



Technical Report

Bartt Precision
Seeder Trial:
Fifth Year Results



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BARTT PRECISION SEEDER TRIAL: FIFTH YEAR RESULTS

by
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and
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ABSTRACT

Fifth year results demonstrate that the Bartt precision seeder increased relative stocking and density of jack pine seedlings compared to a no seeding control treatment on a jack pine sand flat in northwestern Ontario. In addition, jack pine seeds were deposited onto the desired microsite, the mineral soil within the trenches. When compared to an adjacent aerially seeded jack pine stand of the same age, the precision seeder provided comparable relative stocking with less than half the density.

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DISCLAIMER

The views, conclusions and recommendations are those of the authors and should not be construed as either policy or endorsement by Natural Resources Canada, Canadian Forest Service or the Ontario Ministry of Natural Resources.

INTRODUCTION

Aerial seeding has been used extensively in regenerating jack pine (*Pinus banksiana* Lamb.) in northwestern Ontario. Precision seeding is an alternative method where the seed is placed directly onto the desired microsite either manually (shelter cones, hand seeding, etc.) or by machine. It has the following advantages when compared to aerial seeding:

- Less seed is required per hectare.
- Genetically improved seed can be used (since much less seed is required, the higher cost of the improved seed may be justified).
- Seedling density can be controlled within and between rows.
- Simultaneous site preparation and seeding is possible so that only one silvicultural operation is needed to establish the new stand.

Because there was only limited experience with mechanical direct seeding in northwestern Ontario, an operational trial using the Bartt precision seeder was established in June 1989, in the Wabigoon Forest near Ignace, Ontario. This seeder is designed for disc trenchers and is manufactured by Bartt Forestry Equipment of Concord, Ontario. Davidson (1991) provides details of the Bartt system with suggestions and tips for its installation, calibration and maintenance. Briefly, seed is drawn under vacuum pressure from a hopper mounted inside the cab of a prime mover. The system then singulates the seed and transports it through two hoses, each attached to the frame above a trencher disc. The seeds then drop out of the ends of the hoses onto the trench at a rate (spacing) calibrated to the speed of the prime mover.

The trial was located within a 12 hectare cutover on a jack pine sand flat on the Mameigwess Lake Road (Figure 1). Second year results were reported by Corbett (1992). This Technical Report summarizes fifth year results and compares them to an adjacent jack pine aerially seeded area.

PURPOSE OF TRIAL

The trial was established to determine whether, in an operational setting, the Bartt precision seeder could increase jack pine stocking when compared to a control no-seeding treatment. Because the seeder was relatively new and untested, the trial was in essence a screening trial to determine if the machine had the capability to direct seed onto the desired microsite (the trench) under operational conditions.

After five growing seasons, the original control and Bartt seeded treatments were remeasured. In addition, the adjacent large cutover that was disc trenched and aerially seeded with jack pine at the same time as the precision seeding trial, was surveyed. Although this aerial seeding treatment was not a component of the original Bartt trial, the data provide valuable comparisons.

