

EFFECTS ON SURVIVAL AND TREE GROWTH OF SPOT CULTIVATION WITH THE WILCO

INTRODUCTION

The use of excavator-based spot ripper mounds, such as the WILCO (Figure 1), VH Mulcher and ROTREE for spot cultivation during site preparation has increased in the last two years. The main reasons for this have been that excavator-based operations create less site disturbance than bulldozer-based continuous rip-mound (CRM) operations and the attachments create more uniform planting sites (Hall, 1995). The excavator-based attachments are also capable of working in very heavy slash conditions whereas the bulldozer-based ripper mounds need the slash to be cleared first.

There is little formal data on the growth effects from the use of the WILCO, as the majority of the work done with these machines in New Zealand has been in the 1995 and 1996 planting seasons. To provide a snapshot of early tree performance on sites treated by the WILCO and selected alternatives, LIRO measured tree growth, form and survival in selected treated and untreated areas.

ACKNOWLEDGEMENT

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Figure 1 - WILCO spot cultivator on Cat 312 excavator

METHODS

Tree measurements from five sites were collected (two in Tarawera Forest and three in Kaingaroa Forest). At all sites, height, diameter and percent survival were recorded, and at Sites 1 and 2 the health and form of the trees were also assessed. The sites are summarised in Table 1.

Tree health and form were assessed using a scoring system (The average of the scores is presented):

Health, range 1 to 5; 1 = very healthy, 5 = dead

Form, range 1 to 5; 1 = single straight leader, 5 = malformed and toppled.

Table 1 - Site descriptions

Site No.	Forest	Soil	Treatments	Site conditions	Tree age
1	Tarawera	Scoria	Spot cultivate (WILCO) Uncultivated CRM	River terrace, hard pan	2 years
2	Tarawera	Scoria	Spot cultivate (WILCO) Uncultivated CRM	Frost flat, hard pan	1 year
3	Kaingaroa	Pumice	Spot cultivate (WILCO) Windrow + CRM CRM	Frost flat, hard pan	1 year
4	Kaingaroa	Pumice	Spot cultivate (WILCO) V-Blade	Frost flat, hard pan	1 year
5	Kaingaroa	Pumice	Spot cultivate (WILCO) Excavator rip Bulldozer rip CRM Skidder CRM Uncultivated	Frost flat, hard pan	1 year

Note: CRM = bulldozer based continuous rip mound.

RESULTS

Site 1

Measurements of ten trees in ten plots were made for each of the three treatments. On average, trees planted in the spot cultivated sites were significantly taller and healthier than those planted on continuous rip mounds or untreated cutover (Table 2). Trees on the spot cultivation also had better form and higher survivals than the trees in the other treatments.

Table 2 - Mean results for Site 1

	Spot cultivate (WILCO)	Continuous rip-mound	Untreated cutover
Height (m)	1.5 a	1.3 b	1.1 c
Diameter (mm)	38 a	33 a	25 a
Health	1.0 a	1.3 b	1.4 c
Form	1.2 a	1.6 b	1.6 b
Survival (%)	99 a	90 b	81 c

Note: For all results, letters in a row denote significant differences. Variables with a different letter are significantly different ($P < 0.05$).

Site 2

Ten plots of ten trees were established and measured in adjacent blocks which had received the three different treatments. With the exception of mean diameters, trees growing on spot cultivated mounds were performing better than trees planted on the other two treatments (Table 3).

Table 3 - Mean results for Site 2

	Spot cultivate (WILCO)	Continuous rip-mound	Untreated cutover
Height (m)	59 a	53 b	44 c
Diameter (mm)	15 a	13 a	10 c
Health	1.1 a	1.4 b	1.4 b
Form	1.1 a	1.5 b	1.4 b
Survival (%)	98 a	91 b	95 c

Site 3

Operational trial, with two replications of double rows of three different treatments:

(i) - Excavator spot cultivate, (ii) - Windrowing with bulldozer rip-mound (BRM), (iii) - Bulldozer rip - mound

There were no significant differences in mean height growth or in survival. There was a significant difference in mean diameter growth, with trees on the excavator spot cultivation site being slightly smaller.

Table 4 - Mean results for Site 3

	Spot cultivate (WILCO)	Windrow BRM	BRM
Height (m)	394 a	363 a	418 a
Diameter (mm)	9.7 b	10.4 a	10.8 a
Survival (%)	97 a	97 a	97 a

Site 4

At this site, there were large blocks of two site preparation treatments (v-blade and excavator spot cultivation), planted with cuttings. The blocks were sampled (5%) by area) using 0.04 ha transects. There were no significant differences in height or diameter growth. The survival of the trees on the excavator spot cultivated areas was 100%, significantly higher than the V-bladed site.

