

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

Project MS-245

by

N.R. Walker

FOREST RESEARCH LABORATORY

WINNIPEG, MANITOBA

INTERNAL REPORT MS-49

Forestry Branch
March, 1967

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to the Manitoba Department of Mines and Natural Resources for undertaking the operational tasks involved in seeding and planting the 1965 burns. Areas were seeded and planted under the supervision of C.D. Rannard, J. Bissinger, and local Conservation Officers of the Southeastern Region.

CONTENTS

	Page
INTRODUCTION	1
WORK COMPLETED IN 1966	1
Re-examination of studies 1 to 4, 1964 Burn	1
Regeneration Treatments Applied to 1965 and 1966 Burns and Method of Assessment	2
RESULTS	5
Study 1 - 1964. Natural Seeding, Planting, and Artificial Seeding	5
Study 2 - 1964. Spring and Fall Seeding and Planting	5
Study 3 - 1964. Planting and Seeding on Seedbeds Prepared Mechanically and by Burning	10
Study 4 - 1964. Germination and Seedling Development on Various Seedbeds	10
Regeneration From Planting, Spot Seeding, Broadcast and Natural Seeding on the 1965 and 1966 Burns	10
Seed Collections from the 1965 Seed Tree Burn	15
WORK PROPOSED FOR 1967	18
REFERENCES	18

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

Internal Report

Project MS-245

by

N.R. Walker

INTRODUCTION¹

In 1964 a research project was begun in the Sandilands Forest Reserve in southeastern Manitoba to investigate the use of prescribed burning in cut-over jack pine (*Pinus banksiana* Lamb.) stands. The objectives of the project are: (1) to determine whether fire can be used for seedbed preparation for seeding or site preparation for planting, (2) to study factors of fire behaviour, and (3) to study the ecological effects of fire. This report deals with the first objective only.

Five one-acre plots were burned in July of 1964. In the fall of 1964 and the spring of 1965 several studies of artificial seeding, planting, and natural regeneration were started on these plots. In 1965 four areas varying from 18 to 51 acres in size were burned and additional studies of seeding and planting were carried out. During the summer of 1966 eleven cut-over areas were mapped and burned and several of the areas were planted during the fall.

WORK COMPLETED IN 1966

Re-examination of Studies 1 to 4, 1964 Burn

The plantings and natural, broadcast, and spot seedings on studies 1 to 4 of the 1964 burn were re-measured during late August and September. The row seeding which was carried out during the spring of 1965 as part of study 1 was also examined at this time; the height of each seedling was taken and its location mapped.

¹ For additional information, the reader is referred to the establishment and progress reports prepared for this project (Cayford 1965, Walker 1966).

Row seeding was done between April 22-27, 1965. Parallel rows were located on three one-fifth-acre plots and spaced ten links apart. Along each row 2-4 seeds were sown at one-foot intervals. The seeds were placed in 1/4-inch depressions and covered with sand.

Regeneration Treatments Applied to 1965 and 1966 Burns and Method of Assessment

Table 1 shows the areas, date of treatment, number of acres treated, amount of seed used, and the planting stock age which was used on the 1965 and 1966 burns. Table 2 shows the number of permanent regeneration transects which were located on the natural and broadcast seeded areas of the 1965 burns and the number of rows of the spring and fall planting and spot seeding which were examined on the 1965 and 1966 burns.

Seedlings were planted in rows at a spacing of approximately six feet between each seedling and between each row. No ground preparation other than burning was used. Seedspots were also located in rows with the same spacing as that employed in the planting. For each seedspot all burned litter and ash was removed and the seedspot raked down to mineral soil. An area somewhat less than one square foot was prepared. Approximately 25-30 seeds were placed on each seedspot and then lightly tamped down with the foot. Broadcast seeding was done with a Cyclone hand seeder.

All seed was collected in the Sandilands Forest Reserve by the Manitoba Department of Mines and Natural Resources during 1964. It was identified by the Provincial Forester as seedlot no. 164, jar no. 19. It was pretreated during the winter of 1965-66 by the Federal Department of Forestry in Winnipeg as follows:

Arasan 75 - 2.6 pounds per 100 pounds of seed
Endrin 75W - 1.0 pounds per 100 pounds of seed
Aluminum flakes - 1.0 pounds per 100 pounds of seed

One part of Latex (Dow 512-R) to 9 parts of water was used as a sticker. A germination test, made during 1966, indicated a viability of 72 per cent.

Transects were established randomly on the natural and broadcast seeded areas. Transects were marked at the northeast corner by a numbered wooden post 2 by 2 inches by 2.5 feet in length. The other three corners and the mid-points of the long boundaries were marked with numbered wooden posts, 1 by 1 inch by 2 feet in length. Quadrat 1 in each transect was located adjacent to the large corner post. Each quadrat was recorded as stocked or not stocked to jack pine regeneration and on every fifth quadrat of each transect a total seedling count was made. The height of the tallest seedling on each quadrat was recorded.

