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RESULTS OF A 1927 JACK PINE THINNING IN SASKATCHEWAN

by
J. H. Cayford

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PREFACE

This report presents the results of a jack pine thinning experiment that was begun in central Saskatchewan in 1927 by the Department of the Interior. It is one of the earliest thinning experiments undertaken in the Prairie Provinces and the results provide a valuable 32-year record of jack pine stand development following thinning.

The author is pleased to acknowledge the work of the forestry pioneers, O. G. Horncastle and S. C. Pocock, who established the experimental plots. In 1948 G. M. Wilson remeasured the plots and prepared a publication which was particularly useful in preparing this present report. A. J. Kayll and C. H. Winget remeasured the plots in 1959 under the author's general guidance and the author wishes to express his appreciation of their competent work.

Since 1930 the Saskatchewan Government forestry authorities have been responsible for protecting the experimental plots from fire and other disturbance. The availability of the 32-year record is in part due to their co-operation.

Results of a 1927 Jack Pine Thinning in Saskatchewan

by

J. H. Cayford[1]

ABSTRACT

An 18-year-old jack pine stand in the Boreal Forest Region in central Saskatchewan was thinned experimentally in 1927. The stand was located on a weakly podzolized fine to medium siliceous sand which varied from dry to moderately fresh. Four plots were established where the stand averaged 4,100 trees per acre and three where it averaged 2,300 trees. Five plots were thinned to various spacings and the other two were retained for control.

In 1959 within each part of the stand the control plots had a greater number of stems, basal area, and total cubic-foot volume than thinned plots. However, with only one exception, merchantable volumes in both cords and board feet were greater on thinned than on control plots. Thinning to an average spacing of 6.3 feet produced maximum cord and board-foot volumes in the less dense portion of the stand. Thinning to 5.9 and 6.6 feet in the denser portion of the stand produced maximum cord and board-foot volumes, respectively.

The experiment has demonstrated that a single non-commercial thinning in a dense young jack pine stand can increase merchantable yield; board-foot increments on thinned plots were two to three times greater than on control plots.

INTRODUCTION

Dense, even-aged jack pine[2] stands of fire origin are common throughout the forested areas of Saskatchewan and thinning has often been a recommended silvicultural treatment for them. It is generally recognized that the total cubic-foot volume produced by a stand can rarely be increased by thinning. However, it is possible by concentrating growth on fewer stems to increase total yield of usable material and to reduce the length of rotation for products of a given size (Hawley and Smith 1954).

In 1927 an investigation was begun to study the effects of different intensities of thinning in an 18-year-old stand of jack pine in central Saskatchewan. Results of a 1948 remeasurement were reported by Wilson (1952) and this report presents results to 1959.

DESCRIPTION OF EXPERIMENTAL AREA

The experimental area is located in the Holbein Block of the Nisbet Provincial Forest, approximately 20 miles west of the City of Prince Albert. It lies within the B.18a (Mixedwood) Section of the Boreal Forest Region (Rowe 1959).

[1] Research Officer, Forest Research Branch, Manitoba-Saskatchewan District Office, Winnipeg, Manitoba.

[2] For a list of botanical names of all plants mentioned in text, see Appendix.

Topography of the area is characterized by a gentle northwest-facing slope of approximately 5 per cent. The soil is a weakly developed podzol of fine to medium siliceous alluvial sand.

The site is dry on the upper slope and between dry and moderately fresh on the lower slope. According to Hills' (1952) system of classification, moisture regimes vary from 1 to 2.

In 1959 lesser vegetation was not continuous and a considerable percentage of the forest floor was covered with a thin layer of litter, which consisted mainly of jack pine needles. Reindeer lichen was the most abundant species while Schreber's moss and wavy dicranum moss were occasionally present. Scattered shrubs, herbs, and grasses occurred of which the most common species included golden pea, false lily-of-the-valley, slender mountain-rice, velvet-leaf-blueberry, rock-cranberry, choke-cherry, hairy golden-rod, smooth aster, and Lindley's aster. The lower slope was characterized by less litter, reindeer lichen, and golden pea and by a greater cover of Schreber's moss and wavy dicranum than the upper slope.

In 1927 when the plots were established there were pronounced variations in the density of the 18-year-old stand. On the lower slope, there were between 2,000 and 2,600 trees per acre, whereas on the upper slope, there were between 3,300 and 4,400. Diameters ranged up to 4 inches on the lower slope and to 3 inches on the upper slope.

In 1959, at age 50, site index on the upper slope was 42 and on the lower slope 46. Site indices are equivalent to those for average jack pine sites in Saskatchewan. The vegetation type appears to be intermediate between the jack pine-*Cladonia* and the jack pine-*Vaccinium* types recognized by Kabzems and Kirby (1956).

Before the experiment was begun, rabbits (*Lepus americanus phaenotus* Allen) caused considerable injury in the stand and damaged trees could be recognized by the occurrence of basal scars. The pitch nodule maker, *Petrova albicapitana* (Busck), had killed the terminal shoots of a small number of trees and many of these trees were forked (Wilson 1952).

