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Spot Mounding for Cutover Rehabilitation – Ngaumu Forest

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Figure 1 – Trial at age three - untreated site on left showing poor growth, ripped and mounded site on right showing good growth

Introduction

A trial to look at the effectiveness of spot ripping and mounding as a means for improving establishment on a failed cutover re-establishment site was planted in 1996. It is now four years old. It was typical of patches of failed cutover re-establishment within Ngaumu Forest (Wairarapa, New Zealand). This site has an imperfectly drained mottled Pallic Soil, part of the Ngaumu silt loam series (Hewitt 1993).

It was initially unclear as to why the trees had failed to survive or grow satisfactorily in the first attempt at re-planting as a crop of trees had been harvested from the area. However, it was found that despite the fact that much of the site was close to gullies the area was not well drained, with a water table at approximately 10 to 15 cm below ground level.

It was hypothesised that despite the apparent ability for the site to drain into gullies, the ground water was not moving laterally through the soil and the trees were waterlogged. Radiata pine does not grow well on wet or poorly drained sites (Miller and Wilkinson, 1995). It was also felt that the site may be nutrient deficient, and foliage samples were taken from the few trees that had survived the initial planting. There were no obvious nutrient deficiencies but very high levels of manganese were found.

This trial was designed to show whether or not building spot mounds on this site would alleviate the problems of patches of stand failure at re-establishment after harvesting (Figure 1).

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Figure 2 – Wilco spot-cultivator (left) and mounds next to waterlogged holes, one day after cultivation (right)

Methods

A growth trial was planted on the site, with the following treatments:

- Untreated (control)
- Fertilise (two Agpro slow release NPK pellets per tree)
- Spot rip-mound
- Spot rip-mound + fertilise

Eight replications of the four treatments were set out, with each plot containing three rows of 12 trees. The outer rows, and end trees in the centre row, were not measured, as they were buffers between plots, leaving 10 measured trees in each plot.

The trial was measured annually for four years. Measurements taken were height, diameter and the health, form and survival of the trees were assessed. Health and Form scores; these scores are based on a subjective assessment of each tree on a scale of 1 to 5, with 1 being an optimum score and 5 being the lowest. A lower average health or form score for a treatment indicates a superior result.

This report summarises the results from the fourth year's measurements.

Results

Table 1 – summary of results for annual measurement – 2000 at age 4

	DBH Inc	DBH (mm)	Height Inc	Height (m)	Health	Form	Survival (%)	Stocking (s/ha)	Basal area (m^2/ha)	Volume (m^3/ha)
Untreated	14 b	20 b	0.8 b	2.2 b	1.9 b	1.7 b	68 b	566 b	0.18 b	0.13 b
Untreated +fert	18 b	26 b	1.0 b	2.5 b	1.6 b	1.5 b	49 b	408 b	0.22 b	0.18 b
Spot rip mound	29 a	53 a	1.5 a	3.9 a	1.1 a	1.3 a	99 a	825 a	1.82 a	2.37 a
Spot rip mound + fert	32 a	56 a	1.7 a	4.1 a	1.0 a	1.2 a	93 a	775 a	1.91 a	2.61 a

Note; results in a column (Table 1) followed by the same letter are not significantly different, results in a column followed by different letters are significantly different (P< 0.05).

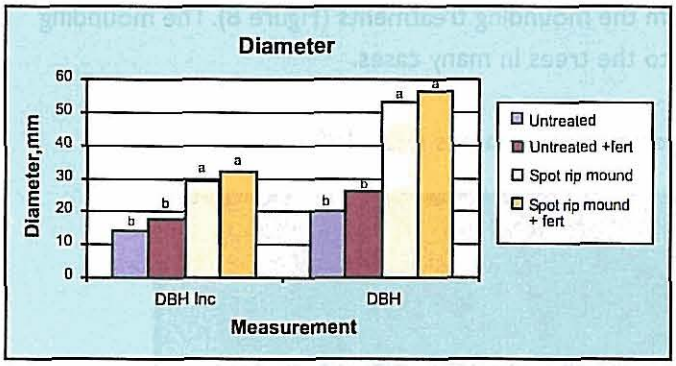

Figure 3 – Diameter and diameter increment at age 4

There were significant differences in DBH and DBH increment (Figure 3), with the two mounding treatments giving significantly better growth than the unmounded treatments. The difference in diameter increment indicates that the diameter growth of the mounded versus unmounded treatments are divergent.

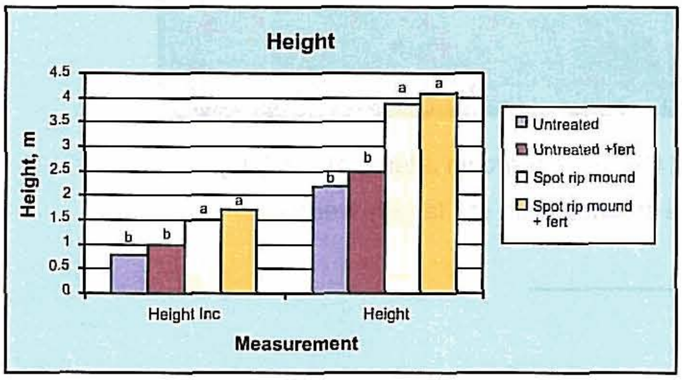

Figure 4 – Height and height increment at age 4

There were significant and substantial differences between the mounded and unmounded plots for height and height increment (Figure 4), but no significant differences between the fertilisation/no fertilisation. The significant difference in height increment indicates that height growth of the mounded and unmounded treatments are divergent.