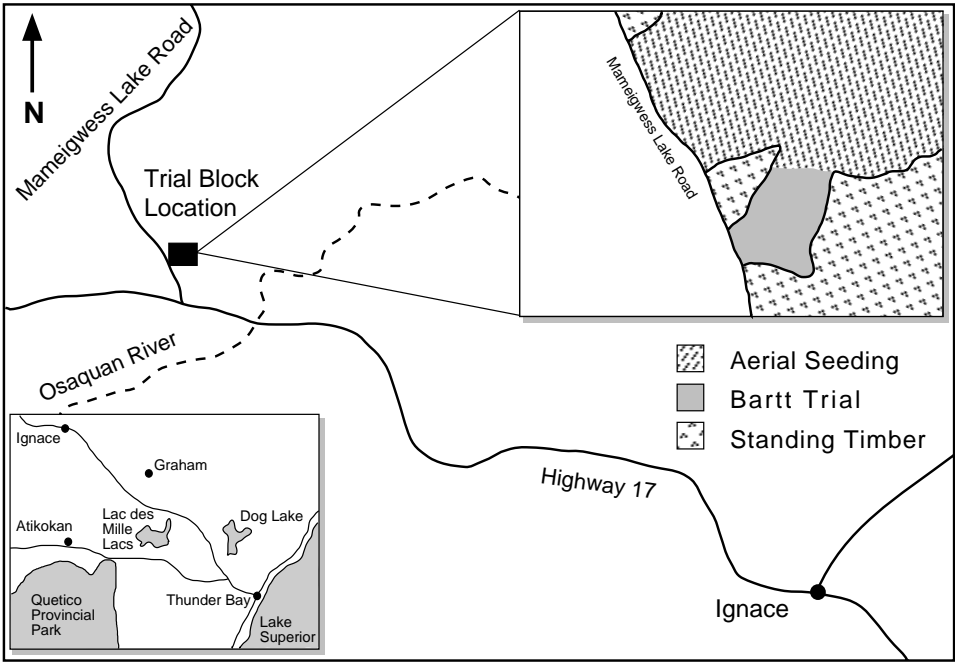


Figure 1: Trial block is located off of the Mameigwess Lake Road, approximately 260 kilometres northwest of Thunder Bay.

DESCRIPTION OF TRIAL

The soil type of the trial area is S1 (moderately dry, medium to very coarse sand) and the pre-harvest vegetation type was V29 (Jack pine/ericaceous/shrub/feathermoss) (Sims *et al.* 1989). At the fifth year remeasurement, the major understory species were blueberry (*Vaccinium* spp.), speckled alder (*Alnus rugosa*), bearberry (*Arctostaphylos uva-ursi*), and bunchberry (*Cornus canadensis*).

For the fifth year remeasurement in August, 1993, eighteen measurement clusters were randomly established in each treatment. Each cluster contained four, 4 m² plots (2 m x 2 m) centred on, and run parallel to, the trench (Figure 2). Therefore, the total sample area per treatment was 288 m² (18 clusters x 16 m²/cluster).

Within each 4 m² plot, all seedlings were counted in each of two microsites: (i) on the bare mineral soil inside the trench and (ii) on the undisturbed forest floor between the trenches.

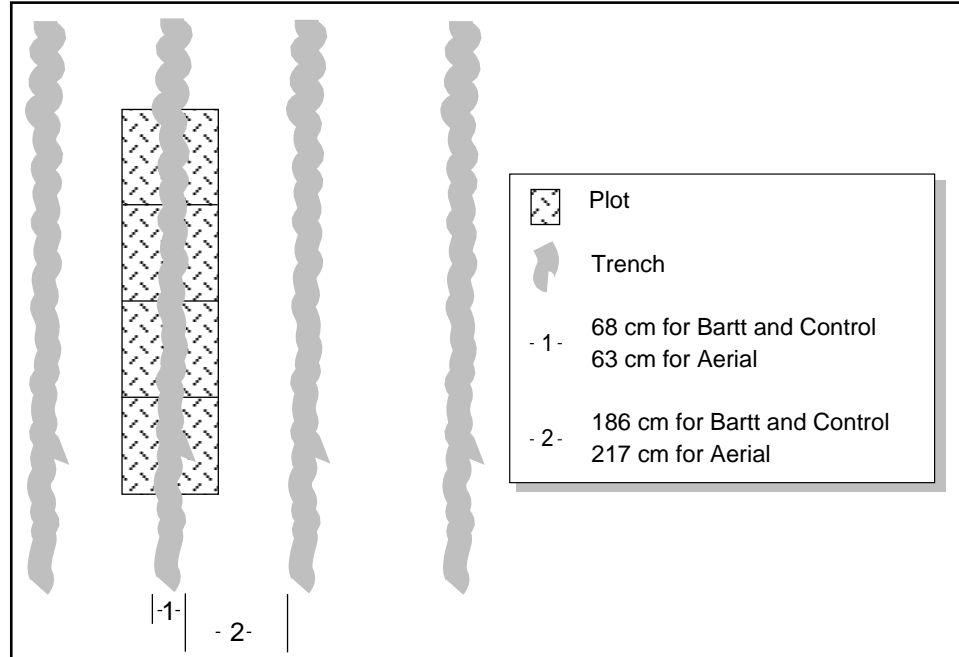


Figure 2: Schematic layout of one cluster. Each cluster contained four, 4 m² plots (2m x 2m). Each cluster was centred on, and run parallel to, the trench.