Table 5 - Mean results for Site 4

	Spot cultivate (WILCO)	V-Blade
Height (m)	346 a	348 a
Diameter (mm)	10.7 a	10.5 a
Survival (%)	100 a	95 b

Operational trial of unreplicated blocks of different cultivation treatments on a burnt cutover. Data were collected using 0.04 ha plots at a 5% sample.

There were no significant differences in growth between the treatments. However, there were some significant differences in the survivals between the treatments. The low survivals for the unmounded treatments (excavator rip, bulldozer rip, skidder rip and no cultivation) are thought to be related to frosting. The survivals in the other two treatments were highly variable and the mortality that occurred was due to hylastes attack which may be related to the burning.

Table 6 - Mean results for Site 5

	Height	Diameter	Survival
Spot cultivate (WILCO)	405 a	11.4 a	88 a
Excavator rip	418 a	11.4 a	58 b
Bulldozer rip	387 a	10.3 a	56 b
BRM	391 a	10.8 a	89 a
Skidder rip	363 a	10.3 a	63 b
No cultivation	420 a	11.5 a	61 b

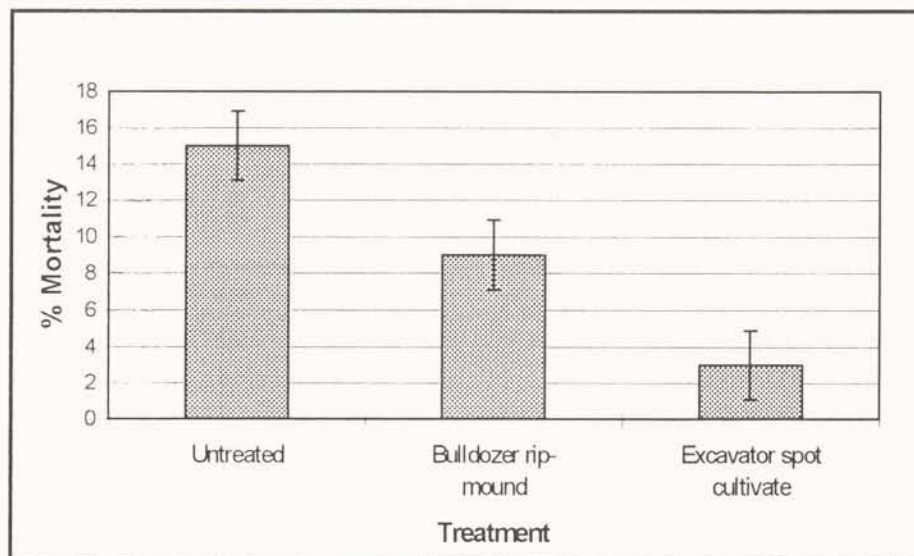


Figure 2 - % mortality for different treatments, average survivals from all sites

SUMMARY

This brief investigation relied on measurements of tree performance on different site treatments in selected operational areas. Despite being a snapshot of current performance, several trends became apparent.

In terms of mean height and diameter growth, trees planted on the WILCO spot cultivated sites performed as well as trees planted in untreated or in continuous rip-mounded sites.

Of particular note were the consistently high survivals on the WILCO spot cultivated sites. Sites treated using the WILCO had average mortalities of 3% or less (Figure 2). The other common treatment, bulldozer rip-mound sites had average mortalities of 9% on the same sites. When compared to the continuous ripping and untreated areas, the spot cultivation was consistently producing more viable trees.

If the target stocking is currently 833 stems per hectare, with an inbuilt allowance of 10% for the mortality that

has been given by existing treatments, the stocking could be reduced by 10% on the WILCO treated sites, giving an initial stocking of 750 stems per hectare. The savings in reduced planting costs (planting stock and planting time) would be at least \$35 per hectare.

The effects of the different cultivation treatments on growth in radiata pine are relatively small in physical terms. However, in combination with the superior health and form scores they indicate that the trees are well established and better able to withstand climate extremes such as drought or frost. This is reflected in the higher survivals.

REFERENCE

Hall, P. (1995) : "A Comparison of Continuous Ripping-Mounding with Spot Ripping Mounding". LIRO Report Vol. 20 No. 5.

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