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# **A MECHANICAL FOREST SEEDING TECHNIQUE**

by

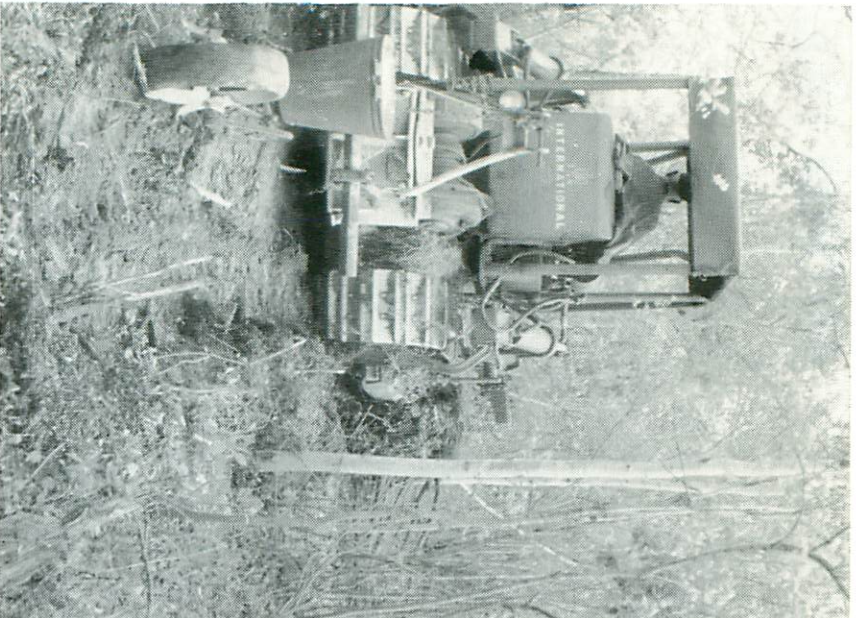
**K. W. HORTON and J. F. FLOWERS**

Résumé en français

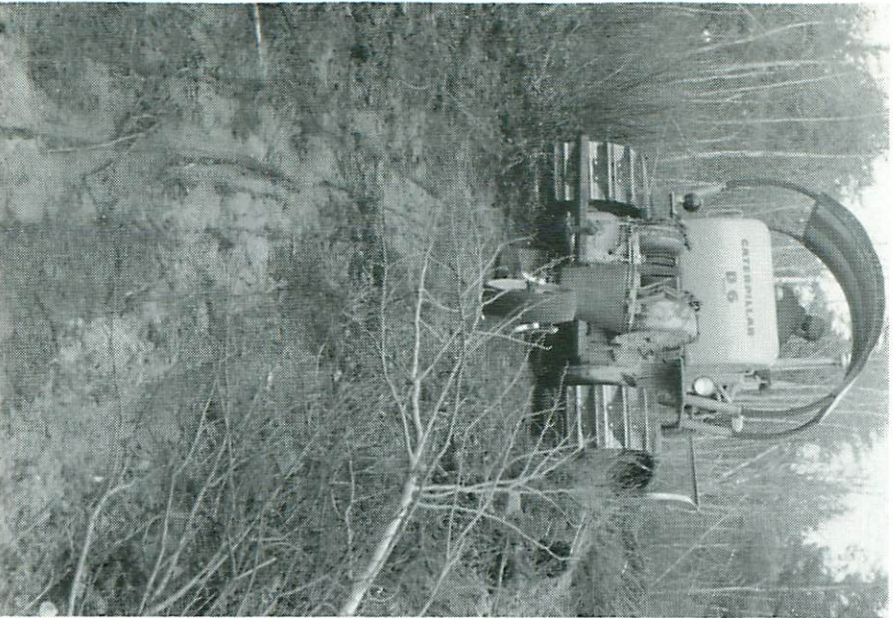
**DEPARTMENT OF FORESTRY, CANADA**

# Mechanized forest

Forest seeding by this one-man, one-pass mechanized system can be done at a cost of about \$10 per acre, often less



Agricultural planter was modified and strengthened for towing by tractor for forest seeding.



Seedbed is prepared by V-blade at front of bulldozer. Seeding unit at rear sows to 1/4 in. depth.

## FOREWORD

This project was a cooperative venture of the Forest Research Branch, Federal Department of Forestry and the Timber Branch, Ontario Department of Lands and Forests.

The seeding method and equipment was developed through experimentation by the federal agency, which also provided funds for the pilot operational trials. Field operations were contracted through and supervised by the Sudbury District office of the Ontario Department of Lands and Forests which supplied special scarifying equipment and seed.