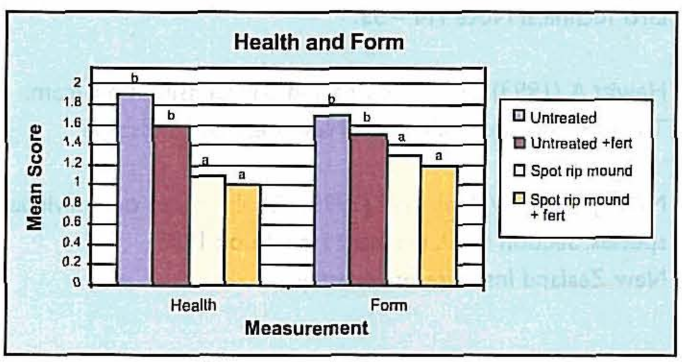

Figure 5 – Results from assessment of health and form at age 4

There were significant differences for both health and form (Figure 5). The mounding has significantly improved the health and form of the trees. The fertilisation had no significant effects. The difference in health score is indicative that the trends for divergence seen in height and diameter will continue, as the less healthy trees in the unmounded treatments are unlikely to grow as well as those in the mounded plots in the next year at least.

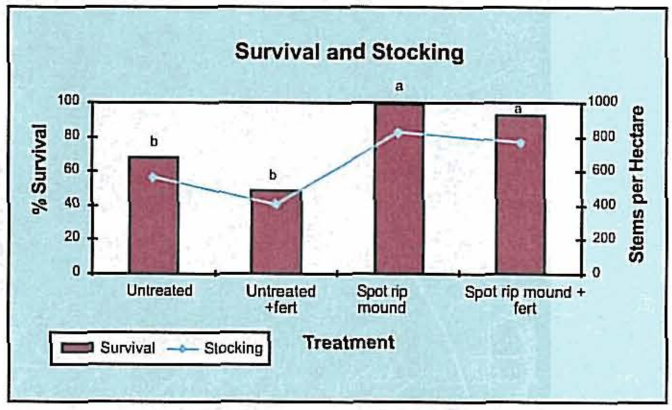

Figure 6 – Survival and stocking at age 4

There were significant differences in survival (Figure 6) with both mounding treatments giving survivals of over 90%. The mounding treatments were not different to each other but were both significantly better than the unmounded sites. The survival rates in the unmounded plots would be unacceptable in a normal forest operation.

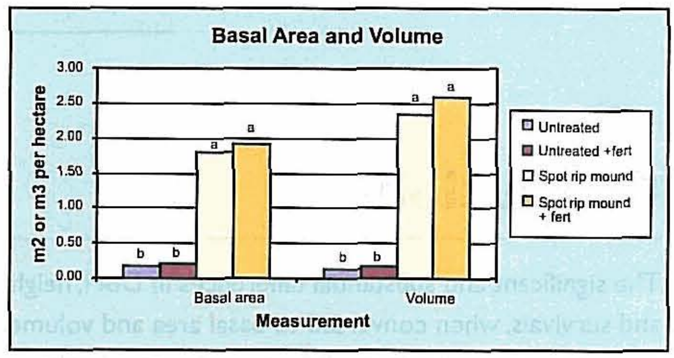

Figure 7 – Basal area and volume per hectare at age 4

When the differences from diameter, survival and height are accumulated in basal area and volume, the effects are substantial as well as significant (Figure 7). The unmounded treatments have only a small percentage of the basal area and volume growth of the mounded treatments. The differences being that the unmounded plots have 10% of the basal area of the mounded plots and only 5% of the volume.

The cultivation system used (Wilco spot cultivator) creates a small hole next to the mound, as this is where the soil to make the mound comes from (Hall, 1995) (Figure 2). In many instances these holes had standing water in them at the time of measurement, indicating that the water table on this site is still at a level of 10 to 15 cm.

The planting of the trees on the top of the mound lifts the trees above this, giving them 30 cm to 40 cm of drained soil to occupy. There have also been effects on weed growth from the mounding treatments (Figure 8). The mounding has reduced the amount of weed growth immediately adjacent to the trees in many cases.

These results were a continuation of trends found in previous years measurements (Hall, 1999).

Figure 8 – Unmounded on left – weeds around tree have regrown after spot spraying, Spot mounded on right – after three years the mounds were still largely weed free.

Conclusions

The significant and substantial differences in DBH, height and survivals, when converted to basal area and volume, have resulted in very large differences in growth. The unmounded plots have produced 10% of the basal area of the mounded plots and only 5% of the volume.

The growth from the unmounded plots would be regarded as unacceptably low, with the survivals alone being so poor as to count these plots an establishment failure.

The second planting of trees into untreated areas on this site has produced similar results to that of the initial attempt at re-establishment, an establishment failure. The trial has shown that the spot ripping-mounding can alleviate this problem and produce a viable crop.

No fertiliser effects were found in the analysis, meaning that it is the cultivation treatment that has had the significant effects on tree growth.

References

Hall P (1995): *Wilco Spot cultivator.* Liro Technical Note TN – 17.

Hall P (1999): Effects of spot ripping and mounding on early tree growth in a poorly drained clay soil. Liro Technical Note TN – 53.

Hewitt A (1993): The New Zealand Soil Classification, from: The living mantle, Soils in the New Zealand Landscape.

Miller J.T. and Wilkinson A. (1995): Tabular notes on individual species. Section 4.1.2, Forestry Handbook 1995. New Zealand Institute of Forestry.

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