Field Performance of Five Interior Spruce Stock Types with and without Fertilization at Time of Planting[1]

Craig Sutherland[2] and Teresa Newsome[3]

Abstract.--The purpose of this experiment was to compare the initial field performance of interior spruce seedlings by container size, root pruning, and fertilization at time of planting. Increasing the container size significantly improved seedling performance after five growing seasons. Mechanical or chemical root pruning and fertilization at time of planting made no significant improvements to seedling performance.

INTRODUCTION

Field performance of spruce seedlings is a concern to both nurserymen and foresters because of the inherent slow initial growth of spruce and the fact that most spruce sites are prone to invasion of non-crop vegetation. The Cariboo Forest Region is no exception. A study concerning plantation performance in the Cariboo found that both bareroot and small container (PSB 211) spruce obtained an average height of only 50 cm after five growing seasons (Vyse, 1981). Many spruce plantations quickly get chocked out by such species as fireweed (Epilobium angustifolium) which restrict light availability, nutrient and water uptake and cause mechanical damage to seedlings through vegetation press. If spruce could compete more effectively with non-crop vegetation by initially being larger in height and caliper and by exhibiting faster growth responses one would expect the seedlings would be at a competitive advantage to the brush.

The objectives of this experiment were to 1) compare the early field performance of five experimentally produced containerized stock types; 2) assess the effects of root pruning; and 3) assess the effects of slow-release fertilizer applied at the time of planting.

This trial was established in four Forest Regions of British Columbia. The results presented in this paper are from the trial estabished in the Cariboo Forest Region.

METHODS

The trial was established on a recently burned clear cut in the Cariboo Forest Region, situated in the interior of British Columbia. The site was classified according to the Biogeoclimatic Classification System (Coupe' and Yee, 1982) as the Interior Cedar Hemlock (h) Subzone with an elevation of approximately 950 m.

The trial was established as a split-plot design with fertilizer as the main plot factor and stock type as the split-plot factor. Four blocks were established on the site.

Five different stock types of British Columbia interior spruce (Picea lg auca x engelmannii) were grown at the Ministry of Forests' North road Lab in 1980, in Victoria, B.C. by A.N. Burdett in 1980 (table 1).

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2Craig Sutherland, Forest Science Officer, British Columbia Ministry of Forests, Cariboo Forest Region, Williams Lake, B.C. V2G 1R8

3Teresa Newsome, Research Silviculturist, British Columbia Ministry of Forests, Cariboo Forest Region, Williams Lake, B.C. V2G 1R8

Table 1.--Five stock types of British Columbia interior spruce

Stock Type	Root Pruning
CBR 1010 1+0 1	Boxed (Mechanical)
PSB 615 1+0 2	None
PSB 415 1+0	Copper (chemical)
PSB 415 1+0	None
PSB 313 1+0	None

1 Container grown bareroot from a (10 x 10 x 10 cm boxed container)

2 Plug Stryro Block container

Forty grams of Osmocote fertilizer (18-6-12) was placed in a 15 cm radius around the base of each seedling at the time of planting. One half of each stock type was fertilized and the other half left as a control.

All seedlings in the five stock types by two fertilization treatments were monitored at the end of each growing season for seedling survival, total height (cm), leader growth (cm), stem diameter (mm), condition and for vegetation cover. An ANOVA was used to analyze the data.

RESULTS AND DISCUSSION

Stock Type Seedling Survival

Seedling survival was excellent across all treatments after five growing seasons. There were no significant differences between average treatment survivals which ranged from 94 to 96%.

Seedling Height Growth

The PSB 615 and CBR 1010 stock types were significantly taller than the other stock types when planted and they have been able to maintain this height superiority for five growing seasons (fig. 1). The total heights of the PSB 615 and CBR 1010 container seedlings after five years were close to one meter in height which was higher than the competing non-crop vegetation. These averages are significantly taller than the 70 to 80 cm heights obtained by the other three stock types which were still competing strongly for light with the non-crop vegetation.

This height superiority can be further illustrated by looking at relative growth rates (fig. 2). Relative growth rate (R.G.R.) is a comparison of a stock types total seedling height and its previous year's height. Relative growth rate is expressed by the slope of each line. Since each stock types R.G.R.'s have parallel slopes, this would indicate that the larger stock types (PSB 615, CBR 1010) are maintaining height superiority. The taller stock types are producing taller terminal leaders and are reaching a free growing state sooner than the shorter stock types.