## RESUME

On vient de mettre au point une nouvelle méthode qui permet d'ensemencer des superficies embroussaillées, sans préparation préalable.

La méthode, des plus prometteuses, permet d'assurer une bonne régénération du pin gris pour aussi peu que \$5 l'acre, et une tout aussi bonne régénération, espère-t-on, du pin rouge, du pin blanc et de l'épinette à raison de \$10 l'acre tout au plus.

La méthode est fondée sur une adaptation de l'ensemencement en sillon; l'ensemencement se fait à l'aide d'un semoir à maïs transformé, tiré par une niveleuse à butoir en forme de V. Grâce à cet ensemble ingénieux, l'ensemencement peut se faire par un seul homme et d'un coup, ce qui permet d'économiser, au maximum, sur la main-d'œuvre et d'éviter le gaspillage des semences, tout en assurant l'espacement régulier des semences.



gressed. In one 15-acre block the rate was 5 acres per hour. This second operator treated 74 acres at \$8 per acre.

These costs included a foreman on the job, delays for working on the machines, changing seed and seed plates and normal stoppage. Excluded are costs of seed and professional supervision. Regeneration results of this trial will be closely followed in 1965.

### Seeding costs much lower than usual

From the operational viewpoint, the method has considerable merit, particularly for scrub sites with an adequate desirable seed source. In effect, acceptable regeneration appears attainable for less than the usual cost of site preparation alone. This results from (1) the high efficiency of the V-blade scarifying equipment and technique and (2) the economy of the machine seeding.

At the sowing rate of 12,500 seeds per acre, using 1963 seed prices, the per acre costs of seed were \$1.40 for jackpine, \$2.30 for white pine, \$3.85 for red pine and \$0.62 for white spruce. The relatively low cost of spruce seed particularly suggests that a higher sowing rate is warranted.

From the ecological viewpoint the first season's results are promising though preliminary. Conditions of seedbed and cover were quite similar to those of previous experiments (Horton 1963) where sowing was done for three successive years and mortality *after* the first year was insignificant in each case.

Greatest seedling losses in the machine trial resulted from frost heaving, particularly in deeply scarified seedbeds on exposed sites; this was not a major problem in properly prepared shallow furrows where a light residual canopy occurred.

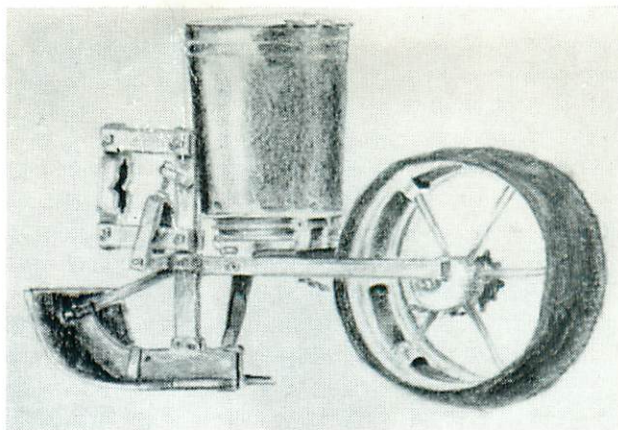
It is felt that vegetative competition will not be limiting for several years in this treatment. More intensive research is warranted to define optimum seedbeds for white and red pine in soils of different moisture regime and texture.

### Could use seeding units in tandem

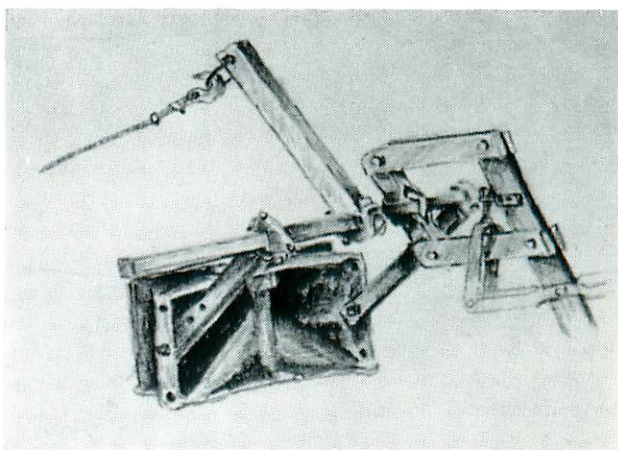
Meanwhile, consider that the seedling catch could readily be increased at relatively small additional cost by raising the sowing rate. Also consider that the coverage could readily be doubled by using two seeding units in tandem spaced 4 or 5 ft apart, and leaving broader (6 to 12 ft wide) untreated strips; this would require modifying the V-blade by adding two scalping extensions at the sides rather than one in the centre.

