

THE USE OF PRESCRIBED BURNING IN JACK PINE
MANAGEMENT IN SOUTHEASTERN MANITOBA

Project MS-245

by

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INTRODUCTION

In 1964 a research project was begun in the Sandilands Provincial Forest in southeastern Manitoba to investigate the use of prescribed burning for seedbed and site preparation in cut-over jack pine (Pinus banksiana Lamb.) stands.

Five one-acre plots were burned in July of 1964. In the fall of 1964 and the spring of 1965 several direct seeding, planting, and natural regeneration studies were established on these plots. During 1965 and 1966, fifteen areas totalling 611 acres were burned and additional regeneration studies were carried out on several of the areas. In 1967, a 46-acre area was burned and studies were initiated to determine the effect of post-burn interval before planting and seeding and to compare prescribed burning, scarification with finned barrels, and burning followed by scarification as methods of site and seedbed preparation.

The following studies have been established as part of project MS-245.

Study	Title	Years of burns on which established	Status
1	Natural seeding, planting and artificial seeding.	1964, 1965, 1966	Continuing
2	Spring and fall seeding and planting.	1964	Terminated; investigation continuing in study 5.
3	Planting and seeding on seedbeds prepared mechanically and by burning.	1964	Terminated; investigation continuing in study 6.
4	Germination and seedling development on various seedbeds.	1964	Terminated; investigation continuing as project MS-251.
5	The effect of post-burn interval before seeding and planting on seedling establishment and survival on burned areas.	1967, (1968)*	Active
6	A comparison of seedling establishment and survival on burned areas, scarified areas, and burned-scarified areas.	1967, (1968)*	Active

* Anticipated.

For additional information on this project, see the establishment and previous progress reports (Cayford 1965, Walker 1966, 1967).

INITIATION OF STUDIES 5 AND 6

Prescribed burning as a means of seedbed and site preparation has been carried out in the Sandilands Provincial Forest since 1964. Planting and seeding results to date have been generally unfavorable. There is indication that poor establishment and subsequent losses result from heat and droughty conditions which prevail on these burned, sandy seedbeds. It is quite possible that by delaying artificial regeneration attempts on prescribed-burns, vegetation development and leaching action will sufficiently moderate the environment to enhance regeneration results. Study 5 was designed to explore this question. Comparisons will be made on prescribed-burns among planting and broadcast seeding results the first fall, first spring, second fall, and second spring following burning.

The disappointing broadcast seeding and planting results on these first prescribed-burns also dictates a more direct comparison between prescribed-burning and other methods of site preparation. Study 6 compares planting and broadcast seeding results on areas which have been (1) prescribed-burned, (2) mechanically scarified, and (3) burned, then scarified.

Study 5. The effect of post-burn interval before seeding and planting on seedling establishment and survival on burned areas.

Prescribed burned cut-over areas will be broadcast seeded and planted to jack pine the first fall, first spring, second fall, and second spring following burning. Should conditions warrant, areas will be seeded and planted the third fall and third spring. The study was started on one area last summer. It will be repeated on another area this summer and probably on a third area in 1969. Broadcast seeding blocks (one each spring and fall) are each one acre in size. Planting blocks are each approximately one-half acre in size. Seeding will be done at the rate of 12 ounces of seed per acre. Seed will be pre-treated with "Arasan" and endrin. Hand planting of 2-0 jack pine stock will be carried out at a spacing of 6 feet by 6 feet.

Regeneration assessments will be made after the first, second, and fifth growing seasons. On each broadcast seeded block five permanent transects, each containing 20 one-milliacre quadrats, will be randomly established. Each quadrat will be recorded as stocked or unstocked to jack pine regeneration and on every fifth quadrat a total seedling count will be made. In the planting blocks, all planted seedlings will be recorded as healthy, sick, or dead. During the five-year assessment, the height of the tallest unbrowsed seedling on each quadrat will be measured. The heights of at least 10 per cent of the planted seedlings will also be tallied.