To determine the density of seedlings per hectare (sph) for each microsite, three 100 m transects approximately 50 m apart were established perpendicular to the trenches. The width of each trench and the distance between trenches was measured along each transect. Average trench width on the trial and aerially seeded areas was slightly different at 68 and 63 cm, respectively, even though the site was prepared at the same time by the same operator. The difference was not statistically significant. With these data, and with the plots centred on the trench, the proportion of each microsite within a 4 m² plot could then be estimated and seedling counts converted to a hectare basis.

Because the 4 m² plots were not randomly established across the site but were instead centred on each trench, the traditional concept of stocking as defined by Skinkle (1990) could not be used. The term relative stocking will be used to describe the distribution of the seedlings on the area. Relative stocking is the percentage of the total number of plots containing at least one seedling.

RESULTS AND DISCUSSION

PRECISION SEEDING

For the mineral soil microsite inside the trench, jack pine density was over three times higher on the precision seeded area than on the control (10,618 versus 3,165 sph, respectively). For the undisturbed forest floor between the trenches, jack pine density was very similar for both the precision seeded and control treatments at 210 and 263 sph, respectively. These results indicate that the Bartt precision seeder successfully directed jack pine seed to the desired microsite inside the trench (Table 1).

Table 1. Fifth year relative stocking and density of jack pine and black spruce by microsite and treatment. Results are based on total number of seedlings within the 4 m² plots.

Treatment	Microsite	Jack Pine		Black Spruce		Jack Pine + Black Spruce	
		Stocking (%)	Density (sph)	Stocking (%)	Density (sph)	Stocking (%)	Density (sph)
Bartt Seeded	Inside	75	10618	13	1327	78	11945
	Outside	6	210	3	105	8	316
Aerial Seeded	Inside	81	23397	1	110	81	23507
	Outside	14	812	0	0	14	812
Control	Inside	22	3165	11	919	32	4084
	Outside	7	263	0	0	7	263

The relative stocking of jack pine demonstrated the same trend. Inside the trench, 75 percent of the 4 m² plots contained at least one jack pine seedling in the precision seeded treatment. In contrast, the relative stocking inside the trench on the control was only 22 percent. This result suggests a very clumped stem distribution inside the trench on the control, but a well distributed pattern of jack pine seedlings inside the trench as a result of the precision seeding treatment.

For the undisturbed forest floor between the trenches, relative stocking was extremely low for both treatments at approximately six percent. This low value, coupled with the very low densities also found here, indicates an unsuitable microsite for jack pine regeneration (Figure 3).



Figure 3. Control (top) and precision seeded (bottom) areas five growing seasons after treatment. Inside the trench, jack pine density and relative stocking were over three times higher after seeding; outside the trench, there were no differences between treatments. Arrows indicate very few trees in control, and well-spaced trees (with an original spacing of 250 seeds per 100 lineal metres of pass) in the precision seeded treatment.



AERIAL SEEDING

The adjacent aerially seeded cutover was not part of the original precision seeder trial but was surveyed at year five for comparison purposes. As shown in Table 1, the data reveal:

- Very high jack pine density inside the trench (23,297 sph) but very low jack pine density on the undisturbed forest floor between the trenches (812 sph) (Figure 4). This creates a "hedge" configuration to the young jack pine stand, and may have implications for precommercial thinning alternatives or future stand development patterns.



Figure 4. Location of the regeneration resulting from aerial seeding, showing "hedges" of overdense trees in the trenches, with very few seedlings between the trenches. Arrows indicate clumps of jack pine seedlings, compared to evenly spaced single stems in Figure 3 (bottom).