METHODS

In 1927 seven rectangular plots were established. Four of these were one acre in area and located in the dense area on the upper slope. The other three were one-half acre in area and located in the less dense area on the lower slope. Two plots were retained for control and the other five plots were thinned to average spacings of between 5.2 and 7.7 feet.

In 1927 after thinning, all trees on each plot were tagged and tree maps prepared. The diameter of every tree and the height of every tenth tree was determined. In 1948 and again in 1959 the plots were remeasured. During remeasurement the diameter of each living tree and the height of each living tree, originally measured for height, were again determined. Additional height measurements were taken to provide adequate data for constructing a height/diameter curve for each plot at each remeasurement date.

TABLE 1. STAND STATISTICS PER ACRE 1927 AND 1959

Plot no.	Specified spacing (feet)	Actual spacing (feet)	No. of trees			Basal area (sq. ft.)		Total vol. (cu. ft.)		Merch. vol. (cords)[1]		Merch. vol. (b'd ft.)[2]	
			1927 B.T.[3]	1927 A.T.[4]	1959	1927 A.T.	1959	1927 A.T.	1959	1927 A.T.	1959	1927 A.T.	1959
Denser part of stand													
6	Control	3.1	4,408	4,408	2,027	50	128	462	2,517	0	19.4	0	443
4	4×4	5.2	3,352	1,634	1,294	22	119	210	2,466	0	23.6	0	878
5	5×5	5.9	4,115	1,236	1,124	16	116	149	2,399	0	24.2	0	1,129
7	6×6	6.6	4,406	1,001	897	14	104	128	2,067	0	22.9	0	1,360
Less dense part													
9	Control	4.1	2,562	2,562	1,390	44	128	448	2,783	0.1	24.7	0	1,750
8	5×5	6.3	2,436	1,082	952	24	120	243	2,529	0.1	25.9	0	3,087
10	6×6	7.7	2,022	732	698	15	106	142	2,194	0	24.7	0	2,922

[1] Stump height, 1 foot; top diameter outside bark, 3 inches.

[2] Stump height, 1 foot; top diameter inside bark, 5 inches. International 1/4 Log Rule.

[3] Before thinning.

[4] After thinning.

Figures 1 to 3. Control plot (no. 6) in denser part of stand as it appeared in 1927, 1948, and 1959, respectively.

Figures 4 to 6. Plot thinned to spacing of 6.6 feet (no. 7) in denser part of stand as it appeared in 1927, 1948, and 1959, respectively.

RESULTS

Stand in 1959

Stand statistics for all plots after thinning in 1927 and in 1959 are shown in Table 1. In 1959 within each group of plots the controls had a greater number of stems, basal area, and total cubic-foot volume than the thinned plots. The heavier the thinning the greater were these differences. Merchantable volumes in both cords and board feet were generally greater on thinned than on control plots. The development of two plots during the 32-year period is shown in Figures 1 to 6.

In 1959 all three plots in the less dense part of the stand had greater cord and board-foot volumes than any of the four plots in the denser part. The less dense part was on a slightly better site; however, it is the author's opinion that the differences in merchantable volume, and particularly in board feet, are largely a result of differences in original stand density rather than of site differences.

Thinning had little effect on cordwood production in the less dense part of the stand; thinning to 6.3 feet increased the volume by only 1.2 cords while thinning to 7.7 feet did not increase cord volume. However, in the denser part thinning increased cordwood volumes by from 3.5 to 4.8 cords. Thinning to a spacing of 5.9 feet produced maximum response.

Board-foot volumes were greatly increased by thinning. Best results were obtained where thinning resulted in average spacings of 6.6 feet in the denser part of the stand and 6.3 feet in the less dense part.

Volume Increment and Mortality

Gross increment of total volume was reduced by both thinning treatments in the less dense part of the stand, and by thinning to an average spacing of 6.6 feet in the denser part. Thinning to spacings of 5.2 and 5.9 feet in the latter part did not affect gross increment of total volume.

Periodic annual increments per acre (including mortality) for the 32-year period since thinning were as follows:

	Total vol.	Merch. vol.	
	(cu. ft.)	(cords)	(bd. ft.)
Average of control plots	76.2	0.7	34
Average of highest increment from each group of thinned plots	72.7	0.8	70

Mortality was appreciably reduced by thinning (Table 2). It was most pronounced in one- and two-inch trees, which were generally suppressed.

