Frontline

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MOUNDING AND HERBICIDE TREATMENTS INCREASE PERFORMANCE OF PLANTED JACK PINE

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CATEGORY: Silviculture
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INTRODUCTION

Site preparation of some kind is generally accepted as a prerequisite for tree planting. Innumerable combinations of kinds, timings and intensities of site preparation are possible. Forest managers face the difficult task of choosing a cost-efficient method of site preparation to secure desired results from coniferous outplantings. A common treatment is patch scarification with a Bräcke scarifier, which creates rows of uniformly spaced patches of exposed mineral soil. Healthy trees that are well planted into or on the edge of the patches commonly perform well (Fig. 1). Additional benefits from supplementary mounding site preparation in Sweden (Berg 1980) prompted the development of the Bräcke mounder. Investigation of mounding site preparation for establishing jack pine (*Pinus banksiana* Lamb.) and black spruce (*Picea mariana* [Mill.] B.S.P.) in Ontario was begun in 1979 (Sutton 1991).

Figure 1. Planting in progress on man-made mounds.

The Lands and Forests Division of the Algoma Central Railway and Forestry Canada, Ontario Region (FCOR), collaborated in designing a field experiment primarily to compare Bräcke scarification with Bräcke scarification plus mounding. The experiment involved both bareroot and paperpot jack pine planting stock and included chemical site preparation, both by itself and in combination with the two methods of scarification.

MATERIALS AND METHODS

The study area, located about 200 km north of Sault Ste. Marie, Ontario (at 47°30'N, 84°30'W) lies in the Algoma Section of the Great Lakes-St. Lawrence forest region (Rowe 1972). It has gently rolling topography on deep glaciofluvial deposits, with mainly silty loam soils. At the time of treatment, the site was grassy and largely treeless as a result of pulpwood cutting between 1925 and 1930 and occasional fires.

Twenty treatments were designed to compare the effects of various combinations of site preparation. Among the site preparation techniques were Bräcke scarification, mounding, and herbicide treatment in patches applied in August 1983 before planting in May 1984. Mounds were produced manually and included mounds placed on mineral soil on the shoulder of a Bräcke patch (M/M) and mounds placed on an organic substrate (M/O). Mounds of two volumes (10 and 20 L) were created.

Superimposed on the 20 treatments was a split-plot comparison between 2+0 bareroot stock and FH408 paperpot stock. Soil was moist when planted, with stock having foliage of good color and well-developed root systems. Weather data for the 1984 growing season indicated near-normal temperatures and precipitation.

Assessments were made immediately after planting, 30 days after planting, and at the end of the first, second, third and fifth growing seasons (Fig. 2). Survival, total height, stem volume and mean relative growth rates in height and volume were evaluated at each assessment.

Figure 2. Fifth-year assessment of jack pine. (Ian Lamont measuring, Gary Raines recording.)

RESULTS

Seedling Survival

The average values for fifth-year survival clearly illustrate the need for site preparation (Fig. 3), especially for paperpot stock. Survival of both stock types was barely adequate (63 to 66%) on Bräcke scalps alone, but was 13 to 15% higher on scalps supplemented with mounds.

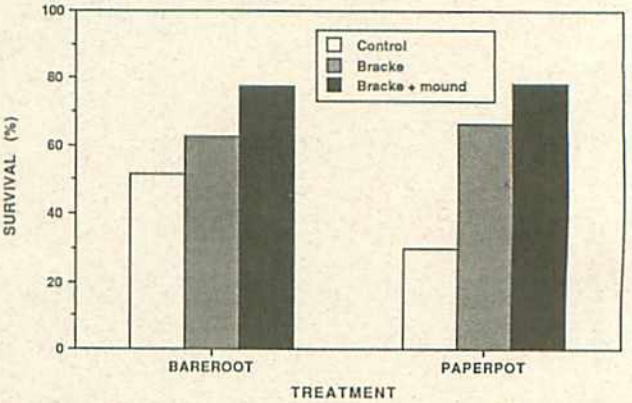

Figure 3. Fifth-year survival (%) of jack pine bareroot and paperpot stock on Bräcke scalps, Bräcke scalps with mounds, and controls (no mechanical site preparation).

