

SURVIVAL AND GROWTH OF SOME PAPERPOT

SEEDLING PLANTATIONS IN QUEBEC

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Abstract.--Survival, growth, rabbit damage and hardwood competition in 20 FH 408 paperpot container plantations of conifers established in Quebec from 1974 to 1979 were studied in the summer of 1980 on 340 1/100-ha plots. Survival and growth were as good as or better than those reported recently for other such plantations in eastern Canada.

Résumé.--La survie, la croissance, les dégâts causés par les lapins et la concurrence des feuillus dans 20 plantations de semis de conifères en tubes de papier FH 408, établies au Québec de 1974 à 1979, ont été étudiés pendant l'été 1980 dans 340 placettes d'un hectare chacune. La survie et la croissance étaient égales ou supérieures à celles qui ont récemment été observées dans d'autres plantations de ce genre, dans l'est du Canada.

INTRODUCTION

The use of containerized seedlings in Canada has increased dramatically since the early 1970s, from 16 million seedlings or 8% of all planting stock in 1971, to 124 million seedlings or 35% of the total in 1980 (Smyth 1980). Quebec declined to embrace any of the container systems being refined and undertook to develop its own system based on an extruded cylinder of peat with a biodegradable paper container (Bonin 1972).

Since the inception of development work, research by the provincial government and the Laurentian Forest Research Centre (LFRC) has concentrated on solving problems associated with paper quality, container size, peat extrusion, and greenhouse production techniques.

Until recently, very little research had been carried out in Quebec on the performance of outplanted containerized seedlings. Consequently, in May 1980, LFRC initiated research in container plantations. This report presents the results of a 1980 study of 20 container plantations, 15 of which are

on freehold land of Consolidated-Bathurst Inc. at Grand'Mère. With a few exceptions, survival and growth have been comparable with those recently reported for eastern Canada (Carrier and Bissonnette 1980, Forcier 1980, Marceau 1980).

DESCRIPTIONS OF PLANTED AREAS

1. Grand'Mère

The container plantations at Grand'Mère were planted following clearfelling of white spruce (*Picea glauca* [Moench] Voss) and Scots pine (*Pinus sylvestris* L.) plantations that had been established on abandoned farmland between 1913 and 1932. Surface soils are mostly excessively drained, loamy, fine sands of poor productivity underlain by 5 m deposits of coarse sand over impervious blue clay (Gagnon 1969). Pockets of richer surface soil are scattered throughout the plantations and on these soils deciduous trees have become established and are growing faster than planted conifers. Where the dominant competition is trembling aspen (*Populus tremuloides* Michx.), the company is reducing this competition by felling aspen with Brush-master mechanical saws.

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Except for the 1974 plantings, all sites were prepared for planting with a Bracke scarifier. FH 408 paperpot seedlings were planted in spring with a Pottiputki at the top of soil scalps near the junction of the organic and mineral soil horizons. By far the most frequently planted species is jack pine (*Pinus banksiana* Lamb.), followed by Scots pine, black spruce (*Picea mariana* [Mill.] B.S.P.) and European larch (*Larix decidua* Mill.).

2. Pembina

Four plantations were established near Pembina Depot, 75 km northwest of Grand Mere, in 1974 (three jack pine, one Scots pine) following clearfelling of mature jack pine stands. Soils are of fluvio-glacial origin and consist of varying depths of medium sand overlying bedrock. Slopes range from nil to gentle and drainage is excessive. The almost total lack of competing vegetation six years after planting suggests that these sites are poorer than those at Grand Mere. Two of the four study stands were scarified with the Bracke prior to spring planting of FH 408 paperpots.

3. Dolbeau

In 1975 jack pine seedlings in FH 408 paperpots were planted on a level site 80 km north of Dolbeau on fluvio-glacial deposits of medium sands overlying bedrock. Drainage is excessive and the humus horizon is almost nonexistent as a result of the burning of logging slash from the parent jack pine stand in 1962. Without doubt this was the poorest site studied; vegetation is limited to cladonia mosses, a few lichens and some patches of *Vaccinium* spp.

STUDY METHODS

At Grand Mere, the long narrow farms, typical of much of Quebec, influenced both the planting row direction and the study method. The original plantations that are being replanted with containerized stock were established on a farm lot basis and subsequently are being harvested on the same basis, usually with the main haul road running lengthwise down the middle of the lot or farm. In turn, scarification was carried out lengthwise on the lots, parallel to the main haul roads, in order to avoid the necessity for making frequent turns.

To sample as many plantations as possible, contiguous 1/100 ha sample plots (4 m x

25 m) were established along cruise lines whose starting points were established at random along the main haul road. Plot lines were run across the scarification rows because preliminary sampling strongly suggested that plots on lines parallel to the scarifier direction were overestimating stocking.