Diameter and Height Increment

Thinning increased diameter increment in all diameter classes and height increment in the one- and two-inch classes (Table 3). Increase in diameter increment was reflected in a larger number of trees per acre in the 6-inch diameter class and up on the thinned plots, as illustrated in the following tabulation:

	Control	Average for thinned plots	Widest spacing
Denser portion of stand	51	126	151
Less dense portion of stand	150	238	250

TABLE 2. PERIODIC NET AND GROSS INCREMENT AND MORTALITY[1] PER ACRE 1927–1959

Plot no.	Actual spacing (feet)	Net inc.	Mortality	Gross inc.	Net inc.	Mortality	Gross inc.	Net inc.	Mortality	Gross inc.
		Total vol. (cu. ft.)			Merch. vol. (cords)			Merch. vol. (bd. ft.)		
6	3.1[2]	2,055	270	2,325	19.4	0.2	19.6	443	0	443
4	5.2	2,256	66	2,322	23.6	0.1	23.7	872	0	872
5	5.9	2,250	29	2,279	24.2	0.1	24.3	1,129	0	1,129
7	6.6	1,939	22	1,961	22.9	0.1	23.0	1,360	8	1,368
9	4.1[2]	2,335	214	2,549	24.6	0.3	24.9	1,750	0	1,750
8	6.3	2,286	44	2,330	25.8	0.1	25.9	3,087	0	3,087
10	7.7	2,052	11	2,063	24.7	0	24.7	2,922	0	2,922

[1] Approximately 60 per cent of the mortality on plot 7 resulted from a trespass cutting between 1927 and 1948. Most trees removed were in the one-inch diameter class. On the other plots trespass cutting accounted for 3 per cent of the mortality.

[2] Control plot.

TABLE 3. PERIODIC DIAMETER AND HEIGHT INCREMENT, 1927–1959

Plot	Actual spacing (feet)	Periodic diameter increment (inches)			Periodic height increment (feet)		
		Diameter in 1927 (inches)					
		1	2	3	1	2	3
6	3.1[1]	1.3	1.8	3.0	16	20	24
4	5.2	2.0	2.6	3.3	22	25	27
5	5.9	2.3	3.0	3.3	25	26	28
7	6.6	2.4	3.3	3.9	22	25	28
9	4.1[1]	1.0	1.9	2.8	14	23	30
8	6.3	1.3	2.8	3.4	20	25	32
10	7.7	2.6	3.4	4.0	26	29	30

[1] Control plot.

DISCUSSION

Results of several thinning experiments in jack pine less than 30 years of age have indicated that young stands will respond to thinning (Schantz-Hansen 1931, Roeser 1932, Anon. 1940, Roe and Stoeckeler 1950). However, older stands may not appreciably respond and in a 37-year-old stand in Minnesota, diameter growth was not stimulated by thinning (Hansen and Brown 1929). In closed stands jack pine crowns recede very rapidly and thinnings, if they are to be effective, must be made before the crowns become so small that they are unable to utilize additional space effectively.

In this experiment a single non-commercial thinning in dense young jack pine increased merchantable yield; board-foot increments on thinned plots were two to three times those on control plots. It is believed that earlier thinning, at least in the denser part of the stand, would have given even better silvicultural results, as in 1959 its merchantable volumes, regardless of intensity of thinning, were considerably less than those in the less dense part of the stand.

The application of thinning in any given situation is determined more by economic factors than by silvicultural considerations, and thinning would more properly be regarded as an economic opportunity than as a cultural operation (Hawley and Smith 1954). Provided that demand for products of a given species in a given area exceeds supply, that products harvested through thinning may be utilized, and that a premium value per unit volume may be obtained from larger trees, then a program of intensive silvicultural treatment including thinnings is probably desirable and justifiable. Recommended rotation ages for jack pine of from 50 to 80 years (Eyre and LeBarron 1944; Bedell, Brown, and MacLean 1953) do not produce large-sized trees, and small diameters limit the opportunity of obtaining premium prices by increasing size of product. Stands on the best sites may be expected to offer the best opportunities for thinning benefits.

In Saskatchewan at present the supply of jack pine exceeds demand and markets are not generally available for material that would be removed in early thinnings. In view of the economic situation it appears unlikely that thinnings in jack pine stands will be warranted in the near future.

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APPENDIX

Common and Botanical Names of Plants Mentioned in Text

Aster, Lindley's	*Aster ciliolatus* Lindl.
Aster, smooth	*Aster lævis* L.
Choke-cherry	*Prunus virginiana* L.
Golden-rod, hairy	*Solidago hispida* Muhl.
Lichen, reindeer	*Cladonia rangiferina* (L.) Web.
Lily-of-the-valley, false	*Maianthemum canadense* Desf. var. *interius* Fern.
Moss, Schreber's	*Calliergonella schreberi* (Bry. Eur.) Grout
Moss, wavy dicranum	*Dicranum rugosum* Brid.
Mountain-rice, slender	*Oryzopsis pungens* (Torr.) Hitchc.
Pea, golden	*Thermopsis rhombifolia* (Nutt.) Richards.
Pine, jack	*Pinus banksiana* Lamb.
Rock-cranberry	*Vaccinium vitis-idaea* L. var. *minus* Lodd.
Velvet-leaf-blueberry	*Vaccinium myrtilloides* Michx.