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SURVIVAL AND GROWTH OF 1949-1962
RED PINE PLANTATIONS
IN SOUTHEASTERN MANITOBA

by

J. H. CAYFORD AND R. A. HAIG

Sommaire en français

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CONTENTS

	PAGE
INTRODUCTION	5
DESCRIPTION OF AREAS PLANTED	5
METHODS	6
Experimental Plantations	6
Examinations in Provincial Plantations	6
RESULTS	7
FACTORS THAT AFFECTED SURVIVAL AND GROWTH	7
Rainfall	8
Site	9
Site Preparation and Planting Method	9
Season of Planting	12
Biotic Factors	13
SUMMARY AND CONCLUSIONS	14
SOMMAIRE ET CONCLUSIONS	15
APPENDIX. Common and Botanical Names of Plant Species Mentioned in Text	16
REFERENCES	16

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Survival and Growth of 1949-1962 Red Pine Plantations in Southeastern Manitoba¹

by

J. H. CAYFORD and R. A. HAIG²

INTRODUCTION

Red pine³ has been planted in the Sandilands Forest Reserve in southeastern Manitoba more or less continuously since 1927, and by 1962 about 1.7 million trees had been set out. The development of red pine plantations in the region has been under study by the Department of Forestry and its predecessors since 1954, and results of an examination of plantations set out between 1931 and 1946 have been reported (Haig and Cayford 1960). Survival and growth of these plantations, many of which were set out during the severe drought of the 1930's, were both found to be poorer than for plantations of comparable age in Ontario and the Lake States. However, all plantations had been set out on dry, excessively drained sandy soils, and it was concluded that survival and growth would be improved by planting on moderately fresh to fresh sandy-loam to sandy soils.

This report records the development of plantations set out since 1949⁴ and is based on results obtained from the following four studies: (1) the survival and early growth of experimental plantations set out by the Department of Forestry between 1954 and 1962; (2) the survival and early growth of provincial government plantations set out between 1954 and 1956; (3) an examination of 22 provincial government plantations in 1961 to determine the effects of a severe drought in that year; (4) an examination of 23 provincial government plantations in 1963 to obtain further data to permit the assessment of all red pine plantings made on the Reserve during the period 1949 to 1962.

DESCRIPTION OF AREAS PLANTED

The Sandilands Forest Reserve is situated in the western portion of the Rainy River Section, L.12, of the Great Lakes—St. Lawrence Forest Region (Rowe 1959), and with the exception of one outlier, it is the northwestern limit of the natural range of red pine (Anon. 1961). Climatic data may be summarized as follows: January mean temperature, 0°F; July mean temperature, 65°F; average annual precipitation, 21 inches; average length of frost-free period, 80 to 100 days (Anon. 1957).

Most plantations were established on areas that originally supported jack pine which had been logged or burned and had not regenerated. Plantation areas varied from one to over one hundred acres. Occasionally, there was a scattered overstorey of jack pine on the planting sites.

Topography of the planting areas is flat to gently undulating. Soils are excessively- to well-drained sands to sandy-loams; sites were classified as dry or fresh. Dry sites were in general characterized by the occurrence of a bearberry-grass cover; common grasses included June-grass, poverty-grass, big blue-stem, and rough mountain-rice. Fresh sites were usually characterized by the occur-

¹Department of Forestry, Canada. Forest Research Branch Contribution No. 653.

²Research Officer, Forest Research Branch, and Forestry Officer, Administration Branch, respectively.

³For a list of botanical names of plant species mentioned in text, see Appendix.

⁴No red pine was planted in 1947 and 1948.

rence of a bracken fern-shrub-grass or grass cover; shrubs included prairie willow, pin cherry, rose, and snowberry, while grasses included rough mountain-rice, northern reed-grass, and big blue-stem.

METHODS

Experimental Plantations

Plantations were set out in the spring using 2-1 or 2-2 stock of Manitoba origin, provided by the Manitoba Department of Mines and Natural Resources. Planting was by hand on 18-inch square scalped spots, in ploughed furrows, or in unfurrowed ground. Periodic survival counts based on all trees were made, usually 1, 2, 3, and 5 years after planting, and each planted tree was recorded as healthy, sickly, or dead. At the five-year examination, total height and fifth-year terminal growth of each tree were measured.

Examinations in Provincial Plantations⁵

Plantations were set out either in the spring or the fall using 2-2 stock of Manitoba origin. Planting was usually by hand in ploughed furrows or by machine. A few small plantations were hand planted either in scalps or in unfurrowed ground.