For each plot, the following information was recorded: species planted, survival, number of living seedlings damaged by rabbit browsing, and, on one half of the plot, the total height (nearest cm) of each planted seedling. Each sample plot was classified by ocular estimate into three vegetation competition classes: light, medium and dense. In the 20 plantations studied, 340 plots were established. Data were compared by analysis of variance.

RESULTS AND DISCUSSION

Seedling survival has been excellent up to five years after planting (Table 1). Only one 1976 larch plantation and a 1977 white pine (*Pinus strobus* L.) plantation did not have acceptable levels of stocking. In both plantations the soils were better than average, and competition from shrub and herbaceous vegetation was greater; consequently rabbits were numerous and damaged almost every white pine, and nine of ten larch (Table 1).

At Grand Mere, rabbit damage was serious. In three 1978 plantations 23% of the Scots pine, 36% of the jack pine and 25% of the larch were damaged, although few seedlings were killed (Table 1). Damage consisted of severed leaders, which resulted in multi-leadered seedlings, or severed lateral branches, which reduced subsequent height growth. Both types of damage seldom occurred on the same seedling. In two other 1978 plantations, damage was very light.

Height growth of the four main species was excellent, and five years after planting the annual average growth rate of undamaged trees varied from 25 to 55 cm. However, the rabbit-damaged trees have not done nearly as well (Fig. 1).

Efforts to relate conifer height growth to shrub and hardwood competition were unsuccessful (Table 2). Similarly, an analysis to relate degree of rabbit damage to year of planting (age) and degree of competition (rabbit habitat) also failed to reveal any consistent relationships (Table 3).

Table 1. Seedling survival and incidence of rabbit damage in spring plantations of FH 408 paper-pots in Quebec, 1980.

Location	Year of planting	Surviving trees per ha (1980)	Percent survival by species				
			Scots pine	Jack pine	White pine	European larch	Black spruce
Grand'Mère	1976	1940	88(10) ^a	85(22)	-	-	-
		1945	-	90(3)	-	-	-
		1320	-	-	-	65(90)	-
	1977	2218	94(16)	-	-	-	-
		1820	-	93(12)	-	-	-
		993	-	-	50(97)	-	-
	1978	2642	-	98(36)	-	-	-
		2640	-	-	-	-	99(2)
		2317	91(23)	-	-	96(25)	-
		2410	96(3)	-	-	-	-
	1979	2125	92(1)	-	-	-	-
		2183	-	88(1)	-	-	-
		1595	-	-	-	-	67(<1)
		2300	-	-	-	92(10)	89(2)
Average all years and plots ^b			93(8)	90(15)	48(97)	78(42)	80(1)
Pembina	1974	1740	-	70(9)	-	-	-
		1346	73(0)	-	-	-	-
Dolbeau	1975	1675	-	81	-	-	-

^aPercentage of living trees damaged by rabbits given in parentheses

^bCalculated on the basis of 1/100 ha plots

Table 2. Seedling heights by year of planting and competition class, Grand'Mère, 1980.

Year planted	Height ^a (cm) by species and competition class ^{b,c}											
	Black spruce			European larch			Jack pine			Scots pine		
	L	M	D	L	M	D	L	M	D	L	M	D
1974	-	-	-	74	111	-	-	<u>223</u>	<u>179</u>	-	-	-
1976	-	-	-	<u>97</u>	<u>72</u>	-	134	115	91	77	-	101
1977	-	-	-	-	-	-	108	<u>92</u>	<u>86</u>	<u>71</u>	<u>74</u>	-
1978	-	<u>35</u>	<u>31</u>	-	-	50	36	<u>47</u>	<u>50</u>	<u>44</u>	<u>47</u>	<u>45</u>
1979	-	20	26	<u>21</u>	<u>22</u>	-	27	23	-	<u>21</u>	<u>21</u>	-

^aUndamaged trees only

^bL = light, M = moderate, D = dense

^cMeans underlined by the same line are not significantly different at 5% level

Table 3. Incidence of rabbit-damaged trees, by competition class and year of planting, Grand'Mère, 1980.

