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Site Preparation

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Effects of Site Preparation Treatments on Seedling Shoot and Root Growth—Alternatives to Broadcast Burning in the North-Central Interior

by
David Yole and Marty Kranabetter

1 INTRODUCTION

This memo is a continuation of results reported from a study that compared broadcast burning to alternative site preparation practices. Four site preparation treatments including disc trenching, pile-and-burn, broadcast burning, and no treatment were compared

for differences in soil properties, soil disturbance levels, and seedling performance. In this memo, seedling response after three growing seasons will be examined across the treatments, as well as root growth from various treatment microsites.

2 STUDY SITE AND EXPERIMENTAL DESIGN

The study is located 50 km northeast of Smithers in the Bulkley Forest District, on a mesic site with a gently sloping north aspect, transitional between the SBSmc and ESSFmc subzones (elevation 1000m). The site has well-drained to moderately well-drained soils of loam to silty clay loam texture, a variable coarse fragment content (0-60% volume), 3-8 cm of forest floor (hemimor), and has a gentle slope gradient (0-5%).

A randomized study design was used, with three replicates nested within four site preparation treatment types (broadcast burn, pile-and-burn, disc trench, and no treatment). Each treatment unit was planted with lodgepole pine (*Pinus contorta* Dougl. ex Loud) and hybrid white spruce (*Picea glauca*

[Moench] Voss *x engelmannii* Parry ex Engelman) seedlings (1+0 312 pine stock; 2+0 415 spruce stock).

Measurements of height growth and caliper were taken after three growing seasons for 49 seedlings from each replicate. The disc-trench seedlings were planted at the hinge microsite, while the pile-and-burn seedlings were planted on and between burn piles. Root growth was examined after the second growing season by randomly selecting and excavating seedlings from nine different microsites across the four treatments. At least four seedlings were sampled from each microsite. Emergent roots were clipped from the plug, dried, and weighed. No statistical analysis was made of the root data because of the small sample sizes.

3 SEEDLING RESPONSE AFTER 3 YEARS

Seedling survival can be affected by factors such as vegetation competition or frost events. One of the goals of site preparation is to alter conditions so that seedling survival and growth is improved. On this site, however, the survival of the planted seedlings was high (> 90%) regardless of treatment (Table 1).

After three growing seasons, some increases in seedling height growth were found for the broadcast-burn and disc-trench treatments (Table 1; Figure 1). No significant

differences were found for diameter. Poorer height growth was found for the no-site-preparation and pile-and-burn treatments. The seedling response probably reflects the change in soil properties brought on by site preparation. Broadcast burning and disc trenching improved soil warming, drainage, and nutrient release, but pile-and-burn treatments also caused some slight increases in soil bulk density from compaction (Yole and Kranabetter 1996).

TABLE 1. Seedling survival, height, and diameter after 3 growing seasons

Treatment	Survival (%)		height (cm)		diameter (mm)	
	pine	spruce	pine	spruce	pine	spruce
no treatment	97	99	37.8ab	29.7b	11.5a	8.5a
broadcast burn	92	97	50.5a	40.9a	14.7a	11.5a
disc-trench hinge	99	100	43.2ab	40.0a	13.1a	10.9a
pile and burn	99	97	35.4b	31.2b	11.7a	9.3a

(Means followed by the same letter are not significantly different at $p < 0.05$, Tukey's Multiple Range Test)

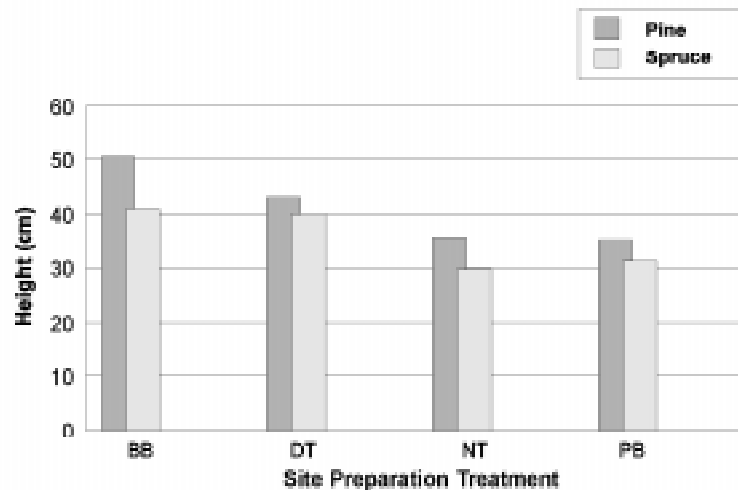


FIGURE 1. Seedling height after three growing seasons (BB—broadcast burn; DT—disc trench; NT—no treatment; PB—pile and burn).