Study 6. A comparison of seedling establishment and survival on burned areas, scarified areas, and burned-scarified areas.

Jack pine cutovers will be sub-divided into three areas, each to receive one of the following treatments:

1. Prescribed-burning
2. Mechanical scarification
3. Burning followed by scarification.

Scarification will be carried out by tractor-drawn shark-finned barrel scarifiers (Brown 1966).

Broadcast seeding and planting to jack pine will be carried out the first fall and first spring only. The burned only blocks will be the same ones established for study 5. Areas receiving the other site preparation treatment will be located on the same cutovers. Other methods (i.e., those pertaining to block size, seeding and planting methods, regeneration assessment, etc.) will be the same as those described for study 5.

Work completed on studies 5 and 6 in 1967.

On August 25, a prescribed burn was carried out by the Manitoba Department of Mines and Natural Resources on about 30 acres of a 46-acre jack pine cutover located in the Marchand Conservation District. Burning conditions were selected to favor seedbed preparation. The 16-acres of unburned area and about 10 acres of the burn (see fig. 1) were scarified with shark-finned barrel scarifiers (fig. 3) drawn by a D-4 tractor. Portions of the scarified area were also treated with anchor chains. The areas thus created--burned only, burned-scarified, and scarified only--are shown in figures 4, 5 and 6, respectively.

Scarification was carried out between September 26 and October 4 by the Canada Department of Forestry and Rural Development. Four barrels--two rows of two barrels each--were pulled behind a drawbar. Space between furrows was about 6 feet. The barrels each weighed about 600 pounds when empty and 1,200 pounds when filled with water. The leading barrels were two-thirds filled and the trailing barrels were completely filled.

The D-4 tractor used was so underpowered for the job that serious comparisons between performance on the slash area and that on the burned area were precluded. It was evident, however, that production was much greater on the burned area. Moreover, one pass over the burned area produced apparently excellent furrows while one pass over the slash area produced rather narrow furrows with considerably less exposed mineral soil. A second pass over the slash areas improved the furrows considerably but this may well be more expensive than the combined per-acre cost of burning and scarifying.

Anchor chains were drawn through some of the furrows in the slash area and over a small portion of the burned only area. Each anchor chain consisted of 25 links. Two steel rods, each 1 inch by 2 feet, were welded in the form of an X across the inside of each link. Each link with its steel rods weighed about 32 pounds. The anchor chains were expected to enhance slash scattering; however, the links quickly became filled with slash and had the effect of a brush in sweeping cones and cone-bearing slash from the furrows. On the burned only area, very small furrows were created by the anchor chains. Progress was very rapid, however, and even the small furrows may be an improved microenvironment for regeneration.

Planting and seeding blocks are shown in fig. 2. First fall planting was carried out on October 24-26, 1967. The days were overcast and temperatures were near freezing. Planting stock was provided by the Manitoba Department of Mines and Natural Resources' Pineland Nursery at Hadashville. Planting stock measurements are shown in Table 1. Planting on the burned area was carried out on two habitat types--dry and mesotrophic fresh minus (Mueller-Dombois 1964).

Broadcast seeding was carried out on November 30. At the time of seeding, 3-4 inches of snow covered the area. The seed used was from the same batch as that used for reseeding the 1965 burns.

OTHER WORK COMPLETED IN 1967

Reseeding the 1965 burns

Half of each broadcast-seeded area on the three 1965 burns was reseeded on May 4, 1967. At the time of seeding, 1-2 inches of snow completely covered the area. Jack pine seed was broadcast at a rate of approximately 1/2 lb. per acre with a Cyclone hand seeder.

Seed was collected in the Sandilands Provincial Forest by the Manitoba Department of Mines and Natural Resources during 1964. It was identified as seedlot no. 164, jar no. 56. It was pretreated during the winter of 1966-67 with Arasan and endrin (See Walker, 1967, for procedure). Germination capacity at time of sowing was 92%.