Experimental plots were established early in the first growing season following planting in a number of plantations set out between 1954 and 1956. Plots usually consisted of five or ten 100-foot sections of rows located mechanically across the length and width of each plantation. When no site preparation was done the plots were 1/20-acre rectangles, 2 chains by $\frac{1}{4}$ chain. The plots were measured annually for 5 years; each tree was recorded as healthy, sickly, or dead and the height of one tree per plot determined. At the five-year examination, total height and fifth-year terminal growth of each tree were measured.

Twenty-two plantations were examined in the fall of 1961 to assess the effects of the severe drought in the same year. Usually 200 trees, located systematically throughout the plantation, were examined and recorded as living or dead. Characteristic drought symptoms were observed on nearly all dead seedlings.

Twenty-three plantations were examined in 1963 to obtain average survival and growth figures for each year and season of planting from 1949 to 1962, inclusive. Examinations were made on 20 to 40 chains of row mechanically located throughout a plantation. As the original spacing between trees was about 6 feet, the theoretical number of trees sampled ranged from 220 to 440 in each plantation. For each chain the number of trees was counted and the heights of the tallest and last tree were recorded to the nearest 1/10 foot. These figures, in conjunction with measurements of the distances between rows and trees, permitted the calculation of the average number of trees per acre, the per cent survival, the average height and the average maximum height of each plantation. These data, together with results of routine fifth-year survival records made by the Manitoba Forest Service, were used to prepare a summary table of provincial planting carried out during the period 1949 to 1962. The summary shows for each year and planting season the number of plantations established, the number of trees and area planted, the number of years between planting and re-measurement, the average number of trees per acre, the per cent survival, the average height, and the average maximum height.

Plantations with at least 400 trees per acre were considered satisfactorily stocked. This figure is based on the fact that, in Ontario the rate of merchantable volume growth in young red pine plantations is only slightly less at this level of stocking than in much denser stands (Stiell and Bickerstaff 1951). The same criterion of satisfactory stocking has previously been used (Haig and Cayford 1960).

⁵In this report "provincial plantations" means those established by the Manitoba Forest Service as part of the routine reforestation program for the province.

RESULTS

Table 1 is a summary table for provincial red pine plantations set out between 1949 and 1962. In addition to survival and growth data for the sampled plantations, establishment data for all plantations are included in order to indicate the scope of the red pine planting program. With the exception of 1961 (a severe drought year) planting was successful for each year and season of planting. Individual survival records are available for 45 of the 77 plantations, representing an acreage of 934 acres, or 87 per cent of the area planted during the period. Of this acreage, 784 acres or 84 per cent were satisfactorily stocked at the time of remeasurement. This is twice the level of success (42 per cent) achieved by the plantations set out between 1927 and 1946 (Haig and Cayford 1960).

Average heights of the plantations were about 1.6 to 2.0 feet at 5 years; Rudolf (1950) and Stiell (1955) indicate that this is average for red pine in the Lake States and Ontario. At the time of measurement current terminal growth of 4- to 6-year-old plantations was about one-half foot per year, while for those over 10 years of age it was about one foot. Dominant trees in the latter age class had leaders up to one and one-half feet long.

Excellent form and good general health were characteristic of the plantations, and it is expected that most of them will develop into valuable stands.

TABLE 1. SUMMARY OF PROVINCIAL RED PINE PLANTING 1949 TO 1962
SANDILANDS FOREST RESERVE

Establishment data (77 plantations)				Results (45 plantations)				
Year and season	Number of plantations	Number of trees planted	Area planted	Years after planting	Per cent survival	Average number trees/acre	Average height	Average* maximum height
			(acres)				(feet)	(feet)
1949 S	1	3,000	2	14	53	760	6.7	8.6
1950 S	1	2,200	2	13	65	860	4.8	7.0
1950 F	5	27,800	21	12	71	970	4.1	5.8
1951 S	13	112,500	77	12	76	910	4.0	5.9
1954 F	10	33,250	35	5	63	600	—	—
1955 S	10	71,050	73	5	69	670	—	—
1955 F	2	11,850	17	5	82	700	—	—
1956 S	5	87,850	99	5 and 7	48	430	2.2	3.0
1956 F	2	26,650	30	5	81	890	—	—
1957 S	1	9,600	7	6	83	1,200	1.5	2.2
1957 F	2	20,500	20	5	43	520	1.6	2.2
1958 F	6	90,900	86	4	56	610	1.1	1.9
1959 S	2	72,000	98	4	83	760	1.0	1.4
1960 S	8	146,000	141	3	59	540	0.9	1.1
1961 S	5	93,150	133	2	10	100	—	—
1962 S	4	175,200	233	1	72	880	0.5	0.6
S-spring								
F-fall	77	983,500	1,074					

*Average height of the tallest tree in each chain of the sample.

