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## THE BARTT MKIV SEEDER - FOLLOW-UP EVALUATION

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### BACKGROUND

A previous FERIC study of the Bartt MKIV Seeder<sup>1</sup> identified the importance of using an appropriately-equipped prime mover. In that trial, the prime mover was suspected of not generating enough electrical output, at low engine rpm, for the seeding attachment. The current study was conducted to confirm this suspicion, and to collect additional information about the seeder. The Ontario Ministry of Natural Resources (MNR), Dryden District office, and Lakehead University, Thunder Bay, Ont. cooperated in this trial.

### STUDY DESCRIPTION

The seeder was mounted on a 1982 John Deere 740 wheeled skidder with a TTS-Delta disc trencher. Radio-tagged jack pine (*Pinus banksiana* Lamb.) seed was placed in both the left and right hoppers, and its position on the ground later determined using a scintillation meter. Methodology followed that in the 1991 study<sup>1</sup>, with the exceptions that 20-hole seed disc plates were used, plot size was increased to 2 m wide by 1.6 m, and two replicates of 10 contiguous plots were assessed for each treatment. During seeder operation, continuous voltage readings at the seeder drive motor were taken once per second using a Campbell Scientific CR10 measurement and control module.

Level (0-4%) and slope ( $\pm 20-27\%$ ) operating conditions were evaluated on a site about 30 km north of Dryden, Ont. The area was characterized by a stony, moderately deep sandy soil (SS5 in the regional forest ecosystem classification) having an average 10-cm thick organic layer. Mean stump density was 2300/ha, and stump height and diameter averaged 16.0 and 13.9 cm, respec-

tively. Total slash volume was 78.3 m<sup>3</sup>/ha, of which 24.9 m<sup>3</sup>/ha consisted of pieces  $\leq 5$  cm in diameter.

### RESULTS AND DISCUSSION

At a 30-cm target spacing, that commonly used by the Dryden MNR, the average distance between closest seeds ranged from 43.5 cm on upslope to 59.9 cm on level ground (Table 1). Had the seeds fallen in a straight line, average distance between seeds would have been 30.2 to 40.0 cm (mean 35.6 cm, or 19% over target). At a 40-cm target spacing, the average distance between closest seeds ranged from 48.2 on upslope to 59.1 cm on downslope conditions (Table 1). Had the seeds fallen in a straight line, average distance between seeds would have been 38.1 to 41.0 cm (mean 39.7 cm or 0.8% under target).

The Bartt MKIV Seeder has one drive motor for both seed discs. The voltage input to that motor varies according to the travel speed, via a microprocessor which monitors ground-speed fluctuations and adjusts motor speed accordingly to maintain constant seed output. However, the readings indicated that for the 30-cm spacing in downslope conditions, average voltage to the seed drive motor was reduced despite a slight increase in travel speed, explaining in part the variation in seed spacing on the ground. The fact that the seeder performed best in upslope conditions at the 30-cm spacing, when engine rpm was greatest, again suggests that there may have been a slight voltage deficiency.

On the site examined, between 28 and 56% of the seeds were placed on mineral soil microsites (most desirable for jack pine germination) in the bottom of the furrow or side of the berm (Table 1), reflecting the degree of mineral soil exposure by the disc trencher. Considering all microsites, from 61 to 74% of the seeds fell in the bottom

<sup>1</sup> Dominy, S.W.J. 1991. Evaluation of the Bartt MKIV direct seeder. FERIC Tech. Note. TN-170. 6 p.

**Table 1. Seed spacing and microsite placement**

	30-cm target spacing			40-cm target spacing		
	Upslope	Level	Downslope	Upslope	Level	Downslope
Avg linear spacing <sup>1</sup> (cm)	30.2	40.0	38.1	38.1	41.0	40.0
Avg actual spacing (cm)	43.5	59.9	56.7	48.2	58.1	59.1
Standard deviation	1.7	1.2	8.5	1.4	0.9	6.1
Range	7-112	11-156	10-197	10-143	5-139	11-163
Number of seed spots sampled per 20 plots	106	80	84	84	78	80
Seed on bottom or side of furrow						
- on mineral soil	28%	32%	29%	56%	34%	33%
- on all microsites	74%	68%	62%	69%	74%	61%

<sup>1</sup> Calculated from the average number of seed spots per metre.

and side positions, indicating that about one third of the seeds deposited by the seeder had little chance of developing into established trees.

The number of seeds per metre calculated from the seed counter readings on the seeder overestimated by an average of 52% the seed output compared to the average number identified on the ground. Part of this difference can be explained by the occurrence of two seeds at a given spot in 6% of cases, based on a 10% systematic sample. Rodent (chiefly mouse) removal of seed from the plot area may account for another component of the difference. The uniform slash conditions on the site and proximity of the study block to standing forest cover may have provided suitable habitat for mice and voles, the principal predators of tree seed. In fact, 6% of the seeds retrieved had evidence of apparent rodent feeding, despite the fact that sampling was completed within 10 days of seeding. If rodents did indeed remove seeds, then the average seed spacing reported here may be high. The inclusion in future studies of a mouse population survey would permit further interpretation of results and more meaningful comparisons between studies in different areas.

### CONCLUSIONS

Performance of the seeder was improved in this study compared to the 1991 evaluation using a different skidder, in which the seeder did not function in downslope conditions. Results of the present study support the previous conclusion that an appropriate prime mover-seeder match is critical to acceptable performance of the Bartt

MKIV. Nevertheless, the promise of consistent, precise seed placement appears to be still lacking, despite the sophisticated nature of this seeding implement. It is possible that the goal is unrealistic given the arduous application for the technology.

Bartt Forestry Equipment Ltd. have recently developed a less-sophisticated seeder, the Bartt MKV, which lacks the microprocessor and seed counters. The seed pickup and delivery system is simpler, providing a constant seed output rate dependent upon user-selected values for average ground speed and desired seed spacing. In addition, the sleeves mounted on the disc trencher housing, which control seed placement position within the trench, are field-adjustable on the newer model. Judging by results of detailed FERIC evaluations of the Bartt MKIV which indicate that on-site factors and variable prime mover conditions greatly affect seed placement and spacing, the Bartt MKV design may be an appropriate compromise.

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### FURTHER INFORMATION

The Bartt line of precision seeders is distributed by:

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