Competition class	Percentage of damaged trees by year of planting, all species ^a					All years ^{b,c}	Jack and Scots pine ^c	European larch and Black spruce ^c
	1974	1976	1977	1978	1979			
Light	0	26	12	26	1	17	8	57
Moderate	24	44	15	13	5	22	19	27
Dense	-	34	28	15	1	12	17	6

^aMeans underlined by same line are not significantly different at 5% level

^bCalculated on the basis of 1/100 ha plots

^cMeans bordered by the same line are not significantly different at 5% level

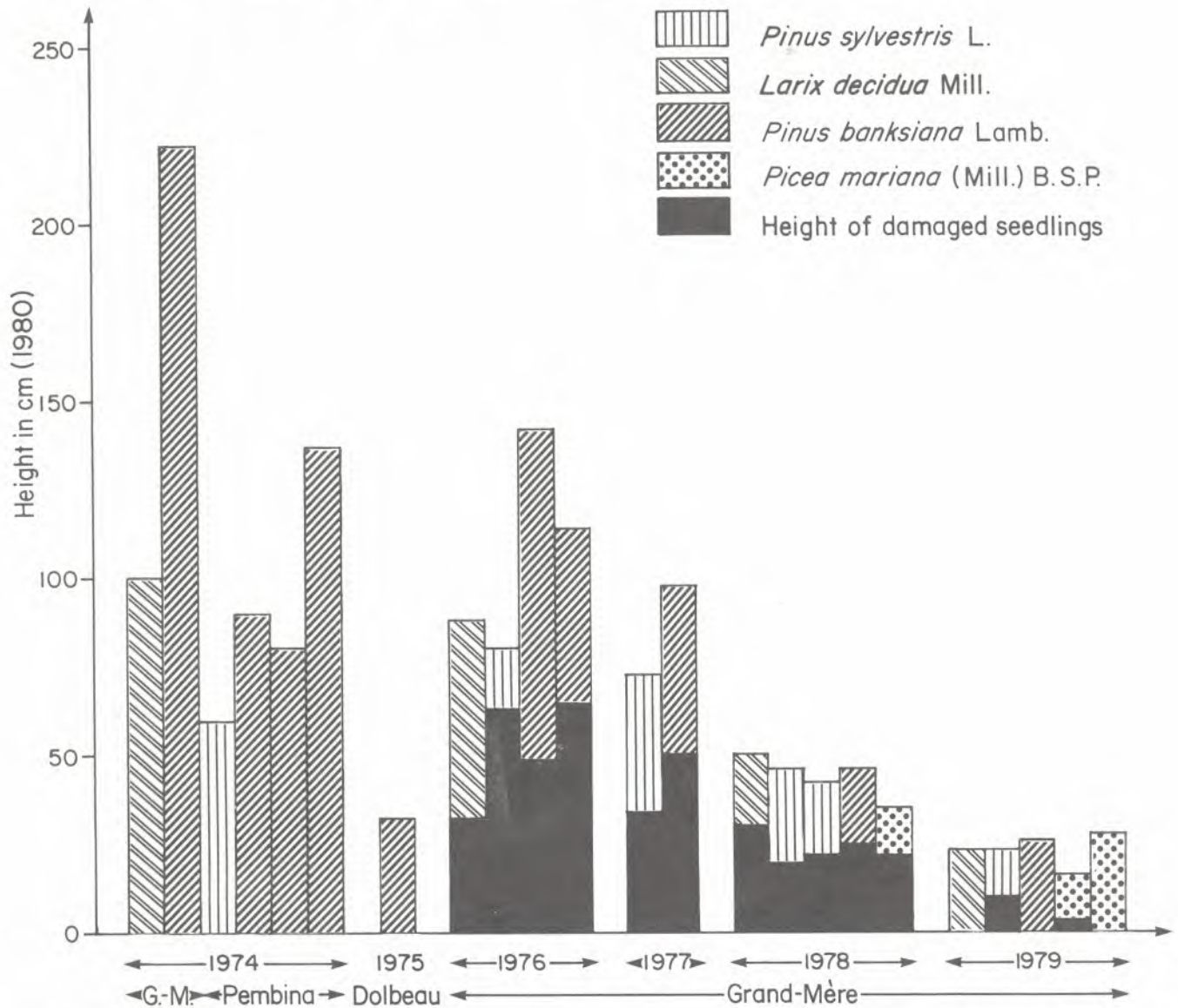


Figure 1. Height of rabbit-damaged and undamaged paperpot seedlings by species and year of planting, 1980.

In each of the three areas several containerized and natural seedlings were excavated and their roots were examined. Without exception the paperpot seedlings had balled and spiralled roots with tissue fusion occurring after five years. None of the natural seedlings exhibited similar characteristics.

In conclusion, the data show that survival and height growth of jack and Scots pine grown in FH 408 paperpots have been excellent up to five years after outplanting. However, there are two causes for concern: 1) the frequency and degree of damage caused by rabbits, and 2) the balled root system produced by containers that do not degrade in these sandy soils within five years.

There is little doubt that frequency and degree of rabbit damage are related to vegetation density but the 1/100 ha plot was too large a study unit to reveal the relationship. Smaller permanent sample plots wherein individual trees are followed need to be established. These same plots will also permit quantification of the effect of competition on height growth and assessment of the long-term effects of balled roots on tree survival and stability.

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