

FIELD PERFORMANCE OF PINE AND SPRUCE REARED IN
THE BC/CFS STYROBLOCK - ALBERTA

by

N. R. Walker and H. J. Johnson

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5320 - 122 STREET
EDMONTON, ALBERTA, CANADA
T6H 3S5

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ABSTRACT

The Styroblock concept of container-reared seedlings was introduced in Alberta in 1970 with a pilot scale trial of rearing and field planting to assess greenhouse-culturing and field performance of western white spruce (Picea glauca (Moench) Voss var. albertiana (S. Brown) Sarg.), lodgepole pine (Pinus contorta Dougl. var. latifolia Engelm.) and jack pine (Pinus banksiana Lamb.). The rearing program resulted in the production of relatively large, hardy and well-balanced seedlings considered necessary for Alberta conditions. The third-year field assessment demonstrated favourable survival and growth rates with minimal problems of frost heaving.

RÉSUMÉ

L'idée du Styroblock (type de potet à semis) fut conçue en Alberta en 1970. On produisit un petit nombre de semis dans ces potets et ils furent ensuite plantés sur le terrain après évaluation de rendement en serre. Les espèces essayées furent l'Épinette de l'Alberta (Picea glauca (Moench) Voss var. albertiana (S. Brown) Sargent), le Pin de Murray ou lodgepole (Pinus contorta Dougl. var. latifolia Engelm.) et le Pin gris (Pinus banksiana Lamb.). Il s'ensuivit des semis relativement gros, rustiques et bien balancés, états nécessaires pour la réussite en Alberta. Une évaluation au bout de trois ans fournit la preuve que les plants ont bien survécu, que leur taux de croissance est bon, et qu'il y a peu de soulèvement par la gelée.

INTRODUCTION

Operational planting of container reared seedlings commenced in Alberta in 1965 with the planting of 200,000 seedlings in the Ontario-type 3/4" split plastic tube by North Western Pulp and Power Ltd. (Ferdinand 1972). After some experimental work the Alberta Forest Service began its operational container planting program in 1967, planting 238,000 seedlings in tubes. By 1970 over 2.3 million containerized seedlings had been planted by industry and the Alberta Forest Service (Anon. 1970). Although first year evaluations were encouraging (Johnson and Marsh 1967), the third and fifth year assessments showed a continuing decline in survival and slow growth (Johnson 1972). These two problems eventually caused North Western Pulp and Power and the Alberta Forest Service to abandon this container. In view of the poor results with the Ontario-type tube the BC/CFS Styroblock (Kinghorn 1970) was introduced and a trial rearing and planting study was begun in 1970 to evaluate greenhouse-culturing and the field establishment and growth of seedlings reared in these containers.

METHODS

To evaluate the field performance of Styroblock-reared seedlings it was decided to outplant them adjacent to performance trials of seedlings reared in the Ontario-type tubes planted during the same year. Seedling size for the two systems was different due to the longer rearing period of the BC/CFS Styro-plugs. However, the true comparison is between the success of the two systems in the field over a period of time. It is considered that stock reared for the Ontario-type tube

trial was of good quality. Similarly the Styroblock seedlings used were vigorous.

Styroblock seedlings were reared for a ten-week period in the Northern Forest Research Centre greenhouses and then transferred to outdoor cold frames for a further eight weeks. Approximately 2,500 seedlings consisting of western white spruce (*Picea glauca* (Moench) Voss var. *albertiana* (S. Brown) Sarg.), lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) and jack pine (*Pinus banksiana* Lamb.) were reared and about 500 were planted in each of five forest districts of Alberta (Lac La Biche, Peace River, Slave Lake, Whitecourt and Edson). The Ontario-type tubes which were used on an operational basis in Alberta had a rearing period of four weeks in the greenhouse with a hardening-off period of four weeks (Carman 1967).

The Ontario-type tubes were planted during the spring and summer and the Styro-plug seedlings during August and September of 1970. Planting in all regions with the exception of Lac La Biche was on scarified strips under mature spruce-aspen (*Populus tremuloides* Michx.) stands or on recent cutovers. The Lac La Biche plantings were on an unscarified abandoned farm field with a heavy grass cover. In this location western white spruce in sausage-type containers (Mitchell, Hocking and Kay 1972) with the thin-walled tubular polyethylene casing left intact were also planted and served as additional comparisons.