Reexamination of 1965 and 1966 burns

The plantings and natural, broadcast and spot seedings carried out on the 1965 and 1966 burns were examined in the fall (late August, September and October) to determine survival after one and two growing seasons.

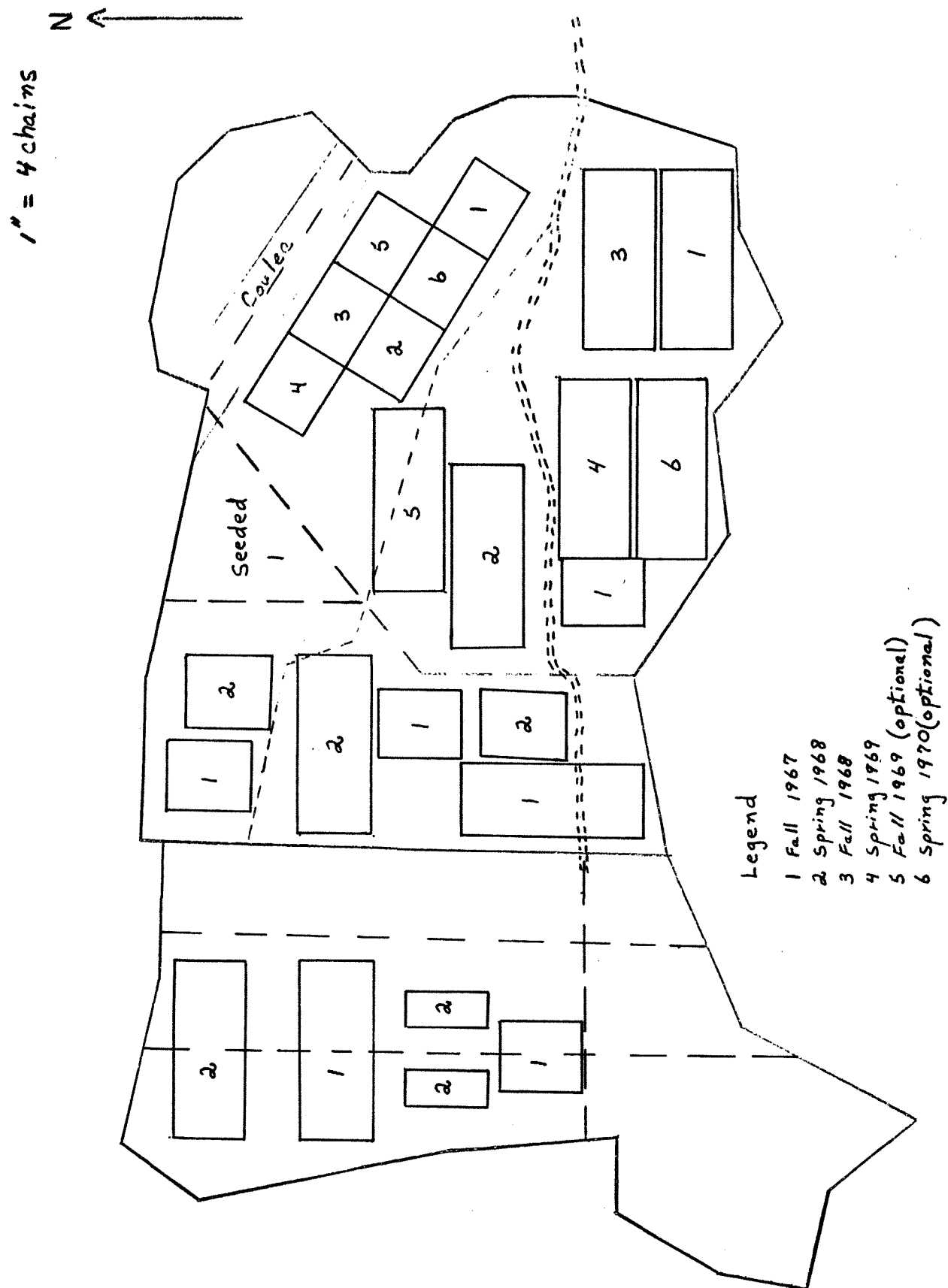


FIGURE 2. PLANTING AND SEEDING PLOTS ESTABLISHED FOR STUDIES 5 AND 6



Figure 3. Shark-finned barrel scarifiers.