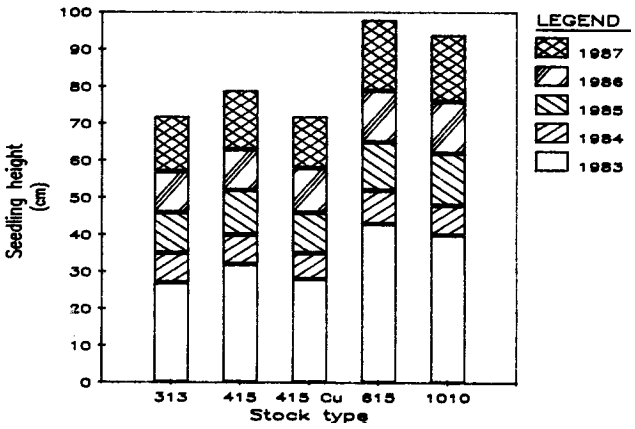

Figure 1.--Total seedling height of five interior spruce stock types by growing season.

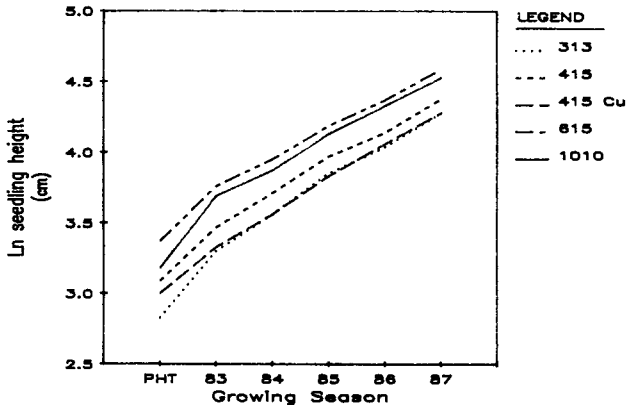

Figure 2.--Relative height growth rate of five interior spruce stock types.

Seedling Diameter Growth

The PSB 615 and CBR 1010 stock types were significantly larger in diameter than the other stock types when planted and they have also been able to maintain a diameter superiority for five growing seasons (fig. 3). The total diameters of the PSB 615 (28 mm) and CBR 1010 (25 mm) seedlings are significantly larger than the 19 to 22 mm diameters produced by the other three stock types. The taller stock types are now receiving increasing amounts of light and so are able to allocate more carbohydrates to the root systems which directly increases diameter growth.

Again this diameter superiority can be further illustrated by looking at relative growth rates (fig. 4). Since the slopes of the lines are parallel the R.G.R.'s are comparable. The larger stock types which have larger root collar diameters are becoming more resistant to vegetation press than the smaller stock types.

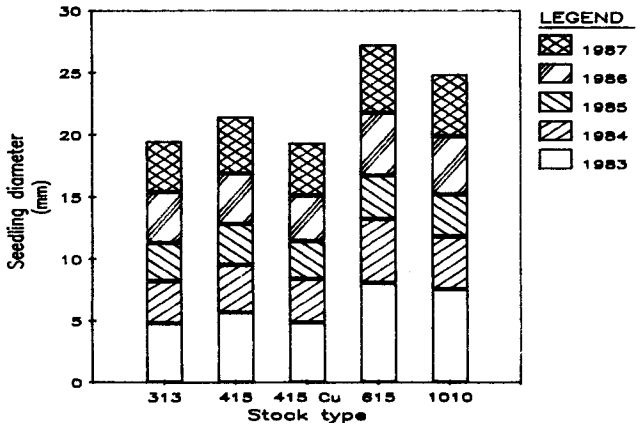

Figure 3.--Total seedling diameter of five interior spruce stock types by growing season.