The Styroblock cavity is 4-1/2 inches long tapered to .07 inches per inch of length with a top diameter of 1 inch and a bottom opening of .375 inches. The rooting volume is 2-1/2 cubic inches and

the seedling is planted in a plug form without the root-restricting container. The Ontario-type split plastic tube used in this study, 3/4 inch diameter and 3-1/4 inches long, has a rooting volume of 1-1/2 cubic inches and the seedling is planted with the tube still intact. The Research Council of Alberta peat sausage is 1 inch in diameter, 3 inches in length and has a rooting volume of 2-1/2 cubic inches. Under present planting procedures the polyethylene casing is removed from the plug prior to planting.

When planted, the average heights of the Styro-plug seedlings were 4.1, 5.0 and 5.0 inches, respectively for jack pine, lodgepole pine and white spruce. Johnson (1972) has reported average pre-planting heights of only 1.1 inches for both pine and spruce reared in the Ontario-type tubes for the North Western Pulp and Power container planting program carried out between 1965 and 1967. The smaller size of the tube stock is a reflection of the much shorter rearing period and smaller container volume.

RESULTS

Survival

All species reared in the various containers showed acceptable survival after three growing seasons (Figure 1). Spruce survival ranged from 60 to 98 percent. Pine survival, with the exception of lodgepole pine at Peace River, ranged from 61 to 90 percent. In the Peace River Forest the pine and spruce Styro-plugs were 100 and 67 percent browsed by rabbits in the year following planting and this was an important factor affecting survival. In the Lac La Biche district the pine and spruce Styro-plugs were 20 and 16 percent browsed, respectively, after the first year.

Height

Western white spruce heights within the Styro-plugs varied from 4.6 to 9.7 inches after three years, those within the Ontario-type tubes varied from 2.6 to 7.2 inches (Figure 2). Lodgepole pine heights in the Styro-plugs varied from 4.7 to 12.4 inches while the single area planted with the Ontario-type tubes showed a height of 3.1 inches after three years.

Jack pine Styro-plugs at the Lac La Biche location had an average height of 13.9 inches. Western white spruce sausage and Ontario-type tubes at this location averaged 4.1 and 3.8 inches respectively; the Styro-plugs averaged 9.1 inches. Seedlings of each container system from this district are shown in Plate 1.

Shoot and root weights and shoot/root ratios for planting stock immediately prior to planting and three years after are shown in the appendix.

Frost Heaving

Frost heaving of the Ontario-type tube was a problem with a total of 19 percent of the tubes heaved. Only two percent of the Styro-plug seedlings were heaved. Forty-one percent of the sausage seedlings at Lac La Biche were heaved to some extent. The retention of the tubular polyethylene casing is believed to have had a significant effect. Mitchell and Kay (1972) have reported similar findings.

CONCLUSIONS

Ferdinand (1972) in co-operation with the Canadian Forestry Service prepared a list of initial specifications for greenhouse quality and field performance of container reared seedlings necessary for planting on the North Western Pulp and Power limits. These specifications are listed below:

- 1) rooting volume of container: minimum 2 cubic inches,
diameter of container: minimum 1 inch,
length of container: minimum 3-1/2 inches;
- 2) total dry weight: 200-300 mgs. at time of planting;
- 3) top to root ratio: between 1.0 and 2.0 at time of planting;
- 4) hardening off to take place to woody stem stage;
- 5) no physical restriction on root development following planting;
- 6) resistance to frost heaving;
- 7) survival 80 percent or better after two years;
- 8) growth rates to equal or better those of natural seedlings of same age.

The larger rooting volume, 2-1/2 cubic inches, of the Styroblock container together with a longer rearing and hardening off period of ten and eight weeks respectively produced a larger, faster growing and better balanced seedling. The rearing program satisfied the above specifications 1 to 5 and after three years the Styro-plugs displayed favourable survival and growth rates with a high resistance to frost heaving.