One final advantage of the method is that re-seeding of fail areas could be easily accomplished; for this purpose we have in mind testing a manually pushed drill seeder which could be guided along the most receptive portions of the furrow and, weighing only 25 lb, could be lifted over occasional obstructions.

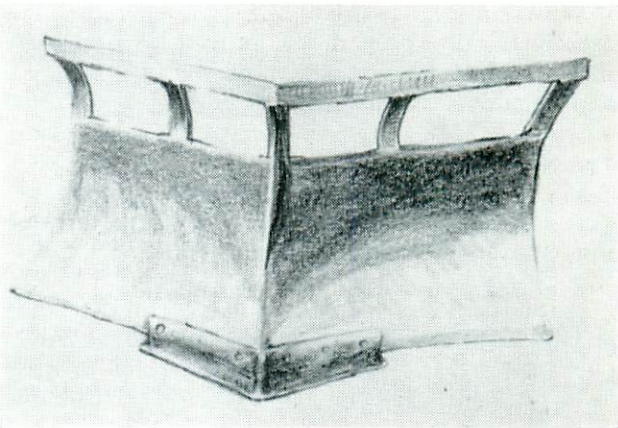
We are convinced that the general technique merits use, particularly for jackpine regeneration. Further trials covering different conditions and machine modifications are warranted. ◀



Detail of seeder shows the heavy steel ski at bottom left which permits the unit to traverse rough terrain. The ski slides over rocks and stumps.



Hitching arrangement for attachment of the seeder to bulldozer. It is bolted below the dozer winch and its design permits lateral swivel action.



V-blade tractor attachment for seedbed preparation is 6 ft wide and has a scalping point stretching 2 ft each side of the blade centre.

### REFERENCE

Horton, K. W. 1963. Experimental seeding of conifers in scarified strips. Can. Dept. For., For. Res. Br. Mimeo Report 63-0-4.





Close-up views of seeding unit showing it elevated for travel and, right, how it's bolted to tractor.

**TABLE 1:—First season's results of June, 1964 mechanized direct seeding trial, Hanmer Township**

	July Tally		Aug. Tally		Nov. Tally	
	% Stocked*	No. seedlings per acre	% Stocked	No. seedlings per acre	% Stocked	No. seedlings per acre
<b>Moisture Regime 1</b> (dry med. sand)						
Jack pine.....	81	2000	88	3200	78	2400
Red pine.....	43	700	45	750	40	800
White pine.....	20	230	34	400	36	750
White spruce.....	18	200	27	250	20	500
<b>Moisture Regime 3</b> (Loamy cap over medium sand)						
Jack pine.....	75	2000	80	3600	86	3100
Red pine.....	45	750	50	1700	55	1700
White pine.....	13	250	42	750	53	1000
White spruce.....	32	300	42	900	39	700

\* Based on 1 or more seedlings per 6.6 ft of furrow.

corridor effect, i.e. subsequent use of the furrow as a runway by wildlife.

With an experienced machine operator this method of site preparation proved exceptionally efficient. The clearing action of the V-blade permitted continuous forward operation at 2 mph and sometimes up to 4 mph, covering prescribed blocks in a concentric pattern.

Pilot trials began in June, 1964 through cooperative action by the federal Forest Research Branch and the Sudbury District office of the Ontario Department of Lands and Forests.

A total of 130 acres of scrub aspen and jackpine on sand flats in Hanmer Township was seeded in rows spaced 8 ft apart at a contract price of close to \$5 per acre, using an old TD9 tractor with the 4-ft V-blade.

Of three different areas treated only one 25-acre block, divided into two sites, was assessed in detail (Table 1). The sample unit was 10 links or 6.6 ft of furrow, and the total sample involved 1,000 units or about 1/12 of the treated block.

First-year results for jackpine were very good on both sites in terms of distribution, number of seedlings and their vigour. For the other species the results were fair considering the adversities, i.e. the usual operational difficulties associated with

a first trial, a hot droughty spell which followed the seeding, and excessive frost-heaving losses in late October. In any case, the drier site is not suitable for spruce and is marginal for white pine. Delayed germination was pronounced in white pine and evident to some degree in the other species.

Further trials covering another 103 acres were carried out in November, 1964, in Lumsden Township, a few miles from the Hanmer area. Conditions here were rougher, with a heavier erratic cover of aspen and jack pine, low hilly topography and sandy soil locally strewn with boulders. A D6-B tractor equipped with the 6-ft V-blade with scalping point proved effective in these rougher conditions.

