REPORT

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Golden Downs Site Preparation Trial
- Growth Results After Six Years

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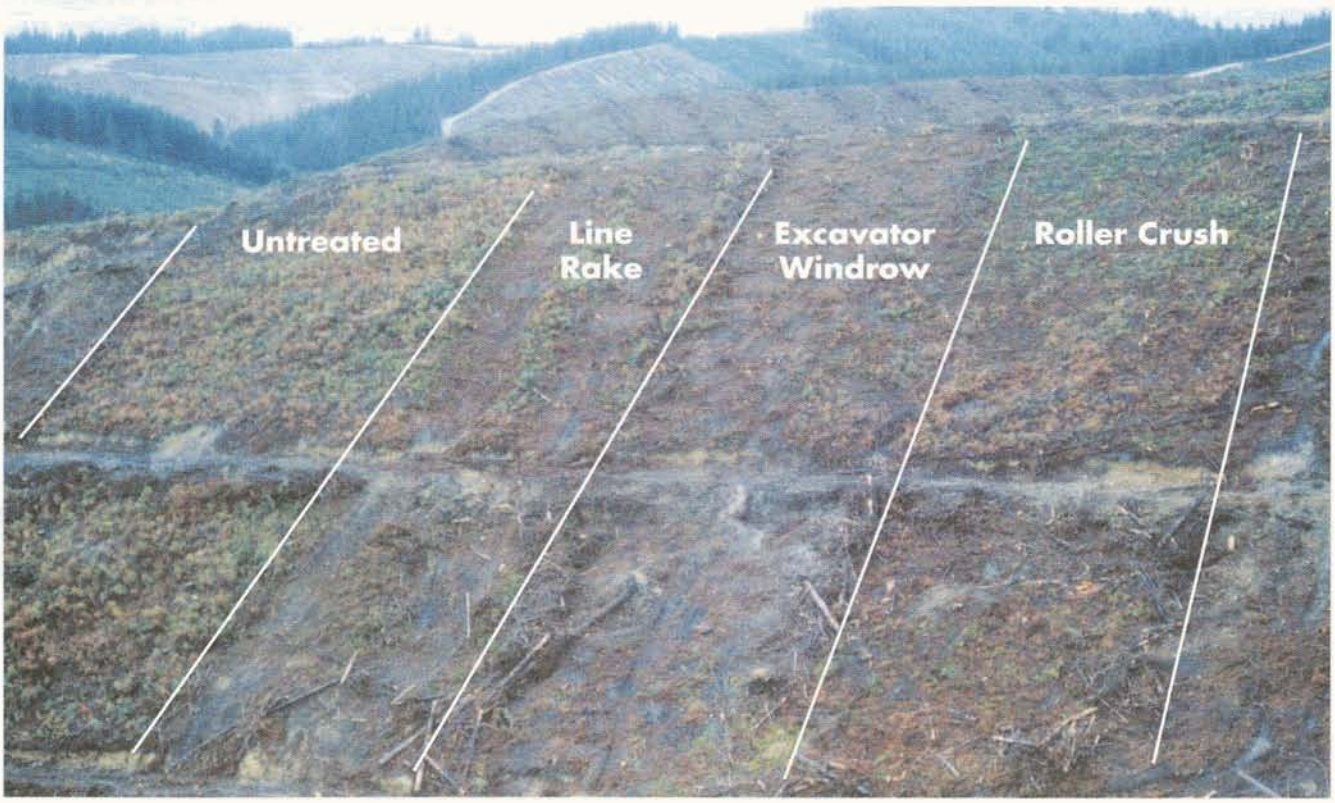

Figure 1 - Site preparation trial in Golden Downs Forest

Summary

In 1992, a mechanical site preparation trial was established in Golden Downs Forest to look at the effects of different slash treatment on the growth rates of radiata pine. The treatments in the trial were:

- *Untreated residue*
- *Line rake*
- *Excavator windrow*
- *Roller crush*

Radiata pine trees planted in this trial have been measured annually for six years for diameter, height, survival, health and form. Basal area has been calculated.