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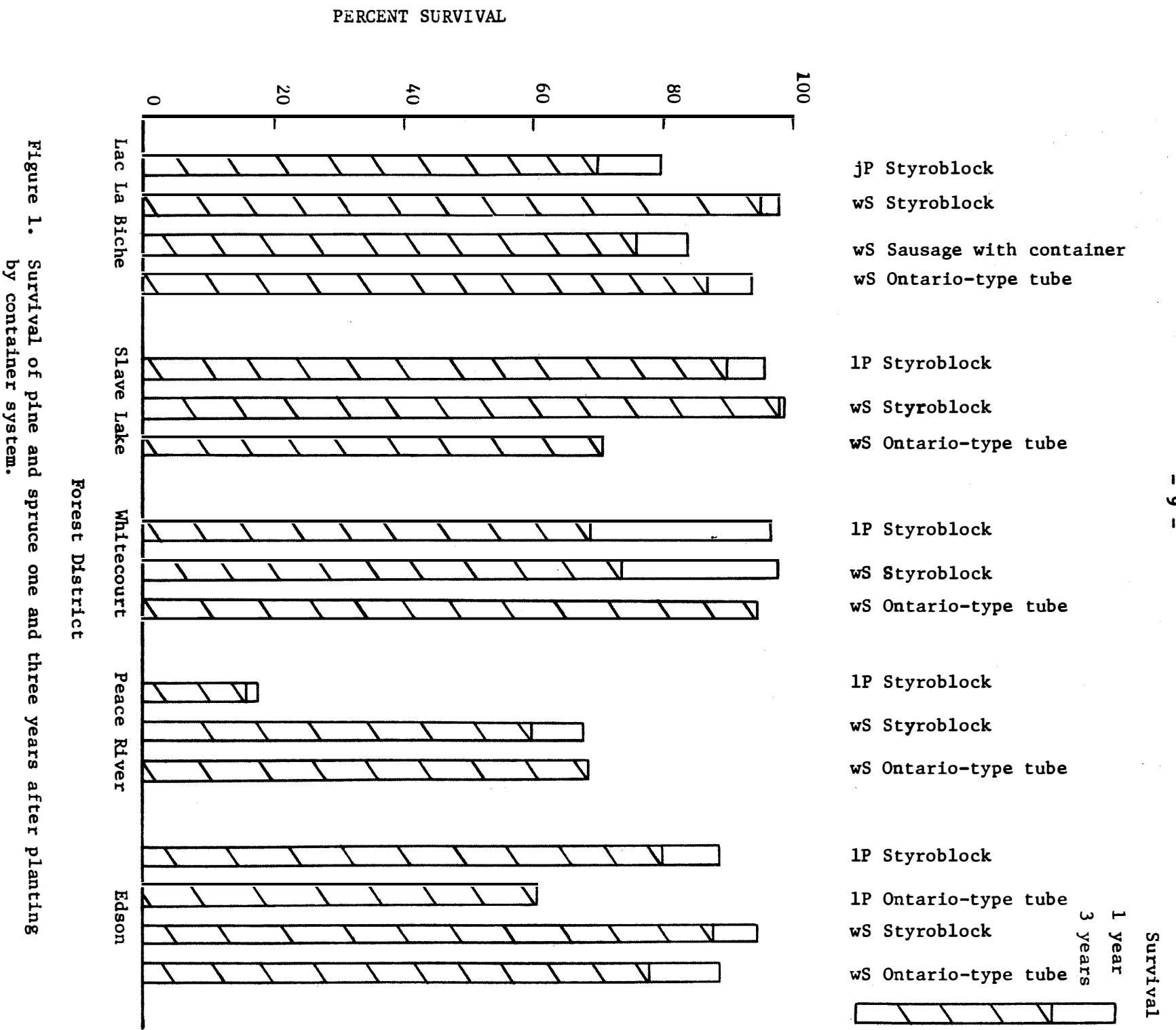


Figure 1. Survival of pine and spruce one and three years after planting by container system.