FACTORS THAT AFFECTED SURVIVAL AND GROWTH

Several factors were responsible for variations in the survival and growth of the plantations. However, as the report is based primarily on the results of a general survey of provincial plantations, there are only limited data available concerning the individual factors, and no statistical evaluation has been carried out. Thus, although the results must be interpreted with care, it is the opinion of the authors that they are representative for red pine plantations in southeastern Manitoba.

Rainfall

Precipitation during the first growing season after planting was the most important single factor affecting plantation survival (Table 2). In six of the eleven years of planting, May to September rainfall was above the long-term average of 12.8 inches, and the average survival of all plantings made in these years was 70 per cent. During four other years, May to September rainfall was between 10.4 and 11.6 inches and survival for these years of planting averaged 57 per cent. The summer of 1961 was one of the driest on record, with only 7.3 inches of rain during the May to September period. This was the only year in which red pine planting was almost a complete failure. Survival after one growing season averaged 87 per cent for plantations set out in years of above average precipitation, 79 per cent for those set out in years of slightly below average precipitation, and 10 per cent for those set out in 1961, when precipitation was only 60 per cent of normal.

Survival of the experimental plantings set out by the Department of Forestry agree closely with the overall results reported in Table 2. Average first-year survivals for planting on dry sites exceeded 70 per cent in 1954, 1955, 1957, 1960, and 1962, but averaged only 35 per cent in 1961.

TABLE 2. SURVIVAL OF PROVINCIAL RED PINE PLANTATIONS, 1949-1962, AND GROWING SEASON PRECIPITATION

Planting year and season	Per cent survival	May-Sept. precipitation* (inches)
1962 spring	72	22.0
1959 spring and 1958 fall	70	17.8
1950 spring	65	16.7
1957 spring and 1956 fall	82	16.1
1956 spring and 1955 fall	65	15.3
1955 spring and 1954 fall	67	14.1
1949 spring	53	11.6
1951 spring and 1950 fall	74	11.0
1957 fall	43	11.0
1960 spring	59	10.4
1961 spring	10	7.3

*Average of precipitation data for first growing season for the two closest weather stations, Winnipeg and Sprague. Long-term average is 12.8 inches.

The severe drought of 1961 caused mortality in plantations set out as early as 1954 (Table 3). In general, severity of damage decreased with age of plantation. However, the second highest losses occurred in 1958 plantations, particularly in several located on old fields with dense grass competition. There appeared to be little difference in mortality between dry and fresh sites.

TABLE 3. MORTALITY OF PROVINCIAL RED PINE PLANTATIONS DUE TO 1961 DROUGHT

Year and season of planting	Dry site	Fresh site
	Per cent mortality	
1954 fall	0.5	7.5
1955 spring	0	4.4
1955 fall	3.0	0
1956 spring	0.5	3.0
1957 spring	2.2	—
1958 fall	32.0	28.2
1959 spring	8.1	—
1960 spring	17.3	10.3
1961 spring	Approx. 90	—

Site

Site, as determined by soil moisture regime, had an important effect on plantation development as indicated in Table 4, which presents 5-year results from 1954 and 1955 experimental plantations and from plots located in provincial plantations. Average fifth-year survival on fresh sites (moisture regime 2-3) was 83 per cent, as compared with 68 per cent on dry sites (moisture regime 1). Survivals on fresh sites varied from 65 to 95 per cent, and on dry sites from 53 to 97 per cent. Availability of moisture plays an important role in plantation establishment, and survival is generally higher on fresh than on dry sites. However, site preparation on a dry site can conserve moisture and result in higher survival than on unprepared fresh sites.

Height growth of red pine showed considerable variation between sites. Five years after planting average height on the fresh sites was 1.9 feet, and on the dry sites 1.1 feet. Similarly, average top height was greater on fresh sites. There are indications that the relative differences in height growth between the two moisture regimes will continue to increase, as fifth-year increment averaged 0.5 feet for plantations on fresh sites as compared with 0.3 feet for dry-site plantations.