There were no significant differences by treatment for any of the variables measured.

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Introduction

In New Zealand plantation forests, the amount of logging residue (slash) left on the cutover after harvesting is often as much as 50m^3 per hectare. On many re-establishment sites, some treatment of the slash is considered beneficial. Heavy slash can cause problems with planter access, planting quality, evenness of tree spacing and tree re-location at releasing. In some cases, the slash persists for several years and continues to hinder access during 1st thinning and pruning. There is some evidence that planting directly into heavy slash may cause reduced tree growth (Hall 1999, In Prep).

Common mechanical slash treatments are line raking, windrowing and roller crushing. Where possible, forest managers tend to leave slash untreated as this is the least cost approach.

In 1992, Liro established a growth trial in Golden Downs forest that was designed to measure the impact of the different mechanical slash (site preparation) treatments on the growth of radiata pine.

This trial is now six years old and the results to winter 1998 are presented in this report. Results from this trial at age four have been reported previously (Hall, 1997)

Acknowledgments

Liro acknowledges the assistance of Fletcher Challenge Forests Limited and Weyerhauser New Zealand Incorporated in the installation, measurement and maintenance of this trial.

Methods

The site where the trial was established is on rolling to steep hills. The hill slopes are long with wide ridges and deeply incised gullies. The previous forest crop was untended radiata pine which was harvested by skidders working from benched contour tracks. The soil (Moutere hill soils) is a clay loam over glacial gravel. Generally, this soil is not very fertile and is often Nitrogen deficient, especially on the ridge tops. The climate is warm, with low to moderate (1000 to 1500 mm per annum) rainfall.

The trial is a randomised block design, with four treatments (untreated, roller crush, line rake and excavator windrow). Initially 10 replications were established. Each plot contained 32 trees (4 rows of 8 trees at 4m by 3m spacing) giving a stocking of 833 stems per hectare.

The treatments were:

Untreated - The residue which was quite dense in places (75m^3/ha) was left untreated with planters instructed to plant at the required spacing (4 m between rows and 3 m between trees) where possible. Planters cleared some slash by hand from the planting spots.

Line Blade - A bulldozer fitted with a root rake blade was used to clear parallel lanes running downhill. Each plot consisted of two lanes. Trees were planted along both edges of each cleared lane, near the slash.

Excavator Windrow - an excavator fitted with a root rake created parallel clear bays running downhill. The clear bays were up to 14m wide between the piles of slash which were 4 to 5m wide and 3m high. Four rows of trees were planted in each bay, with two adjacent to the windrows of slash and two in the clear area.

Roller crush - a gravity roller was used, operated from a bulldozer working from the ridge tops. The roller was raised and lowered over the site. Close to 100% coverage of the site was achieved. The slash was broken into short sections and flattened into a layer 50 to 150mm thick. Planters were able to move the slash aside by hand to create planting spots.

Over the life of the trial, some replications were dropped that were unrepresentative of the treatments. Two replications were affected by the presence of contour tracks above the plots that affected water flow, causing heavy mortality in several plots. Replication 7 was dropped from measurement in 1995 and replication 4 was dropped 1996. In 1997, replication 3 was dropped due to gorse infestation and in 1998 replication 9 was dropped for the same reason. The gorse was starting to affect tree growth. Of the original 10 replications, six (and the trial as a whole) are still considered viable.

Initial measurements of height and root collar diameter were made immediately after planting. Annual measurements were collected for height, diameter (root collar from 1993 to 1996 and DBH from 1996 to 1998). Each year, the trees were individually assessed for health and form. The health and form assessments used were:

Health, 1 to 5 with :

1 = very healthy
2 = healthy
3 = unhealthy
4 = very unhealthy
5 = dead

Form, 1 to 5, with :

1 = single straight leader

2 = straight stem, double leader

3 = multi leader

4 = butt-swept, single leader

5 = butt-swept, multi leader

Note: For both health and form, a lower score indicates superior performance.