TABLE 2
SUMMARY OF REGENERATION PLOTS

Date of Burn	Area	Number	Number of quadrats		Transect numbers		Planting		Spot seeding	
			Broadcast seeding	Natural seeding	Broadcast seeding	Natural seeding	Spring (No. of rows)	Fall	Spring (No. of rows)	Fall
Aug. 23, 1965	Hadash- ville	PB-65-HI	200	200	1-10	1-10	3	2	4	0
Aug. 17, 1965	Richer	PB-65-DI	300	300	11-25	11-25	N O N E		6	0
Aug. 10, 1965	Marchand	PB-66-MI	240	100	26-37	26-30	4	0	0	3
Aug. 26, 1966	Hadash- ville	PB-66-HI	N O N E		N O N E		0	2	0	0

The planting and the spot seeding rows which were assessed were selected at random and the start and the end of each row was marked with a numbered wooden stake 2 by 2 inches by 2.5 feet in length. Every sixth seedling or seedspot was marked with a 1 by 1 inch by 2 foot numbered wooden stake. Where rows were difficult to follow additional stakes were placed beside each seedling or seedspot to mark its location. The height of each planted seedling and its condition was recorded. The number of seedlings on each seedspot were counted and their condition recorded. The height of the tallest seedling was taken.

RESULTS

Study 1 - 1964. Natural Seeding, Planting and Artificial Seeding

Light to moderate mortality occurred on most seeded and planted stock during 1966 on studies 1 to 4. Stocking on the spring broadcast seeding as of September, 1966 was 17 per cent with a density of 333 seedlings per acre. Natural seeding shows a stocking of 8 per cent and a density of 167 seedlings per acre (Table 3). All of the natural regeneration occurred on plot 4 on which 9 seed trees per acre had been left as a seed source.

Spring spot seeding shows a survival of 542 seedlings on 600 seedspots with 29 per cent of the seedspots stocked (Table 4).

Survival of the spring planting was 72 per cent and the average height of the seedlings 14.8 inches (Table 5).

Row seeding produced 308 seedlings per acre on plots 1, 4 and 5 and the average height of the seedlings was 2.7 inches (Table 6).

Study 2 - 1964. Spring and Fall Seeding and Planting

Seeding during the fall whether broadcast or spot seeded has been more successful than seeding during the spring. Fall broadcast seeding shows a stocking of 20 per cent and a density of 333 seedlings per acre. Stocking on the spring broadcast seeding is 7 per cent. Since no seedlings were found on the total tally quadrats, a density value was not obtained (Table 7).

Fall seedspots show a survival of 187 seedlings and a stocking of 44 per cent. Survival on the spring seedspots is 129 and stocking 28 per cent (Table 8).

Spring planting on the 1964 burn has been more successful than the fall planting; survival is 62 and 38 per cent, respectively (Table 9).

TABLE 3

SUMMARY OF JACK PINE REGENERATION SURVEY -

SPRING BROADCAST AND NATURAL SEEDING - STUDY 1, 1964 BURN

September, 1966

Seeding method	Plot number	Number quadrats	Per cent stocking	Seedlings per acre	Average height of tallest seedling (Inches)
Spring Broadcast seeding	1	20	5	500	1.8
	4	20	30	250	2.5
	5	20	15	250	2.8
Total		60	17	333	2.5
Natural seeding	1	20	0	0	
	4	20	25	500	4.3
	5	20	0	0	
Total		60	8	167	4.3

TABLE 4
SUMMARY OF JACK PINE REGENERATION SURVEY -
SPRING SPOT SEEDING - STUDY 1, 1964 BURN
September, 1966

Plot number	Number seedspots	Number seedlings	Per cent seedspots stocked	Average height of tallest seedling (inches)
1	200	46	12	2.8
4	200	264	41	3.1
5	200	232	36	3.0
Total	600	542	29	3.0

TABLE 5
SURVIVAL AND GROWTH OF SPRING PLANTING -
STUDY 1, 1964 BURN
September, 1966

Plot number	Number planted	Per cent survival	Average height (inches)
1	200	60	11.8
4	200	73	15.5
5	200	82	16.1
Total	600	72	14.8

TABLE 6

SURVIVAL AND GROWTH OF ROW SEEDING - STUDY 1, 1964 BURN

August, 1966

Plot number	Number of seedlings	Number per acre	Average height (inches)
1	17	85	1.7
4	104	520	3.1
5	64	320	2.3
Total	185	308	2.7

TABLE 7

SUMMARY OF JACK PINE REGENERATION SURVEY -

SPRING AND FALL BROADCAST SEEDING - STUDY 2, 1964 BURN

August, 1966

Seeding time	Number quadrats	Per cent stocking	Seedlings per acre	Average height of tallest seedling (in.)
Spring	30	7	- ¹	2.1
Fall	30	20	333	1.8

¹No seedlings were found on the six total tally quadrats.