The area was divided into 10 blocks circumventing heavier concentrations of timber; jackpine was seeded on the dry, scrubby blocks and white pine on the better sites.

An interesting cost comparison was obtained. Coverage of the first 30 acres averaged only .75 acres per hour, costing \$20 per acre. This was due to a slow machine operator and to operational and mechanical difficulties with the scarifying blade and the seeder.

When the operator was changed and the equipment modified, the coverage averaged 2 acres per running hour, the rate increasing as the job pro-



# seeding method promises lower costs\*

A new method has been devised for the direct seeding of scrub forest sites. This method promises adequate regeneration of jack-pine for as low as \$5-\$10 per acre and will hopefully permit adequate regeneration of red pine, white pine and spruce for little more than \$10 per acre.

The method is an adaptation of furrow seeding, involving a modified corn seeding unit attached behind a bulldozer equipped with a front-mounted V-blade. It is designed as a one-man, one-pass operation, realizing maximum economy in manpower and seed, plus control of seed spacing.

The seeding approach developed from earlier tests (Horton 1963), which indicated that alternate strip bulldozing was an effective means of site preparation, that freshly scarified seedbeds were as suitable as older stabilized seedbeds in terms of seedling establishment, and that burying the seed produced significantly better results than broadcasting seed on the surface. These findings pointed to the feasibility of a mechanized simultaneous scarifying and seeding operation and led to the development of a mechanical seeder.

## Derived from agricultural seeder

In view of the high costs of design and initial development, it was hoped that an available agricultural seeder could be adapted for the purpose. After considering a variety of small seeding machines, a unit runner planter was selected, the MF 37 model, costing \$100 basically and about \$200 complete with seed hopper kit, press wheel tire and detachable front discs. This is a fairly rugged, versatile machine designed for farm use.

Modifications incorporated for forestry purposes included a sheet metal encasement to protect the sprocket and hopper from tree stubs, and seed plates with holes specially bored to 7/32 in. for white pine, 5/32 in. for red pine and 4/32 in. for jackpine and white spruce.

The machine thus modified and attached to the tool bar of a light farm tractor was suitable for seeding on easy ground such as old-field, scrub sites. Better results were obtained by seeding in pre-plowed furrows than by seeding in the narrow intermittent furrow produced by the seeder discs in sod.

The main interest, however, was to attach the seeder behind a bulldozer for application to more rugged bush conditions — cutover or burned scrub hardwood sites. For this purpose the following modifications were made:

- ▶ Since few available bulldozers have hydraulically controlled rear tool bars but most have winches, a special hitch had to be devised. The hitch used for mounting a heavy-duty tree planting machine proved suitable, bolted and chained below the winch mount; this provided lateral swivel action. Arms bolted horizontally to this hitch held a tool bar to which the seeder unit was attached. Vertical articulation was provided by the bolt connections of these arms, and, more sensitively, by the parallelogram mountings of the seeder unit. The winch was used to lift the seeder by means of either a vertical arm connected to the tool bar or an arch and chain arrangement (see illustrations).
- ▶ The frame of the seeder was reinforced by adding 3/8 in. steel shanks to the main upright.
- ▶ In place of the front discs on the seeder, a heavy steel ski was made for skidding over rocky ground (a similar but much lighter device is supplied by the manufacturers).
- ▶ The unnecessarily large corn seed hopper was cut down and welded to its base.

With these changes the machine proved adaptable to a variety of tractors and operating conditions. It withstood rough treatment remarkably well, riding unharmed over slash, tree stubs, large roots and boulders.

Seeding rate, controllable by different sprocket combinations, was set at 2.5 seeds per foot. Sowing depth, adjustable by a bolt on the seeder frame, was set at 1/4 in. but the roughness of the ground inevitably resulted in some depth variation ranging up to 1 in.

The V-blade method for site preparation was developed for machine tree planting operations in the Sudbury District of the Ontario Lands & Forests Department after several years of trials and modifications.

Two modified versions of the Lowther "Wildland V-blade" were involved, one 4 ft in width suitable for a small (TD-9 or D-4 class) tractor, and a heavier one 6 ft wide with an additional scalping edge extending 6 in. below and 2 ft on either side of the blade point. The latter proved preferable, providing a 6-7 ft cleared strip with a slightly deeper flat bottomed furrow about 4 ft wide in the center.

Elimination of the duff and herbaceous rooting layers was the aim, exposing mineral soil, ideally no deeper than the reddish upper B<sub>1</sub> horizon. Because of the undulating ground there was considerable irregularity in furrow depth with intermittent short stretches unscarified, but this was considered advantageous since it would reduce the

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