TABLE 4. SURVIVAL AND GROWTH OF RED PINE PLANTATIONS ON DRY AND FRESH SITES, SOUTHEASTERN MANITOBA (PROVINCIAL AND EXPERIMENTAL PLANTATIONS)

Planting data			Site	Survival per cent		Average height	Top* height (feet)	Height inc. (feet)
Year	Season	Method		1 year	5 years	5 years after planting		Fifth year
1954	Spring	Hand, scalps	Fresh	98	81	1.2	2.0	0.2
			Dry	74	62	0.8	1.6	0.2
1954	Fall	Hand, furrows	Fresh	98	95	2.7	4.0	0.7
			Dry	76	53	1.2	2.2	0.3
1955	Spring	Hand, scalps	Fresh	81	65	1.2	2.1	0.4
			Dry	72	59	1.0	1.7	0.3
1955	Spring	Hand, furrows	Fresh	99	92	2.6	4.3	0.7
			Dry	97	97	1.5	2.3	0.4
Average			Fresh	94	83	1.9	3.1	0.5
			Dry	80	68	1.1	2.0	0.3

*Top height based on the tallest 10 per cent of trees per plantation.

Site Preparation and Planting Method

Most provincial plantations were hand planted in furrows prepared by a Middlebuster fireline plough. Appreciable numbers were also planted by machine (principally the Lowther Standard Planter) while a few small plantations were set out by hand either in scalped spots or without any site preparation. The experimental plantations were planted by hand, in scalped spots, in ploughed furrows, and in unprepared ground.

In Table 5 comparisons are made of the survival of plantations established by different planting methods within a given planting year and season. In every instance the survival of trees hand planted in ploughed furrows was superior to that of trees hand planted on scalped spots or on unprepared ground, or planted by machine.

TABLE 5. PER CENT SURVIVAL OF RED PINE PLANTED BY VARIOUS METHODS
(PROVINCIAL AND EXPERIMENTAL PLANTATIONS)

Year	Season	Planting method				Basis-- no. of years after planting
		Machine	Hand (ploughed furrows)	Hand (scalps)	Hand (no preparation)	
1950	Fall	70	72			13
1951	Spring	42	74			12
1955	Spring	33	84			5
1955	Fall	76	88	61		5
1956	Spring		58		32	5-7
1960	Spring		67	30	39	3
1961	Spring		56		0	2
1962	Spring		98		95	1

The main reason for the superior performance of trees hand planted in ploughed furrows is considered to be the reduction in competition effected by furrowing. Ploughing with the Middlebuster plough creates a flat-bottomed furrow about 4 to 6 inches deep and about 1½ to 2 feet wide (Figure 1). Trees planted in the centre of this furrow are relatively free from competition from



Figure 1. Seedlings set out by hand in ploughed furrows. Note lack of competition.

minor vegetation for at least three years. All the other planting methods provide less effective protection from competing vegetation. In some instances, scalping knives on the planting machines bare a strip about 4 inches wide on each side of the planted seedlings (Figure 2); in others, the scalping knives are omitted and the trees are set directly into almost undisturbed sod. Where trees are hand planted in scalped spots the scalps are seldom as wide or deep as a ploughed furrow, and where trees are hand planted without ground preparation there is no reduction of competing vegetation (Figure 3).

On dry sites ploughing is considered beneficial chiefly because it reduces competition for available moisture. On fresh sites the moisture supply may not be as critical, but competing minor vegetation is heavy and can crush or smother small seedlings not protected by a furrow.

The survival of hand planting with no site preparation varied greatly between years, ranging from 0 to 95 per cent. The lowest survival occurred in the extreme drought year of 1961, and the highest survival in the very wet year of 1962, when May-September precipitation amounted to 22.0 inches (over 9 inches above normal). In 1956, although precipitation was 15.3 inches, hand planting with no site preparation was unsuccessful.

The drought year of 1961 showed that the beneficial effect of furrows extended through the second growing season after planting. In the furrows, 54 per cent of the trees planted in 1960 and living at the end of that season were still alive at the end of 1961, whereas for those planted without site preparation the comparable survival was only 42 per cent.



Figure 2. Seedlings planted by machine.



Figure 3. Site of a plantation set out by hand without ground preparation. Note competing vegetation.

Season of Planting

Although most plantations were set out during the spring, a few were made in the fall, and this provided an opportunity to assess another factor affecting plantation survival. Table 6 compares the survival of plantations made in the fall of one year with that of plantations made in the spring of the following year. (This comparison is considered more valid than a comparison between spring and fall plantings made in the same year.)