TABLE 8

A COMPARISON OF JACK PINE REGENERATION SURVEYS OF
 SPRING AND FALL SPOT SEEDING - STUDY 2, 1964 BURN
 August, 1966

Seeding time	Number of seedspots	Number seedlings	Per cent seedspots stocked	Average height of tallest seedling (inches)
Spring	150	129	28	1.7
Fall	150	187	44	2.1

TABLE 9

COMPARISON OF SURVIVAL AND GROWTH OF
 SPRING AND FALL PLANTING - STUDY 2, 1964 BURN
 September, 1966

Planting time	Number planted	Per cent survival	Average height (inches)
Spring	150	62	11.0
Fall	150	38	10.8

Study 3 - 1964. Planting and Seeding on Seedbeds Prepared Mechanically and by Burning¹

Planting and seeding on mechanically-prepared seedbeds have been more successful than in applying the same treatment to burned areas. Planting in furrows shows a survival of 98 per cent and on burned areas 62 per cent (Table 10). On 150 seedspots in furrows there are 1,072 surviving seedlings and 94 per cent of the seedspots are stocked. For seedspots prepared by burning there are 129 surviving seedlings and 28 per cent are stocked (Table 11). Stocking on the furrow broadcast seeding is 90 per cent and the density 5,167 seedlings per acre; stocking on the burn area is 7 per cent; no density value was obtained (Table 12).

Study 4 - 1964. Germination and Seedling Development on Various Seedbeds

Heavy wind erosion took place on all plots of this study and the results obtained cannot be considered as being conclusive. Although litter appears to be most favourable for germination and survival, wind erosion was more severe on the mineral soil and ash seedbeds and germination here is less than could be normally expected. Since the seed used for study 4 was untreated, losses to rodents could further confound the results.

Germination and survival of seedlings was improved with all treatments to ameliorate heat and, or drought losses. For the no watering-no shading treatment on all seedbeds 44 seedlings germinated and only one is surviving to September, 1966, while on the watering-shading treatment 88 seedlings germinated and 20 have survived to date (Table 13).

Regeneration from Planting, Spot Seeding, Broadcast and Natural Seeding on the 1965 and 1966 Burns

Spring broadcast seeding on the 1965 burns resulted in stocking which ranged from 17 to 32 per cent on the three areas and a density from 188 to 950 seedlings per acre (Table 14). Stocking was inadequate on all areas (if 40 per cent is considered minimum) however, the sowing rate was only a maximum of .4 pounds per acre on the Hadashville area and .3 pounds on Richer and Marchand (Table 1).

¹ Seedbeds prepared mechanically are compared with those prepared by burning on the spring treatment of study 2.

TABLE 10
 SURVIVAL AND GROWTH OF SEEDLINGS PLANTED ON BURNED
 AND ON MECHANICALLY-PREPARED SEEDBEDS - STUDY 3, 1964 BURN
 September, 1966

Site preparation method	Number planted	Per cent survival	Average height (inches)
Burning	150	62	11.0
Furrows	150	98	12.8

TABLE 11
 COMPARISON OF JACK PINE REGENERATION SURVEYS OF SPOT SEEDING ON BURNED
 AND ON MECHANICALLY-PREPARED SEEDBEDS - STUDY 3, 1964 BURN
 August, 1966

Site preparation method	Number of seedspots	Number seedlings	Per cent seedspots stocked	Average height of tallest seedling (inches)
Burning	150	129	28	1.7
Furrows	150	1072	94	2.4

TABLE 12
 COMPARISON OF REGENERATION SURVEYS OF BROADCAST SEEDING
 ON BURNED AND ON MECHANICALLY-PREPARED SEEDBEDS - STUDY 3,
 1964 BURN
 August, 1966

Site preparation method	Number quadrats	Per cent stocking	Seedlings per acre	Average height of tallest seedling (inches)
Burning	30	7	- ¹	2.1
Furrows	30	90	5,167	2.0

¹ No seedlings were found on the six total tally quadrats.