Figure 4. Prescribed-burned area.



Figure 5. Burned and barrel scarified area. Furrows were created by one pass.



Figure 6. Barrel scarified area. Furrows were created by two passes.

TABLE 1
SUMMARY OF PLANTING STOCK MEASUREMENTS

No. of seedlings	Age	Avg. root length (inches)	Avg. top length (inches)	Avg. oven dry wts. (grams)		Root/shoot ratio (oven dry) ¹
				Root	Top	
25	2-0	10.3	6.6	0.97	3.16	0.31

¹

dried at 105°C for 48 hours.

RESULTS

Regeneration, planting, spot seeding, broadcast and natural seeding on the 1965 and 1966 burns.

The per cent stocking and density for the broadcast and natural seeded areas of the 1965 burns is shown in Table 2. All areas, except PB-65-D1 on which 10 seed trees per acre were selected prior to cutting were understocked* after one growing season (internal report MS-49, March 1967). A severe drought during late summer of 1967 caused high seedling mortality with the result that all areas are now understocked. Table 2 also shows the results of reseeding portions of the areas originally seeded during the spring of 1966. Little improvement in stocking or density was achieved by reseeding in spring 1967.

Seedling mortality on the spot seeded areas was due chiefly to the drought, however, these areas were not affected to the same extent as the broadcast or natural seeded portions. Observations in the field indicated that survival was related to the site, generally the drier the site the higher the mortality. Stocking on the Hadashville and Richer areas (spring seeded in 1966) was still quite high after two seasons with an average of 68.7 per cent of the seedspots stocked (Table 3). Stocking on the Marchand area, seeded during the fall of 1966, was quite poor with a total of only 20.9 per cent of the seedspots stocked.

* Forty per cent is considered "adequate" stocking.

Plantations established on the Hadashville and Marchand areas appeared quite healthy during the 1967 examination after an initially poor start in 1966. Second year mortality was only 8.2 and 3.3 per cent leaving adequate stockings of 64.4 and 50.1 per cent, respectively. The average tree height was 9.8 inches (Table 4).

A comparison of planting survival the first fall and second fall after burning is shown in Table 5 for two adjacent areas burned in the Hadashville district. Second fall planting survival was 30.9 per cent; first fall planting survival was 14.3 per cent. An area burned in the Woodridge district compares the survival for the first fall and first spring after burning; survival was 19.0 and 69.4 per cent respectively. The latter comparison shows the effect on survival of the time of year of planting with spring appearing markedly better than fall. The former comparison indicates that planting the first fall after burning may have a detrimental effect on seedling survival.

WORK PROPOSED FOR 1968

Spring and fall seeding and planting will be carried out on studies 5 and 6 on the 1967 burn. Transects will be established on the seeded portions and a regeneration examination will be made during the fall of 1968 for areas seeded fall 1967 and spring 1968. A survival count will be made during the fall on all seedlings planted fall 1967 and spring 1968 (Table 6).

An additional area will be burned during 1968 and studies 5 and 6 will be replicated.

Height measurements will be taken during the fall on seedlings planted on the following areas, PB-65-H1 and PB-66-H1 (fall, 1966 planting) and PB-66-W1 (spring, 1967 and fall, 1966 planting).