TABLE 6. PER CENT SURVIVAL OF RED PINE PLANTATIONS PLANTED IN FALL AND SPRING (PROVINCIAL PLANTATIONS)

Year	Fall	Spring
1950-1.....	72	77
1954-5.....	79	84
1956-7.....	81	83
1958-9.....	61	83
Averages.....	74	82

For comparable seasons survival of spring planting was higher than that of fall planting. However, in three instances the difference was 5 per cent or less while in the fourth instance it was 22 per cent.

The advantage of spring planting may be explained by the probability of better moisture conditions in the spring than in the fall. Spring planting is usually carried out in May, when the soil is still moist from snow melt. June is the month of heaviest average precipitation (3.1 inches) and if June rains are normal, new plantations have a good chance of success. On the other hand, fall plantings are made in September or October, when the soil is often drier than in the spring. Since October is a month of low average precipitation (1.5 inches) there may be a critical moisture shortage for newly planted seedlings. Of course, the amount and seasonal distribution of precipitation varies widely from year to year, and fall plantations may be successful. However, on the average, moisture is more likely to be abundant in the spring, and spring planting can be expected to show a higher percentage of survival than fall planting.

Biotic Factors

The plantations included in the studies appeared to have suffered relatively little damage from biotic factors. Only two agents were noted, white grubs and white-tailed deer. Only a few plantations were affected and even in these, stocking was not reduced below the accepted standard for a successful plantation.

Of the two agents, white grubs appeared to cause the more severe damage. They were noted as the major cause of mortality and reduced height growth in at least four plantations. In one of these survival at the end of the first year was only 44 per cent. The effects of white grub damage are shown in the following data from two pairs of plantations for which all factors appeared to be similar except that one planting site in each pair supported a fairly high population of white grubs (Table 7).

TABLE 7. EFFECTS OF WHITE GRUB DAMAGE ON FIVE-YEAR SURVIVAL AND GROWTH OF RED PINE PLANTATIONS

Plantation	Grub damage	Per cent healthy	Per cent sickly	Average height (feet)
1	Yes	47	6	1.2
2	No	95	0	1.5
3	Yes	72	4	0.9
4	No	85	1	1.4

Damage was caused by white grubs feeding on the roots of the young trees, particularly during the first few growing seasons. Typically, it consisted of removal of some or all of the lateral roots and, in some cases, the tap root and main stem were stripped of bark also. Heavily damaged trees died, other lightly damaged ones survived, but they were noticeably sickly and their height growth was reduced. As a result of a study of white grub damage in Manitoba plantations, Warren and Hildahl (1963) suggested that it might be advisable to provide chemical protection as a routine procedure at the time of planting. Investigation of the white grub control problem is being undertaken by the Forest Insect Laboratory in Winnipeg and further information can be provided upon request.

Extensive deer browsing damage was noted in at least six plantations, and in one of these it was estimated that 80 per cent of the trees were affected. Damage consisted of removal of the leader and/or some of the upper lateral branches. Although mortality was not extensive, height growth was reduced and the multiple leaders typical of some browsed trees may reduce the ultimate value of the affected plantations. An indication of the effect of heavy browsing is

provided by data obtained from two of the heavily browsed plantations five years after planting. There, 49 per cent of the trees had been browsed. Of these 80 per cent had been terminally browsed and 20 per cent laterally browsed. The average height of undamaged trees and those only laterally browsed was 1.2 feet, while the average height of terminally browsed trees was 0.9 feet, indicating that browsing of the terminal leaders had been responsible for a small reduction in height growth.

SUMMARY AND CONCLUSIONS

Studies were made of the extensive red pine plantations set out by the provincial government in the period 1949 to 1962 on the Sandilands Forest Reserve in southeastern Manitoba. These studies were supplemented by data from small-scale experimental plantations made by the Federal Government.

Results from the provincial plantations indicate that, on the basis of 400 trees per acre representing satisfactory stocking, planting was successful on about 84 per cent of the total area. The only plantations that failed completely were those made in 1961, a year of severe drought. Although rainfall during the first planting season was the most important single factor affecting plantation success, other major factors were site, site preparation and planting method, season of planting, and biotic agents.

Survival and growth were generally better on fresh than on dry sites. Hand planting in ploughed furrows was more successful than machine planting or hand planting in scalps or where no site preparation was undertaken. Results of spring planting were somewhat superior to those of fall planting. White grubs and deer appeared to be the only damaging biotic agents, and the damage caused was seldom extensive.