Data were analysed by analysis of variance, followed by a least significant difference test.

Weed control in all plots was the standard treatment practised in the forest block surrounding the trial. This consisted of a broadcast pre-plant spray and spot releasing in the first year after planting. Regenerating pine seedlings were removed from the trial in 1993, 1994 and 1995.

Results

Slash volumes when the trial was established were:

	Pre-treatment	Post treatment (within planted area)
Untreated	67 m^3/ha	67 m^3/ha
Roller crush	79 m^3/ha	79 m^3/ha
Line rake	109 m^3/ha	20 m^3/ha
Excavator windrow	82 m^3/ha	9 m^3/ha

There were no significant differences in diameter or in diameter increment between treatments (Figure 2).

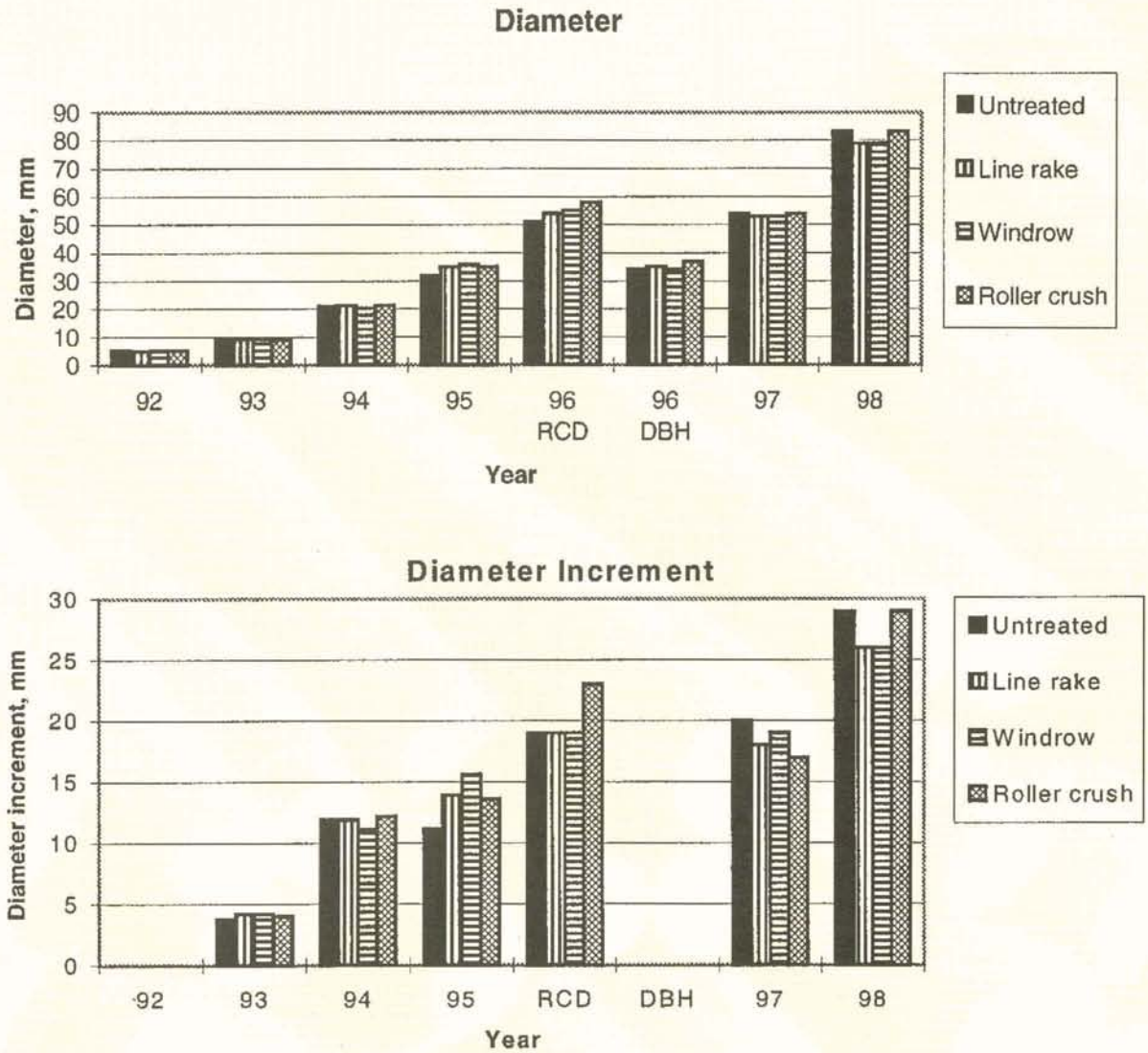

Figure 2 - Diameter and Diameter Increment (Note: change from root collar diameter to DBH measurement in 1996)

There were no significant differences in height growth between treatments (Figure 3).

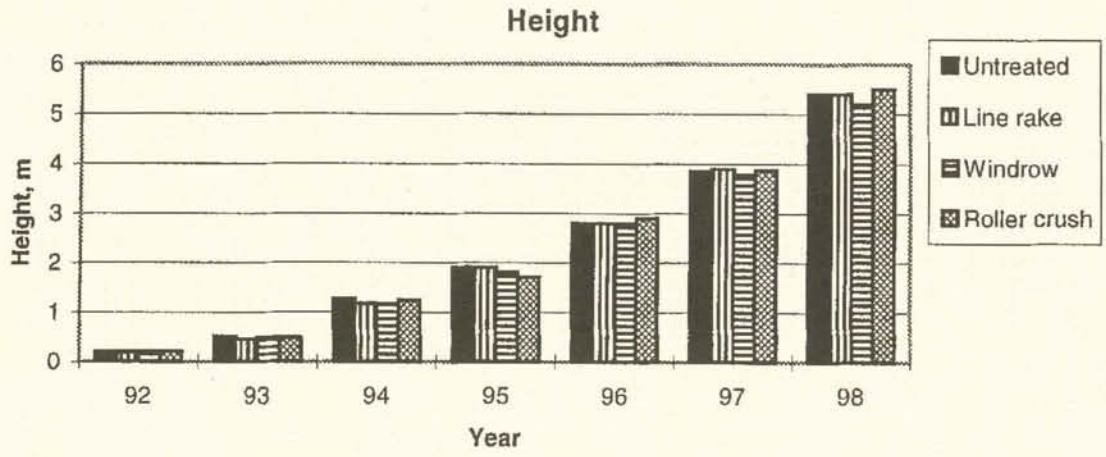

Figure 3 - Height growth

There have been no changes in percent survivals since 1994, and there were no significant differences by treatment (Figure 4).

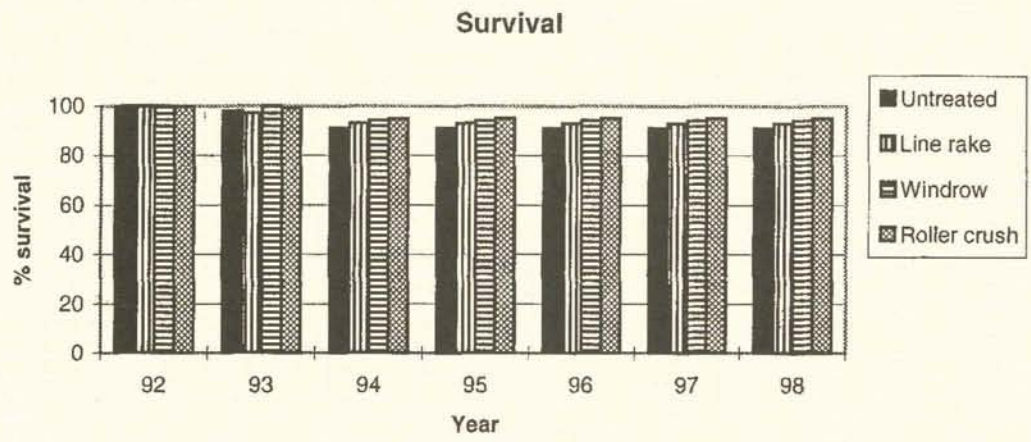

Figure 4 - Percent survival

The health score can, and has, fluctuated over time, declining in 1993 with a recovery in 1994 and little change since then. There were no significant differences in health score by treatment (Figure 5).