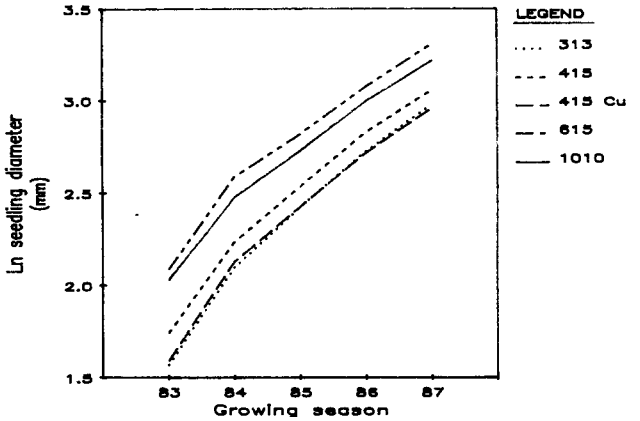

Figure 4.--Relative diameter growth rate of five interior spruce stock types.

Fertilization

Osmocate fertilization produced an irregular response but overall it did not significantly improve seedling height or diameter growth. Brockely (1988) stated that response to fertilization has not been consistent in the past. This study confirms his statement by identifying treatment response irregularities between the four blocks (fig. 5 and 6). Although this study was not designed to test site differences, the data suggests that the better growth responses to the fertilizer treatment (Block 1 & 3) occurred on mesic sites and the poor growth responses (Block 2 & 4) occurred on submesic and subhygric sites respectively.

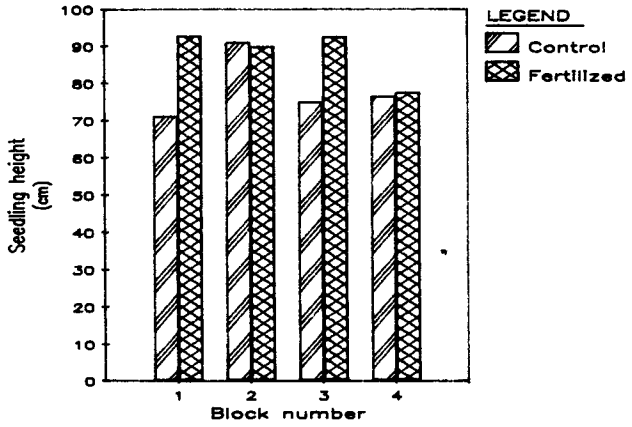

Figure 5.--Total seedling height of the fertilized and control treatments for all stock types within each block.

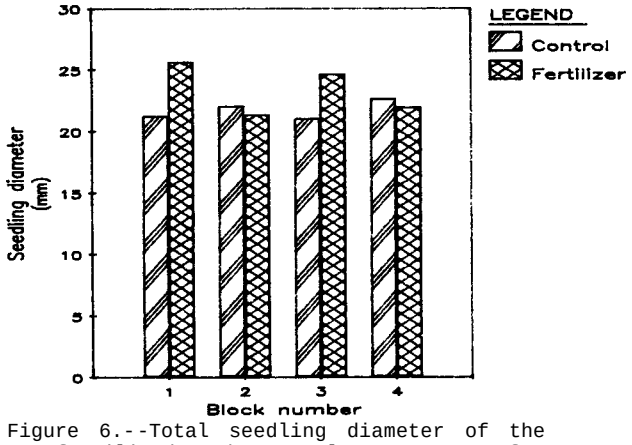

Figure 6.--Total seedling diameter of the fertilized and control treatments for all stock types within each block.

Root Pruning

The purpose of mechanical or chemical root pruning was to stimulate lateral root development in container plugs. The height and more importantly diameter growth responses indicate that the mechanical root pruning of the CBR 1010 stock and the chemical root pruning of the PSB 415 copper treated stock had little or no effect on seedling growth.

Insect Damage

Pissodes strobi (terminal spruce weevil) attacked approximately 10 percent of the PSB 415 and 615 and CBR 1010 seedlings and 5 percent of the PSB 313 and 415 CU seedlings. The attack has concentrated on the taller stock types and where the frequency of tall seedlings was high. This insect attack once again points out that seedlings reaching a height defined, free growing state may not necessarily be free to grow.

CONCLUSIONS

1. Seedling survival ranged from 94 to 96 percent across all treatments after five growing seasons.

2. The PSB 615 and CBR 1010 stock treatments produced significantly larger height and diameter growth responses than the PSB 415, 415 CU and 313 stock treatments.

3. Fertilization produced irregular results but generally did not improve growth response.

4. Mechanical or chemical root pruning had little or no effect on seedling growth response.

5. Pissodes strobi are attacking young seedlings and protection measures must be taken once seedlings have reached a free growing status.

ACKNOWLEDGEMENTS

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