These results support the main conclusions reached in the earlier study of plantations set out between 1931 and 1946 (Haig and Cayford 1960). Only 42 percent of the area planted in the earlier period was satisfactorily stocked, whereas for the area planted between 1949 and 1962 the level of success was 84 per cent. The poor performance of the earlier plantings was attributed largely to the severe drought of the 1930's and to the fact that all plantations were on dry, excessively-drained sandy soils. With the exception of 1961, moisture conditions during the period 1949 to 1962 were generally favourable, and in this period some plantations were established on fresh sites. These are considered to be the main reasons for the superior performance of the later plantations.

On the whole, all plantations appeared to be healthy, and most of them are expected to develop into valuable merchantable stands. While it is doubtful that the growth of red pine in Manitoba will equal that of the more central parts of its range, continued planting of the species appears fully justified.

SOMMAIRE ET CONCLUSIONS

Les auteurs ont procédé à une étude des vastes sapinières de pins rouges plantés par le gouvernement provincial entre 1949 et 1962 dans la Réserve forestière de Sandilands, située dans le sud-est du Manitoba. Cette étude a été complétée à l'aide de données obtenues dans des petites plantations expérimentales du gouvernement fédéral.

D'après les résultats de l'étude des plantations provinciales, où on avait planté 400 sujets à l'acre, ce qui représente une moyenne satisfaisante, le reboisement a réussi sur 84 p. 100 de la superficie totale de reboisement. Seules les plantations faites en 1961, année de grande sécheresse, n'ont aucunement survécu. Bien que les pluies abondantes de la première saison de plantage aient contribué pour beaucoup au succès obtenu, d'autres facteurs importants sont intervenus, notamment le milieu, la mesure de préparation du terrain, la méthode de plantage, la saison choisie et les facteurs biologiques.

La survivance et la croissance furent meilleures dans les stations fraîches que dans les stations sèches. Le plantage à la main dans des sillons de charrue a mieux réussi que le plantage à la machine ou à la main dans les scalpements ou les endroits non préparés. Le plantage printanier a un peu mieux réussi que le plantage automnal. Les vers blancs et les chevreuils ont semblé être les seuls facteurs biologiquement nuisibles, et les dégâts qu'ils ont causés ne furent d'ailleurs pas bien graves.

Les résultats de la présente étude corroborent les conclusions auxquelles on était arrivé à la suite de l'étude des plantations entreprises de 1931 à 1946 (Haig et Cayford, 1960). Seulement 42 p. 100 de la superficie des plantations précédentes étaient peuplées de façon satisfaisante, tandis que les plantations faites de 1949 à 1962 ont réussi dans la proportion de 84 p. 100. La maigre réussite des premières plantations a été attribuée à la forte sécheresse qui a sévi durant les années trente, et aussi à la sécheresse des sols drainés à l'excès où on avait fait la plantation. A l'exception de l'année 1961, l'humidité fut favorable à la survie des plants de 1949 à 1962, et en outre plusieurs de ces plantations ont été faites en sol frais. Ce sont là les principales raisons auxquelles on attribue la réussite des plantations récentes.

Dans l'ensemble, toutes les plantations avaient l'air saines et on prévoit que la plupart d'entre elles se développeront au point de devenir des peuplements de grande valeur marchande. Bien qu'il soit douteux que la croissance du pin rouge au Manitoba puisse jamais égaler celle qu'il atteint dans la zone centrale de son habitat, il semble qu'on serait bien fondé de continuer à planter cette espèce dans la province.

APPENDIX

Common and Botanical Names of Plant Species Mentioned in Text

Bearberry.....	<i>Arctostaphylos uva-ursi</i> (L.) Spreng.
Blue-stem, big.....	<i>Andropogon gerardi</i> Vitman
Cherry, pin.....	<i>Prunus pensylvanica</i> L.f.
Fern, bracken.....	<i>Pteridium aquilinum</i> (L.) Kuhn
June-grass.....	<i>Koeleria cristata</i> (L.) Pers.
Mountain-rice, rough.....	● <i>Oryzopsis asperifolia</i> Michx.
Pine, jack.....	<i>Pinus banksiana</i> Lamb.
Pine, red.....	<i>Pinus resinosa</i> Ait.
Poverty-grass.....	<i>Danthonia spicata</i> (L.) Beauv.
Reed-grass, northern.....	<i>Calamagrostis inexpansa</i> A. Gray
Rose.....	<i>Rosa acicularis</i> Lindl.
Snowberry.....	<i>Symphoricarpos Albus</i> (L.) Blake
Willow, prairie.....	<i>Salix humilis</i> Marsh.

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