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- Within the trench, relative jack pine stocking was only slightly higher than that achieved by the Bartt (81 versus 75 percent, respectively). This suggests that the aerial seeding operation dramatically increased jack pine density, but did very little for improving the spatial distribution of the regeneration over that achieved by precision seeding.
 - Relative stocking on the undisturbed forest floor between the trenches was only 14 percent. This figure is still very low, but was double that found on the precision seeding trial area. This indicates that the aerial seeding operation increased germination on the comparatively unsuitable microsites found between the trenches.

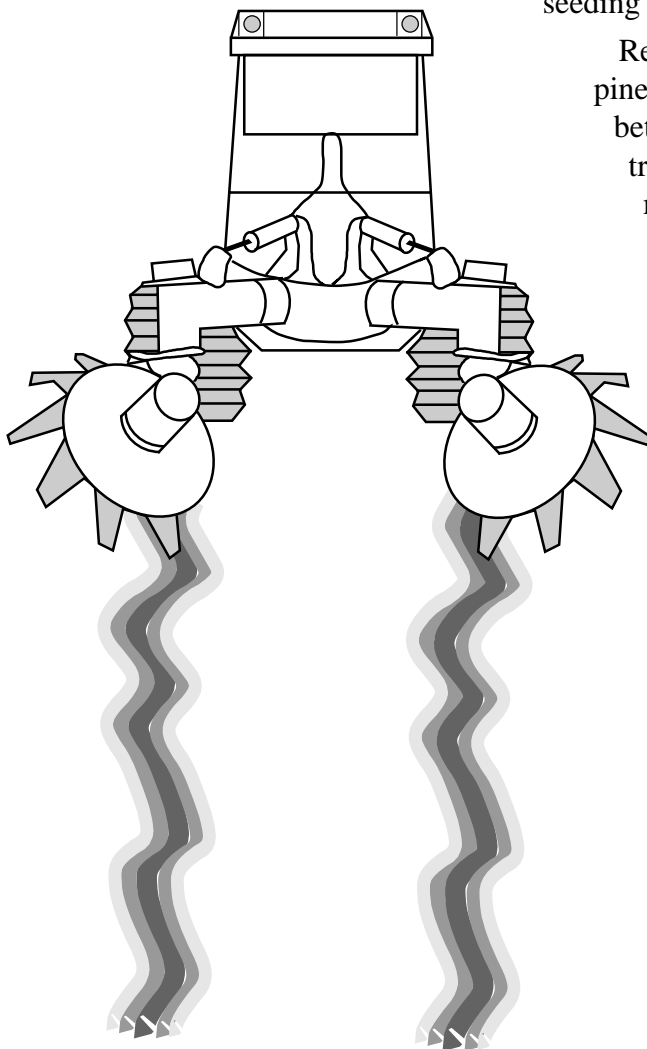
Black spruce natural regeneration was more abundant on the Bartt seeder and control areas compared to the aerial seeded areas. Uncut stands containing overstory black spruce surround three sides of the 12 hectare seeder trial area, close enough to provide a seed source. In contrast, the aerial seeding data were collected from the middle of a large cutover, far from any edge effect.

SUMMARY

Fifth year results indicate that the Bartt precision seeder increased relative stocking and density of jack pine seedlings compared to control on a jack pine sand flat in northwestern Ontario. In addition, jack pine seeds were deposited onto the desired microsite, on the mineral soil within the trenches. When compared to an adjacent aerially seeded stand of the same age, the precision seeder provided comparable relative stocking with less than half the density.

As a silvicultural system, the results are consistent with those of Bryson and Van Damme (1994). They indicate that precision seeding would be very cost-effective because the site is both prepared and regenerated at the same time, using much less seed than an aerial seeding treatment. Also, the expenses and organizational problems of an aerial seeding operation are circumvented.

Relative stocking and density of jack pine on the undisturbed forest floor between the trenches was low across all treatments. These data suggest that mineral soil exposure is necessary to ensure successful jack pine establishment on these dry sites where the forest floor is dominated by ericaceous vegetation (blueberries and bearberry) and feathermoss.



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