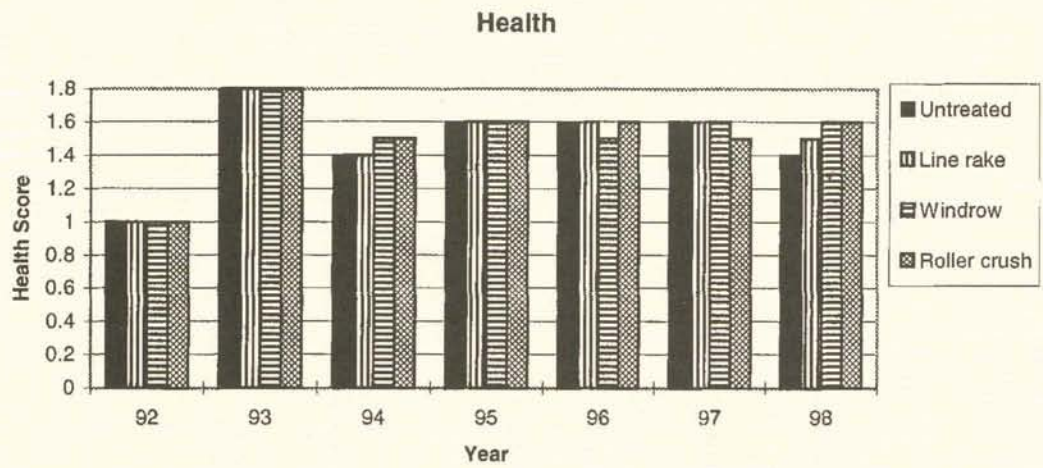

Figure 5 - Health score

As with the health score, the form score can fluctuate over time. Form declined in 1993 and then improved in 1996. There were no significant differences in form between treatments (Figure 6).

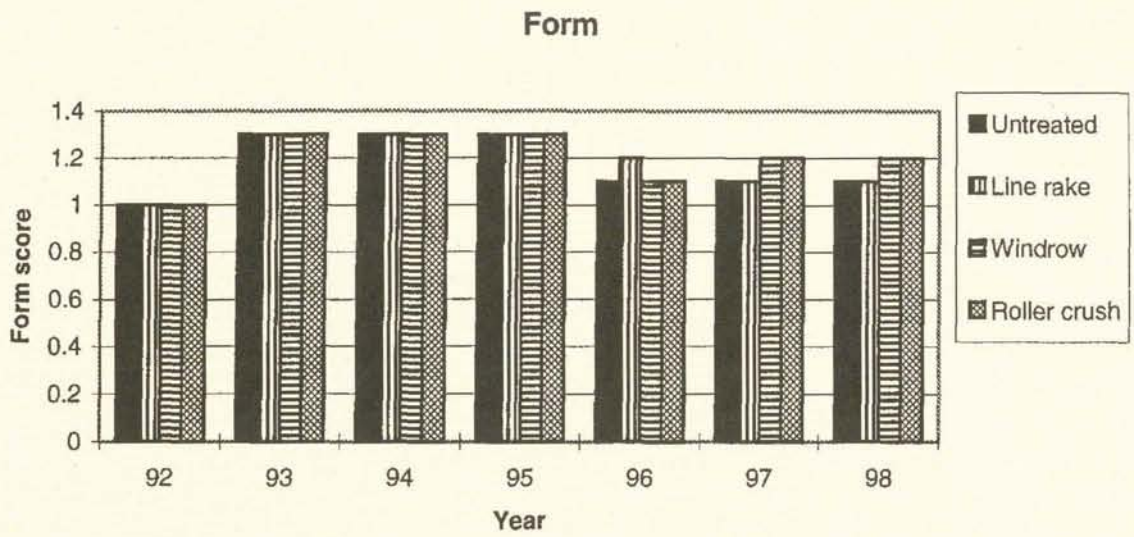

Figure 6 - Form score

There were no significant differences in basal area by treatment (Figure 7).

