of it had on planting production. To this end, time studies were carried out on the planting of these trials.

Overseas studies indicated that a lane clearing and cultivation treatment improved planter productivity by 30-50% on flat land. Uniformity of spacing also improved and no significant change to planting quality was evident. (Stjernberg, 1991).

A more recent New Zealand study found that harvesting residue restricts access for restocking operations, particularly planting, and made all terrain difficult to negotiate. Heavy slash adversely affected planting quality by restricting cultivation and the opening of holes for good root positioning. (Trewin and Kirk, 1992).

Balneaves (1990) demonstrated long term nutritional and associated crop growth benefits of retaining slash, duff layers and other organic materials.

These studies of the effects of harvest residue treatments on re-establishment cost and growth show that untreated harvest residue can increase planting difficulty and costs. However, benefits of retaining slash are evident as it increases soil fertility and tree growth.

This report covers planting productivity through harvest residue which has been subjected to different mechanical treatments in three different forests.

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METHODS

The logging residue treatments were line raking with bulldozers, windrowing using an excavator and roller crushing using gravity rollers (Figure 1). These were compared with untreated slash. No cultivation treatments were used.

Each trial had side-by-side sections of the different residue treatments. While these sections were being planted, a continuous time study was carried out on the planter.

Data recorded were; walk and plant times for each tree, access and preparation times, slope and whether the planter was working uphill, downhill or on the flat.

Volumes of slash within the planted area of each treatment in the trials were recorded before and after treatment.

Quality assessment was carried out on the planting by examining 10% of the trees planted and assessing tree straightness, firmness, planting depth, root orientation and cultivation depth.

Comparative production figures were obtained by using a standard eight hour day in production calculations.

Table 1 - Trees planted per 410 minute day

	Logging residue treatment			
Site No. Slope/Soil	Untreated Residue	Excavator Windrowed	Line Raked	Roller Crushed
1. 0-5° Clay	490	570	520	--
2. 10-30° Clay/gravel	510	675	665	595
3. 15-30° Scoria	730	--	--	855

Table 2 - Trees per hour of productive planting time

	Logging residue treatment			
Site No.	Untreated Residue	Excavator Windrowed	Line Raked	Roller Crushed
1	71	83	77	--
2	75	99	97	87
3	107	--	--	125

RESULTS

Of an eight hour (480 minute) day (not including lunch break), it is reasonable to expect around 410 minutes of actual planting time. The other 70 minutes being taken up with two 15 minute breaks, access in and out of the block, loading trees, preparing equipment and personal time.

Tables 1 and 2 show some marked differences in levels of production. Some of this can be attributed to minor differences between planters, but much of it is site and treatment related. All the planters studied were fit, experienced, competent and working to the same prescribed method. Planting quality was very good and did not vary with planter, soil type or residue treatment.

Analysis of the timed elements showed that the walk times did not vary significantly between either flat and steep ground or between up and downhill planting (Table 3). Walk times varied, but not significantly, between treated and untreated slash. There was also some variation between different slash treatments. Plant times varied between treated and untreated slash at Site 2 only.

The greatest effect on plant times came from soil type, with the scoria soil giving a planting time, on average, 45% less than the other soil types. This was due to its

Table 3 - Average walk and plant times

		Logging residue treatment			
Site No.	Element.	Untreated	Excavator Windrowed	Line Raked	Roller Crushed
1	Walk	0.15	0.08	0.10	--
	Plant	0.69	0.65	0.68	--
2	Walk	0.20	0.12	0.13	0.16
	Plant	0.61	0.48	0.48	0.53
3	Walk	0.18	--	--	0.14
	Plant	0.38	--	--	0.34

Table 4 - Logging residue volumes (m^3/ha) before and after treatment

		Logging residue treatment.			
Site No.	Before/After	Untreated	Excavator Windrowed	Line Raked	Roller Crushed
1	Before	123	116	203	--
	After	N/A	38	60	--
2	Before	67	82	109	79
	After	N/A	9	24	79
3	Before	51	--	--	53
	After	N/A	--	--	53

very friable, easily cultivated structure. The other two soils were hard and heavy, which meant more time and effort were required to create a suitable planting spot.

Although the element times did not vary significantly, the averages were, in some cases, sufficiently divergent that over a day there was a substantial accumulated difference (Table 1). As expected, the greatest differences in planting production occurred between untreated and windrowed areas. At Site 1 the difference was 16% and at Site 2 the difference was 32%. There was also a difference between untreated and roller crushed areas, 16% at both Sites 2 and 3. Untreated and line raked areas also differed. At Site 1 the difference was 7% and at Site 2 the difference was 30%.

The volume of logging residue varied from site to site, and typical of most logging operations the distribution was patchy rather than uniform (Table 4).

Although the treatment of slash was a factor which affected planting times, the variation in volume encountered in these trials was not. This may not be true in cases where volumes of residue are very high.

DISCUSSION

The gain in planting production even at the maximum of 32% only partly covers the cost of mechanical site preparation, on average $190 per hectare in these trials (Hall, 1992).

The re-arranging of logging debris cannot be justified in terms of gains in planting production, except in cases where the slash is extremely dense, say 200 m^3/ha+, and where planters are struggling all the time to find firm footing and suitable planting spots.

However, there may be other considerations which affect the decision to treat or not treat the residue, including the desire for uniform stocking which enhances the ease of finding trees at releasing, frost control and a better choice of micro sites to plant in.

It has been suggested that significant savings in releasing costs can be obtained by using mechanical site preparation, such as the excavator windrowing. If the site has no site preparation treatment, release spraying has to be done by broadcast aerial application at a cost of $250-$300 per hectare. If the site has been windrowed, the releasing can be carried out by hand at a cost of $100 per hectare.

The combination of the improved planting productivity and the potential saving in releasing costs make the mechanical treatment of heavy slash an economic proposition in many cases.

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