Research Branch  
British Columbia Ministry of Forests  
Report Title and Approval Form  

Report Title  
WORKING PLAN

Project #  
E.S.946

Project Title  
Improving early growth after outplanting (SXP)

Experiment #  
.09

Experiment Title  
Fertilization of Interior Spruce at time of planting  
proposed operational trial

Report Title

Author(s)  
A.N. Burdett

Keywords  
Interior Spruce, Planting, Fertilization, Slow Release Fertilizer

Coding

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<thead>
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<tr>
<td>S. Willis</td>
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<td>Regional Research Silviculturists (5)</td>
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<td>P. Pollock</td>
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<td>District Managers Plant, Si</td>
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<td>L. Herny</td>
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<td>K.C. Jones</td>
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<td>A. Vyse</td>
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<td>S. Willis</td>
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Vault
Introduction

Results of Experimental Project 858 and others indicate that fertilizing interior spruce seedlings at the time of planting can double plant biomass within two years. Where seedling survival is jeopardized by rapidly encroaching competition, fertilizing newly planted stock may thus provide an effective means to improve plantation establishment success. Whether fertilization will prove to be more cost-effective than the use of larger stock depends largely on the cost of applying fertilizer operationally and this has yet to be determined. Often, however, the field forester can obtain only one type of stock for a particular site in which case the use of larger stock as an alternative to fertilization does not exist. It is proposed therefore that operational trials of fertilization at planting be conducted with interior spruce in a number of Districts. The trials will have three objectives: first to confirm experimental trial results under operational conditions; second to determine operational costs of fertilizing at planting; and third to assess the effect of enhanced growth due to fertilization on plantation establishment success and the cost per hectare of satisfactorily restocked land.

Participation

Regions (P.R. & P.G.) should select 2 Districts.

All Districts planting interior spruce are invited to establish a trial. Those wishing to do so should make known their interest to Steve Willis (Silviculture Branch, Victoria) who will coordinate the trials.

Installation, assessment and reporting

Trials will be installed and assessed by the District R.O. Silviculture in accordance with this working plan. Results should be reported to Steve Willis who will prepare interim and final reports on all the trials.

I suggest broad block application of tent. with controls.

\[ F + C \]

P.G. Region

14 + 11
Biological constraints

A substantial response by interior spruce to fertilization at planting has been observed only when stock with a high root growth capacity (RGC) is planted on well-prepared (weed-free) sites and a slow release fertilizer is used. Operational trials should only be considered therefore where these three conditions can be met.

Testing RGC of trial stock

Early growth of stock with a low RGC is usually checked by moisture stress not mineral nutrient deficiency. Hence fertilizing low RGC stock is generally unproductive. Thus, to ensure that operational fertilization trials have the best chance of success only tested stock, known to have a high RGC, should be used. To have stock tested, the R.O. Silviculture should notify Steve Willis well in advance what stock is to be used in the trial, where it is being produced and where it will be stored. The estimated trial planting date should also be indicated.

Steve Willis will arrange RGC tests on samples of the trial stock within 6 weeks of the anticipated planting date. There will be a limit of 24, however, on the number of samples that it will be possible to test. This will set the upper limit to the number of trials conducted. Of the batches of stock tested only those with an RGC of more than three on the IRG scale (1 week test) will be used in the trials. If 12 or more batches tested exceed an IRG of 3.5 a lower limit of 3.5 will be adopted instead.

After stock has been tested for RGC it must be handled carefully until planted. Prolonged field storage at temperatures well above 0°C, or careless field handling, can make the result of an earlier RGC test entirely irrelevant. Notes on handling condition after leaving cold storage, primarily duration and temperatures, should be compiled to the extent practical.

Site preparation

Large responses of interior spruce to fertilization at planting have been observed on a wide range of sites. In the presence of severe weed competition, however, fertilization has been observed to have a slight or negative effect on tree growth. Trials should, therefore, be confined to
sites where initial weed competition has been effectively eliminated by logging, burning, or mechanical scarification, within the year prior to planting.

