WORKING PLAN

SX 84115 Q: Fertilizing Interior Spruce at Time of Planting
S. Willis, A.N. Burdett

Introduction

Results of E.P. 858 and others indicate that fertilizing interior spruce seedlings at the time of planting can double plant biomass within 2 years. Where seedling survival is jeopardized by rapidly encroaching competition, fertilizing newly planted stock may provide an effective means to improve plantation establishment success. Whether fertilization will prove to be more cost-effective than the use of large stock depends on the cost of applying fertilizer operationally and this has not yet been determined. Frequently, however, the forest manager can obtain only one stock type for a particular site and thus the use of large stock as an alternative to fertilization does not exist. It is proposed therefore that operational trials of fertilization be conducted with interior spruce on a wide range of sites throughout the Province.

Objectives

1) To determine operational problems and costs associated with fertilization at time of planting.

2) To assess the effect of enhanced growth due to fertilization on plantation establishment success and the cost per hectare of satisfactorily restocked land.

Biological Constraints

Operational trials will only be considered where the following conditions can be met:

1) Stock must have an PGC of 3.0 or greater. Early growth of stock with a low RCG is usually checked by moisture stress not mineral nutrient deficiency. Hence fertilizing low RCG stock is generally unproductive.
2) Sites must be well prepared.
   Where weed competition has been severe fertilization was observed
to have a slight or negative effect on tree growth. Trials will,
therefore, be confined to sites where initial weed competition has
been effectively eliminated, within a year, prior to planting.

3) A slow-release fertilizer must be used.
   Soluble fertilizers have been consistently unsuccessful. A slow
release fertilizer is 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.

Participants
Prince George - M. Bruhm, J. Revel
Prince Rupert - J. Pollack, G. Pinkerton
Cariboo - Al Vyse, Al Randall
Kamloops - R. Brockley, M. Faliszewski
Nelson - C. Thompson, E. Fraser
Research Branch - L. Ebell, N. Burdett, D. Lousier, E. Hamilton
Silviculture Branch - S. Willis

Responsibilities
Research Branch - Working Plan
   - liaison with Silviculture Branch
   - technical aspects of field problems
   - assist with data analysis and reporting
   - coordinating RGC testing

Silviculture Branch - Working Plan
   - requisition and distribution of fertilizer and supplies
   - coordinating field program with regions
   - compiling regional reports
Regions - selection of candidate sites, seedlots and stock types
- conducting field operations, foliage sampling
- obtaining cost data
- conducting subsequent survival and growth assessments
- preparing interim and final reports providing site description, observations, data analyses, etc.

Schedule

<table>
<thead>
<tr>
<th>Plant - Spring '85</th>
<th>Establishment Report - With Cost Data - Winter 85/86</th>
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</thead>
<tbody>
<tr>
<td>Assessments - Fall '85</td>
<td>Interim Report - Winter 86/87</td>
</tr>
<tr>
<td>Fall '86</td>
<td>Final Report - Winter 89/90</td>
</tr>
<tr>
<td>Fall '89</td>
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</tbody>
</table>

Trial Design

1) Treatments: Control and 9 month release osmocote, 30 gms broadcast in a 15 cm radius around each seedling. Fertilizer to be applied no closer than 5 cm from stem and no further than 15 cm radius of the stem around each seedling.

2) Layout:
- Two 10-20 ha plantations will be used in each region (Note, 900 kg of fertilizer has been ordered for each Region. This is sufficient fertilizer to treat 30,000 trees).
- Select units of reasonable ecosystem association uniformity.
- Use experienced contractors and experienced planters for operational uniformity.
- Each plantation will be fertilized in its entirety except for control plots as detailed below.
- Within the fertilized planting unit control plots will be located, flagged and taped prior to planting to exclude fertilization. Fertilized plots of the same size will be marked out after fertilization, immediately adjacent and randomly to the left or right of the control plots and along the contour.
Foliage samples should be taken between the last week of September and mid-October. Needles should be stripped from 5 cm of the main stem just below the leader from 10 randomly selected trees, outside the staked survival lines, in each of the eight plots. Samples (5 g fresh weight) should be forwarded to M. Vallance, North Road Analytical Laboratory.

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>
<th>Source</th>
<th>d.f.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocks</td>
<td>3</td>
<td>Error</td>
<td>4</td>
</tr>
<tr>
<td>Fertilizer treatment</td>
<td>1</td>
<td>Error</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>Total</td>
<td>7</td>
</tr>
</tbody>
</table>

Further analysis might be performed on data from all sites.

3) Cost Arrangements and Data

As it is too late for competitive bids, costs for each region and plantation will be negotiated with Contractors, suggested at $\pm 3-4\$ per tree based on initial discussions with the W.S.C.A.

Actual costs of fertilizer application to be determined by obtaining productivity counts (i.e., the number of trees fertilized per man-day), combined with operational judgement of licensee, contractor and planters. It is assumed that fertilizing and planting trees will be separate operations. Productivity counts should be recorded without biasing effects on the planting and fertilization crew.
4) Site Descriptions - Within each plantation selected for these trials sites are to be characterized as fully as possible.

   Ecological sub-zone descriptions to be obtained from available maps.

   Ecological association level mapping to be undertaken by district staff where possible and checked by regional ecology staff.

   Descriptions to include prediction of immediate and long-term brushing potential and variation within the plantation.

   A complimentary study is under consideration by the ecology program whereby developing competitive vegetation communities would be described in order to characterized brushing in pattern of sites. This study, to be covered in a separate working plan, would lead to the development of competitive index for the sites and development of better brush hazard predictive capability. The experimental design protocol developed by Pollack and Herring (1984) will be adopted for the work.

   Ecological components of these trials to be coordinated through head office for purposes of standardization and to minimize time constraints faced by the regional programs.

5) Other Trials

   The above operational trial has been simplified to a single fertilizer treatment, believed optimum since positive responses to fertilization at planting have been consistently attained under a wide range of research scale conditions. This can be refined since much additional research scale work is needed and is underway. Regional staff are optionally invited to extend the scope of the present operational trial.

   Such an additional investigation has been suggested by A. Vyse, Cariboo Region, as outlined below. It's value as a response trial would be in proportion to the range of regional, plantation and site conditions sampled.
Response Trials

Objective: to determine response to fertilization at time of planting across range of operational planting conditions, using range of operational stock.

Trial design:

a) layout

- establish small fertilizer plots on wide range of sites using following conceptual sampling framework for each Region

<table>
<thead>
<tr>
<th>SITE</th>
<th>Low stress</th>
<th>High stress (light soil)</th>
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<tbody>
<tr>
<td>High quality</td>
<td>X 2</td>
<td>X 2</td>
</tr>
<tr>
<td>RGC 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low quality</td>
<td>X 2</td>
<td>X 2</td>
</tr>
<tr>
<td>RCG 1.5</td>
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<td></td>
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</tbody>
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- each condition combination (quality x stress) to be represented by 2 sites in each Region for a total of 8 sites per Region

- each site will have 6 rows of 25 trees to be marked with wire flags immediately after planting

- fertilizer will be applied to 3 rows chosen at random, immediately after planting

- it would be preferable to have 6 plots of 7 x 7 or 10 x 10 trees for demonstration purposes, but installation will take many more man hours

b) treatment - as before

c) measurement - as before

d) site description - as before

Responsibilities - as before

Cost - establishment 10 man days/Region