TABLE 13

PER CENT SURVIVAL BY SEEDBED AND TREATMENT, May 28, 1965-Sept. 12, 1966 - STUDY 4

Treatment	Mineral Soil			Ash			Litter			All			Average height
	Total germ.	No. living	Per cent survival	Total germ.	No. living	Per cent survival	Total germ.	No. living	Per cent survival	Total germ.	No. living	Per cent survival	
Watering-shading	2	1	50.0	3	2	66.7	83	17	20.5	88	20	22.7	1.4
Watering-no shading	11	0	0.0	9	1	11.1	47	7	14.9	67	8	11.9	1.4
No watering-shading	4	0	0.0	4	0	0.0	48	0	0.0	56	0	0.0	-
No watering-no shading	5	0	0.0	0	0	0.0	39	1	2.6	44	1	2.3	1.0
Total	22	1	4.5	16	3	18.8	217	25	11.5	255	29	11.4	
Average height		2.4			1.7			1.3					

TABLE 14
JACK PINE REGENERATION ON 1966 SPRING BROADCAST AND
NATURAL SEEDING, 1965 BURN
September - October 1966

Seeding method	Area	Number	Number quadrats	Per cent stocking	Seedlings per acre	Average height of tallest seedling (inches)
Spring broadcast seeding	Hadashville	PB-65-HI	200	32	950	1.2
	Richer	PB-65-DI	300	25	400	1.4
	Marchand	PB-65-MI	240	17	188	1.1
Total			740	24	480	1.2
Natural seeding	Hadashville	PB-65-HI	200	16	150	1.2
	Richer	PB-65-DI	300	43	1,050	1.2
	Marchand	PB-65-MI	100	14	100	1.1
Total			600	29	592	1.2

Stocking on the natural seeded areas ranged from 14 to 43 per cent and density from 100 to 1,050 seedlings per acre (Table 14). For Hadashville and Marchand the areas chosen for natural seeding were those which contained the greatest number of standing residual trees following logging. On the Richer area 10 seed trees per acre were selected prior to cutting; stocking on this area was 43 per cent.

Spot seeding on the Hadashville and Richer areas showed good results with an average of 78 per cent of the seedspots stocked. The two areas were 88 and 71 per cent stocked, respectively (Table 15).

The spring planting results on the 1965 burns were not as favourable as might be expected. The average survival for the two areas was 59 per cent and the height of the plantations after one growing season only 3.8 inches (Table 16). Some mortality appeared to be from planting too deep.

The 1966 fall planting on the 1965 and 1966 Hadashville burns took place on September 25 and the plantations were examined one month later. Although precipitation records are not yet available, a local drought prevailed during the planting period; in fact, planting operations in Sandilands were finally suspended for this reason. The plantations were in generally poor condition; there was a severe browning of needles and the terminal bud of many seedlings had to be examined closely to determine if the seedling was still alive. Survival on the 1965 burn was 93 per cent but on the 1966 burn survival was only 74 per cent (Table 17). On these areas planting also appeared to be quite deep.

Seed Collections from the 1965 Seed Tree Burn

Seven collections were made during 1966 on the 1965 Richer seed tree burn (Table 18). A total of only 29,800 seeds fell per acre and 46 per cent of these were sound when a cutting test was made.

TABLE 17
SURVIVAL OF 1966 FALL PLANTING, 1965 AND 1966 BURNS
October 27, 1966

Date of Burn	Area	Number	Number of seedlings	Per cent survival	Average height (inches)
Aug. 23 1965	Hadashville	PB-65-HI	97	93	6.0
Aug. 26 1966	Hadashville	PB-66-HI	98	74	7.2

TABLE 18
SEED FALL PER ACRE - 1965 SEED TREE BURN

Date of collection	Seed fall per acre	Per cent of seeds sound	Sound seed per acre	Pounds sound seed per acre
April 25/66	10,400	54	5,616	.04
June 2/66	3,600	78	2,808	.02
July 5/66	3,600	44	1,584	.01
July 29/66	5,720	29	1,659	.01
Sept. 2/66	4,080	20	816	.01
Sept. 29/66	2,000	60	1,200	.01
Oct. 26/66	400	0	0	0
	29,800	46	13,708	.10

WORK PROPOSED FOR 1967

All of the regeneration treatments carried out on the 1965 and 1966 burns will be re-examined for the second year results during the fall of 1967.

Two new studies (5 and 6) will be started during the fall on the 1967 burns. Study 5 will determine the effect of post-burn intervals before planting and seeding on seedling establishment and survival. Areas will be broadcast seeded and planted to jack pine the first fall, first spring, second fall, and second spring following burning. Two areas will be treated each year and replicated for three years.

Study 6 will compare the regeneration results of seeding and planting on areas burned and areas burned and scarified. Areas will be scarified with barrel scarifiers and anchor chains during the fall and then broadcast seeded or planted the first fall and first spring only. Two areas will be treated each year and replicated for three years.

REFERENCES

- Cayford, J.H. 1965. The use of prescribed burning in jack pine management in southeastern Manitoba. Canada, Dept. Forestry, Forest Research Branch, Unpubl. MS. 65-MS-1. 27 pp.
- Walker, N.R. 1966. The use of prescribed burning in jack pine management in southeastern Manitoba. Canada, Dept. Forestry, Forest Research Branch, Unpubl. MS-20. 24 pp.