4 ROOT GROWTH

Among the site preparation treatments for both lodgepole pine and hybrid white spruce, the untreated soils generally showed poor root growth compared to the favourable microsites (Figure 2). Treatments that remove logging slash, loosen the soil, or release more nutrients result in better root growth. Root growth in the berm microsite is comparable to the hinge microsite, which suggests that both microsites would be favourable planting spots. In this ecosystem (SBS-ESSF transition) the berm microsite is unlikely to dry enough to hamper seedling growth, as can happen in other, drier ecosystems. In addition, the hinge microsite

may experience more sweep of the seedling stem because of snow creep into the trench.

A range of responses was found for the pile-and-burn treatment, which illustrates the favourable and unfavourable microsites created by this treatment. The burn pile microsite has favourable microclimate and nutrient supply, which leads to good root growth. The roots from the track microsites were quite black, with very little root tip growth from the original seedling plug. This is a result of growing in the wetter, denser soil created by the excavator track.

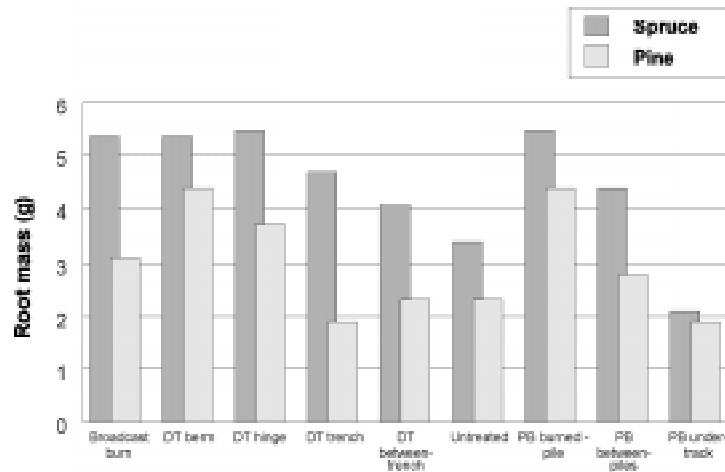


FIGURE 2. Mean root biomass for several microsites and treatments after two growing seasons (DT—disc trench; PB—pile and burn).

5 CONCLUSIONS

Site preparation was not required to ensure adequate stocking at this site, since seedling survival was very high without any treatment. Seedling growth did benefit from some forms of site preparation, however, because of the wet, cool soils.

Preliminary results indicate that disc-trench and broadcast-burn treatments were both effective in improving seedling growth compared to no treatment. The disc-trench treatment was planted, as is common practice, at the hinge microsite. A better planting spot

may be between the top of the berm and the hinge. This microsite would have better soil conditions than the hinge microsite and less risk of moisture stress during a dry year than the top of the berm.

The pile-and-burn treatment may improve some site conditions by removing logging slash, but the excavator also caused light disturbance, which resulted in some compaction of the soil. Seedling root growth was hindered by this compaction, and, subsequently, no overall increase was found for seedling growth in the pile-and-burn treatment compared to the control. These early results suggest there are more risks to soil productivity with pile-and-burn treatments than with broadcast burning or disc trenching.

More information on methodology and treatment response is contained in the second-year progress report, which may be obtained through the Ministry of Forests (Smithers) Regional Forest Science Section.

LITERATURE CITED

Yole D. and J.M. Kranabetter. 1996. Effects of site preparation treatments on soil properties—alternatives to broadcast burning in the north-central Interior. Can. For. Serv. and B.C. Min. For., Victoria, B.C. FRDA memo No. 230.

Prepared by: Dave Yole
Comp. 10 Site 8 RR1
Telkwa, B.C. VOJ 2X0
(604) 846-9055

and

Marty Kranabetter
Ministry of Forests,
Forest Sciences Section
Postal Bag 5000
Smithers, B.C. VOJ 2N0
(604) 847-7435