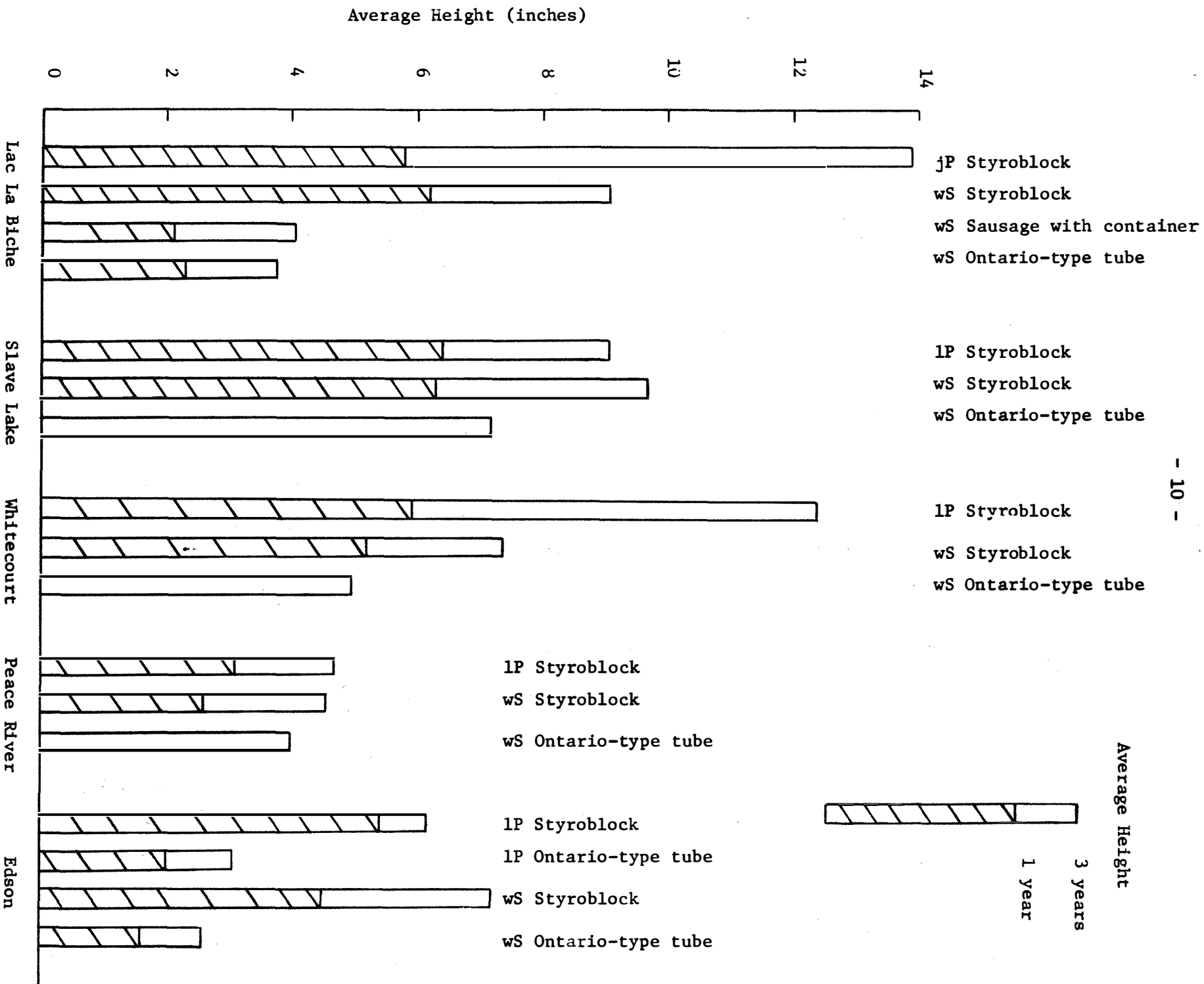


Figure 2. Average heights of pine and spruce one and three years after planting by container system.



Plate 1. Container seedlings three years after outplanting.
1. White spruce, Sasuage plug with polyethylene casing.
2. White spruce, Ontario-type tube.
3. White spruce, Styro-plug.
4. Jack pine, Styro-plug.

Note: The Styro-plugs do not display the entire root system due to extraction difficulties.

APPENDIX

Dry weights of the BC/CFS Styroblock and the Ontario-type split plastic tube containers prior to and three years after outplanting

District	Species	Container	Shoot wt (mg)		Percent increment	Root wt (mg)		Percent increment	Shoot/root ratio	
			(before planting*)	(3 years**)		(before planting)	(3 years)		(before planting)	(3 years)
Lac La Biche	jP	Styroblock	464	5094	998	211	776****	268	2.20	6.56
	wS	Styroblock	417	2218	431	123	554	349	3.39	4.00
	wS	Sausage w. container	NM***	212		NM	42			5.04
	wS	Ontario tube	NM	137		NM	54			2.54
Slave Lake	1P	Styroblock	441	4046	817	215	1190****	454	2.05	3.40
	wS	Styroblock	401	4074	917	130	834	543	3.08	4.88
	wS	Ontario tube	NM	2078		NM	357			5.82
Whitecourt	1P	Styroblock	363	12280	3280	242	2210****	814	1.50	5.56
	wS	Styroblock	375	3736	897	119	694	485	3.15	5.38
	wS	Ontario tube	NM	1443		NM	447			3.23
Peace River	1P	Styroblock	349	1272	264	198	400****	102	1.76	3.18
	wS	Styroblock	342	1146	235	120	426	254	2.85	2.69
	wS	Ontario tube	NM	962		NM	288			3.34
Edson	1P	Styroblock	363	2280	528	226	826	265	1.61	2.76
	1P	Ontario tube	NM	1787		NM	487			3.67
	wS	Styroblock	374	2666	613	111	746	570	3.37	3.57
	wS	Ontario tube	NM	268		NM	152			1.76

* Average of 20 seedlings

NM *** No measurements

** Average of 5 seedlings

**** Less than true weight due to difficulty of extracting entire root system