TABLE 2

JACK PINE REGENERATION ON 1965 BURNS (BROADCAST AND NATURAL SEEDING)

August-September, 1967

Seeding method	Area	Number	Number quadrats	Per cent stocking	Seedlings per acre	Average height of tallest seedling (ins.)
Spring, 1966 broadcast seeding	Hadashville	PB-65-H1	120	26.7	833	4.1
	Richer	PB-65-D1	120	7.5	382	4.0
	Marchand	PB-65-M1	100	28.0	300	2.1
Total or average			340	20.3	382	3.3
Spring, 1967 broadcast reseeding	Hadashville	PB-65-H1	80	36.2	812	3.8
	Richer	PB-65-D1	180	13.3	222	2.8
	Marchand	PB-65-M1	140	28.6	393	1.7
Total or average			400	23.2	400	2.7
Natural seeding	Hadashville	PB-65-H1	200	14.0	175	3.4
	Richer	PB-65-D1	300	15.0	300	4.3
	Marchand	PB-65-M1	100	13.0*	50*	3.0
Total or average			600	14.3	217	3.8

* The anomaly between stocking and density values result from sampling procedure. Density values are based on seedling tallies in every 5th quadrat only.

TABLE 3

JACK PINE REGENERATION ON 1965 BURNS (SPOT SEEDING)

August-September, 1967

Area	Number	Seeding time	Number of seedspots	Number of seedlings	Per cent seedspots stocked	Average height of tallest seedling (inches)
Hadashville	PB-65-H1	Spring 1966	208	1,190	84.1	2.5
Richer	PB-65-D1	Spring 1966	364	2,964	59.9	3.2
	Total		572	4,154	68.7	2.9
Marchand	PB-65-M1	Fall 1966	201	74	20.9	0.8

TABLE 4

SURVIVAL AND GROWTH OF 1966 SPRING PLANTATIONS ON 1965 BURNS

August-September, 1967

Area	Number	Number of seedlings	Per cent survival	Average height (inches)
Hadashville	PB-65-H1	191	64.4	9.7
Marchand	PB-65-M1	293	50.1	9.8
	Total	484	55.8	9.8

TABLE 5
SURVIVAL OF 1966 FALL AND 1967 SPRING PLANTING ON 1965 AND 1966 BURNS
September-October, 1967

Date of burn	Date of planting	Area	Number	Number of seedlings	Per cent survival	Average height (inches)
Aug. 23 1965	Sept. 25 1966	Hadashville	PB-65-H1	97	30.9	7.9
Aug. 26 1966	Sept. 25 1966	Hadashville	PB-66-H1	98	14.3	9.8
Aug. 3 1966	Mid-Sept. 1966	Woodridge	PB-66-W1	100	19.0	7.7
Aug. 3 1966	Early June 1967	Woodridge	PB-66-W1	85	69.4	6.4

TABLE 6
ACTIVITY SCHEDULE

	Time Activity Required							
	1967	1968	1969	1970	1971	1972	1973	1974
	fall	spr. fall	spr. fall	spr. fall	spr. fall	spr. fall	spr. fall	spr. fall
1967 Area								
Regeneration time	Regen.	1 yr.	2 yr.			5 yr.		
1st fall		exam.	exam.			exam.		
1st spring		Regen. 1 yr.	2 yr.			5 yr.		
		exam.	exam.			exam.		
2nd fall		Regen.	1 yr.	2 yr.			5 yr.	
			exam.	exam.			exam.	
2nd spring			Regen. 1 yr.	2 yr.			5 yr.	
			exam.	exam.			exam.	
1968 Area								
Regeneration time		Regen.	1 yr.	2 yr.			5 yr.	
1st fall			exam.	exam.			exam.	
1st spring			Regen. 1 yr.	2 yr.			5 yr.	
			exam.	exam.			exam.	
2nd fall			Regen.	1 yr.	2 yr.			5 yr.
				exam.	exam.			exam.
2nd spring				Regen. 1 yr.	2 yr.			5 yr.
				exam.	exam.			exam.

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