After three growing seasons, the survival rate of bareroot stock was significantly greater than that of paperpot stock. However, the two survival rates no longer differed significantly after five growing seasons.

Seedling Growth

For both stock types, growth was virtually the same on Bräcke scalps and on the control. However, mounding was clearly beneficial: 5 years after planting, the average bareroot seedling was more than 70% larger in stem volume than its counterparts on the Bräcke scalps and the control; for paperpot stock, the corresponding difference was more than 100% (Fig. 4).

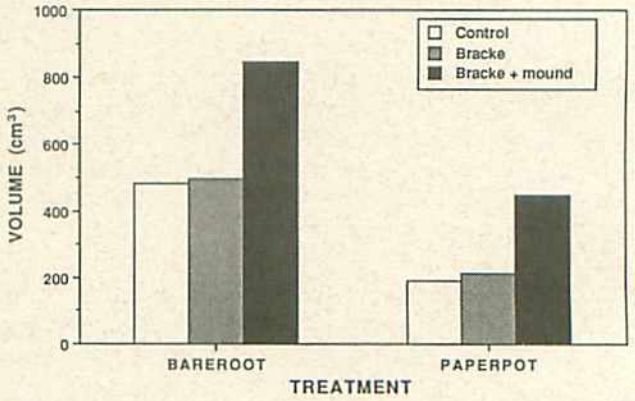

Figure 4. Mean stem volume (cm^3) of jack pine bareroot and paperpot stock 5 years after planting on Bräcke scalps, Bräcke scalps plus mounding, and controls (no mechanical site preparation).

Statistical analyses of the 5 years of data reveal the advantages of large (20-L) mounds over small (10 L), and M/O mounds over M/M. Mean stem volume and ground-level stem diameter at the end of the fifth growing season, as well as the relative growth rate in volume over the first five growing seasons after outplanting, were significantly greater in trees on the larger mounds. (Relative growth rate takes initial size into account, thereby permitting valid comparisons of *rates* rather than *quantities* of growth.) Seedlings on M/O mounds were significantly superior to those on M/M mounds in terms of both mean stem volume and stem volume adjusted by survival rate (Table 1).

Table 1. Mean adjusted stem volume index after five growing seasons for jack pine, by stock type, mound size, mound type, and chemical site preparation.

	Stem volume index			
	M/M mounds		M/O mounds	
	Chemical site preparation			
Mound size	without	with	without	with
Bareroot				
10 L	603	548	604	768
20 L	590	722	620	830
Paperpot				
10 L	234	287	300	414
20 L	336	356	376	473

Herbicide treatment had little effect on survival, but did enhance growth in both stock types. The effects of various combinations of mounding and herbicide treatments are illustrated by way of an adjusted growth index (volume x survival rate, Table 1). This table attests to the benefit of a site preparation treatment that combines mounding (20-L size, mineral mound over organic substrate) and herbicide patch treatment.

Importance of a 5-year Time Span

Had the study ended after the third-year assessment, the conclusions would have been that bareroot stock survived better than container stock and that the size and type of mound had little effect on survival or growth. However, in the fourth and fifth growing seasons, significant differences in favor of paperpots, large mounds, and M/O mounds became manifest. This underlines the value of long-term research. Detailed results are contained in a report currently being prepared by Sutton and Weldon.

CONCLUSIONS

Five years after planting, Bräcke scarification was clearly beneficial to the performance of jack pine bareroot and paperpot stock. Mounding in addition to Bräcke scarification increased the survival and growth of both stock types, and herbicide site preparation enhanced their growth. Survival rates were similar for both stock types. When afforded sufficient site preparation, paperpot stock performed as well as or better than bareroot stock 1 year younger. Performance was best on 20-L mounds of mineral soil on an organic substrate.

In another study (Sutton 1991), mounding conferred no benefit compared with regular Bräcke scarification on 11 cutover sites in northern Ontario. However, the grassier site in the present study would seem to be conducive to obtaining growth responses to mounding.

REFERENCES AND FURTHER READING

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