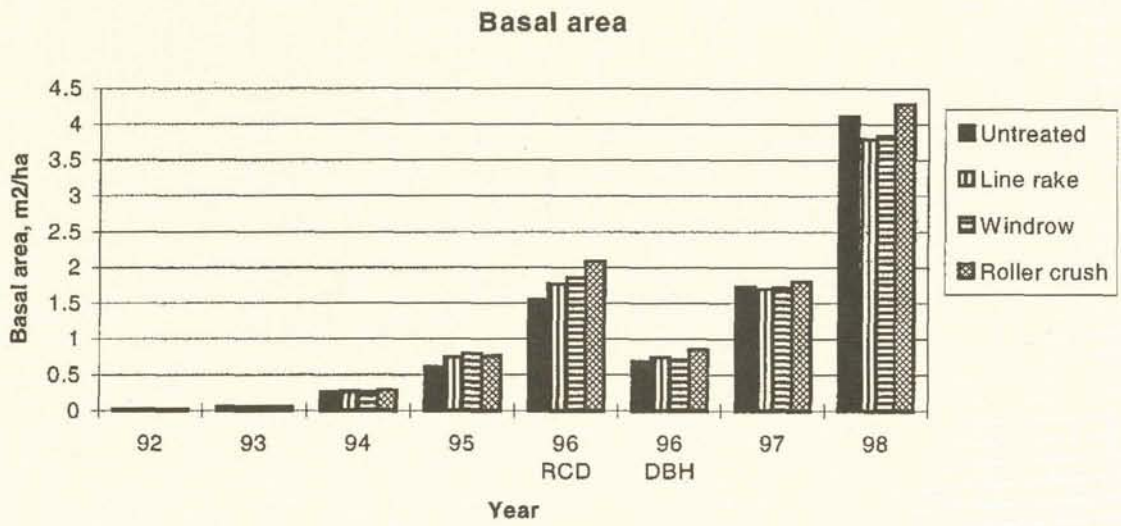

Figure 7 - Basal area (Root collar diameter 1992 to 1996, DBH 1996 to 1998)

Costs

The costs per hectare of the treatments were estimated based on observed treatment times and hourly machine costs derived using standard Liro costing practices (Riddle, 1994):

Untreated	$0/ha
Roller crush	$230/ha
Excavator Windrow	$280/ha
Line Rake	$175/ha

Discussion

The retention of slash on the site near the trees is regarded as having potential long term benefits to tree growth as the slash decays and releases nutrients for trees to absorb (Ballard 1977, Balneaves, 1990). There is no evidence of this occurring at this early stage of the trial with little in the way of growth differences by treatment.

The fine material (needles and fine branches) decay quite quickly (three to six months) if they are in contact with the ground. Where the residue is being held off the ground, it is taking much longer to decay. The larger stem residue is still visible after six years, although decay is advanced.

Given that there are no differences in growth at this point in the trial, it is difficult to justify the extra costs of the mechanical slash treatments over the untreated option.

The trial, is scheduled to be thinned in 1999 and will be remeasured after this has been completed. The trial will then be remeasured in three years time, at age ten.

Conclusions

There were no significant differences by treatment at age six for tree;

- diameter
- diameter increment
- height
- survival
- health
- form
- basal area

References

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The costs stated in this report were derived using the procedures shown in the Liro Handbook, Business Management for logging. They are indicative only and do not necessarily represent the actual cost of the operation.