**Type of fertilizer**

Trials of fertilization of interior spruce at planting using soluble fertilizers have been consistently unsuccessful. The use of a slow release fertilizer is therefore essential. Osmocote 18-6-12 (N-P-K) with a 9 month release period (at 25°C) is readily available and has proved effective in experimental trials. This product will be used therefore for the operational trials.

**Trial design and measurements**

Within the trial plantation, eight 20x20 (400 tree) blocks will be marked out with corner posts. Four blocks, chosen at random will be fertilized. The remaining blocks will serve as controls. At the centre of each block 7 trees in 7 rows will be individually staked. Survival and growth of these trees will be followed over 5 years. The observations to be made are as follows:

<table>
<thead>
<tr>
<th>Time</th>
<th>Survival</th>
<th>Height</th>
<th>Diameter</th>
<th>Foliar Nutrient Content</th>
<th>% Trees Free to Grow</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>+</td>
<td></td>
<td>+</td>
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<td>+</td>
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<tr>
<td>Year 2</td>
<td>+</td>
<td>+</td>
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<td></td>
<td>+</td>
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<td>Year 5</td>
<td>+</td>
<td>+</td>
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1 nearest cm (every third tree) or as required in the event of low survival
2 nearest 0.1 cm (every third tree)
3 5 g fresh sample to Steve Willis forwarded by Regional Research Silviculturists to A. Vallance, North Road Analytical Laboratory
4 immediately after planting
Successful height and diameter measurements will be made on the same 16 individually identified trees in each block.

**Application rate and method**

Fertilizer (Osmocote 18:6:12, 9 month release) will be applied at the rate of 30 g/plant (one 35 mm film holder-full) distributed around the base of the tree over an area approximately 30 cm in diameter. At this rate, three 22.6 kg bags of fertilizer (enough for approximately 2000 trees) will be required for each trial. Fertilizer may be dispensed by hand from a bucket, although a horticultural granule dispenser may be suitable and quicker (for information contact S. Willis).

A record should be made of the person hours required to apply the fertilizer.

**Site selection and classification**

The R.O. Silviculture should mark the centres of the 8 plots to be established before the trees are planted. The assistance of the Regional Ecologist or Pedologist should then be sought in classifying the plots according to ecological subzone, confirming the homogeneity of the plots, estimating the probable moisture conditions and assessing the site's potential for brush development. Two bulk soil samples (500 g) representative of the 0-25 cm, and two of the 25-50 cm layers should be sent to Steve Willis for texture, pH, c.e.c. and mineral nutrient analysis to be conducted at the Ministry of Forests' laboratory in Victoria.

**Data analysis**

Stem volume will be calculated from the field measurements as one third basal area times height. For each site, the stem volumes will be subject to analysis of variance; the analysis being as follows:

<table>
<thead>
<tr>
<th>Source</th>
<th>d.f.</th>
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<tbody>
<tr>
<td>Blocks</td>
<td>3</td>
</tr>
<tr>
<td>Fertilizer treatment</td>
<td>1</td>
</tr>
<tr>
<td>Error</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
</tr>
</tbody>
</table>
A further analysis might be performed on data from all sites.

**Preparation of foliage samples for nutrient analysis**

Needles should be stripped from 5 cm of the main stem just below the leader from 10 randomly selected trees (outside the 49 tree survival plot) in each block. Samples from pairs of fertilized and unfertilized blocks should be combined and air dried. The bulked samples (2 from fertilized plots, 2 from unfertilized plots) should be sent to S. Willis for macronutrient analysis at the Ministry of Forests' Laboratory in Victoria.

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*Responsibilities*

See next page...
Responsibilities

Branch Branch, A.M. Burdett

Working Plan
Line with Silviculture Branch
Technical Aspects of Field Problems
Assist with data analysis and reporting

Silviculture Branch, S. Willis

Coordination of field program with Regional
Research Silviculturists and District Staff
Requisition and distribution of fertilizers and supplies
Data compilation, analysis and preparation of interim
and final reports on all trials.

Regional Research Silviculturist

Coordination with Regional Ecologists, Pathologists,
and District Staff.
Measurements and Sampling, Vegetation Assessments

District Staff

Selection of Candidate Sites
Conduct of Field Operations and Cost Information
Vegetation Control and Cost Information