TITLE

EFFECTS OF MYCORRHIZAL FUNGI ON CONIFEROUS NURSERY STOCK AND REFORESTATION IN BRITISH COLUMBIA.

COMPANY BACKGROUND

Date of Incorporation: 1981.

Controlling Interest: The BRC is 50% owned by Balco Industries Ltd. and 50% by the Canfor Corporation.

Major Shareholders: Balco Industries Ltd. and the Canfor Corporation

Type of Operation: The BRC is a forest tree nursery and a tree improvement Centre.

Major Product: The BRC produces forest seedlings and genetically improved seed.

Affiliation to Other Companies And Sales Organizations:

The seedlings are sold to the British Columbia Ministry of Forests and a small portion of private sales. (Enclosed see the Balco Industries Ltd. and Canfor Corporation Annual Report)

COMPANY TECHNICAL CAPABILITY

Presently the BRC is only involved with grad students in Research and Development. We do have an in-house nursery trial program. The proposal will require a qualified researcher for whom the subject funding application is intended. We will be hiring Dr. Gary A. Hunt and a technical assistant for the proposed project during May and June 1986. Nursery field and additional technical assistance is available presently employed with the BRC and Balco Industries Ltd.

PROJECT OBJECTIVES

The objective is to evaluate the potential of mycorrhizal fungi for improvement of container grown nursery stock and increase survival and growth after outplanting. The findings will lead to specific recommendations for integrating mycorrhiza management with current nursery and reforestation practices in the Interior of B.C. These studies will be conducted in close collaboration with other researchers to answer questions that will benefit the reforestation program in B.C. as well as complement past and ongoing mycorrhiza research in Canada. Research will be divided into phases to be conducted concurrently.

1. Collection, identification and isolation in pure culture of native mycorrhizal fungi likely to be useful in nursery and plantation testing.
PROJECT OBJECTIVES (con’t)

2. Maintenance of an axenic stock culture collection of fungal isolates for our use as well as to share with collaborating researchers.

3. To establish the affect of fertilizers on the mycorrhizal formation by selected isolates and/or seedling growth of three tree species.

4. To correlate whether seedlings inoculated with specific species or ecotypes of mycorrhizal fungi differ in selected growth parameters.

5. To quantify the growth and survival in two plantations of seedling inoculated with selected species in three fungal genera.

6. A further objective will a) determine the performance of additional fungi, especially native B.C. sources of spores and isolates b) experiment with new methods of inoculation with vegetative mycelium c) effects of cupric carbonate on root morphology of inoculated seedlings (Ruehle 1985) d) effects of rooting hormone on mycorrhiza formation and e) effect of cold storage on mycorrhiza root systems.

PROJECT TECHNICAL BACKGROUND

Forest tree seedlings are obligately dependent on symbiotic fungi for adequate uptake of nutrients. These fungi also increase drought resistance and therefore are particularly important where sites exhibit a paucity of moisture and nutrients. Mycorrhizal fungi confer the same root structure and physiological mechanisms of nutrient uptake present in all naturally occurring conifers. The addition of specific mycorrhizal fungi to nursery grown seedlings is known to yield well-developed root systems and healthy resilient planting stock. Container grown seedlings having root systems strongly mycorrhizal with fungi adapted to plantation conditions can improve reforestation success. (Molina 1981)

Nursery stock inoculated with selected mycorrhizal fungi has increased survival and growth of pine seedlings in the south eastern U.S. (Marx et al. 1977, Ruehl 1980). British Columbia (B.C.) contrasts dramatically with the South in that site conditions are more diverse and tree species more numerous. Unlike the South, one species of fungus is not effective over the broad range of site conditions and tree species found in B.C. forests. Thus determining the fungi which will be most effective with specific combinations of tree species and site conditions presents a formidable but potentially rewarding challenge for research. The payoff could be a vast improvement in reforestation success in the Interior of B.C.
PROJECT TECHNICAL BACKGROUND - (con’t)

Research on the use of mycorrhizal fungi for improving reforestation success in the Interior of B.C. or in Canada is relatively young. However, published results as well as preliminary data from studies conducted elsewhere are encouraging (Castellano and Trappe 1985, Castellano et al. 1985, Kropp et al. 1985). For example, Castellano and Trappe (1985) reported that after two years, Douglas-fir inoculated with Rhizopogon spores had greater survival, stem height, stem diameter and biomass than noninoculated seedlings. Kropp et al (1985) recorded better top growth on inoculated western hemlock two years after outplanting than on noninoculated controls. Seven additional inoculation studies are in progress in Washington, Oregon and northern California (Castellano, unpublished data).

Before an isolate of mycorrhizal fungi can be recommended it must be identified and shown to improve seedlings performance in plantations.

The proposed research will evaluate the potential of mycorrhizal fungi for the improvement of container grown seedlings (presently ~180 million per year in B.C.) and identify mycorrhizal fungi which improve survival and growth of seedlings subsequent to outplanting. The result will lead to specific recommendations for integrating mycorrhiza into nursery and reforestation practice which could be directly applicable to the M.O.F. and C.F.S. current backlog reforestation programs. The potential benefits are to be realized from stronger mycorrhizal root colonization through more efficient root systems that allow energy to be directed toward the production of useable biomass (growth). Because of the magnitude of British Columbia forests, improvement in survival and growth can yield substantial economic benefit to the Province and Canada.

PROPOSED INVESTIGATION

The BRC now uses both soluble (Peter’s) and slow release (Osmocote) fertilizer for container-grown seedlings. This study will determine the effects of differing fertility rates on mycorrhizae formation by three fungi on three tree species. Seedling growth parameters will be measured to relate fertility and fungal treatments to seedling size.

An important objective of ectomycorrhizal research in western North America is to identify specific fungal isolate-host combinations which improve the quality of container-grown stock. This study will compare effects of four fungal isolates (prepared as vegetative inoculum) on growth of two host species. Additional treatments of spore inoculation with appropriate species of Rhizopogon will be included.

Before an isolate of mycorrhizal fungus can be recommended for wide-scale inoculation of seedlings to be outplanted, it must be shown to improve seedling performance in plantations (Trappe 1977). This study will determine the effects of selected species in three fungal genera on growth and survival of seedlings in two plantations.
WORK PLAN

Summer - Fall/85
Examine present facilities and determine alterations necessary to accommodate proposed research; collect native mycorrhizal fungi from areas adjacent to 1987 planting sites; culture fungal collections; write research proposal.

February - October, 1986
Set up office and lab equipment, prepare specific fertilization project and growing medium; organize growing space for 100,000 seedlings, sow, thin, grow and monitor; apply spore suspensions, conduct measurements, prepare field test sites, expand native mycorrhiza collections and culture same, establish project to compare effects of three genera of mycorrhizal fungi on three tree species in a container nursery.

November - December, 1986
Harvest all treatments, record all measurements, establish cold storage effect on mycorrhiza trial.

January - March, 1987
Assess mycorrhizal status, sample individual seedlings, enter data on computer, analyze and write up results; duplicate 1986 sowing using promising native collections.

April - October, 1987
Establish field plantations, assess performance survival and growth, expand native collections and culture same, test new methods of inoculation, quantify effect of cupric carbonate, correlate effect of rooting hormones.

November - December, 1987
Lift, bag and record pertinent data for all seedlings.

January - March, 1988
Complete analysis of nursery and field data and report writing, duplicate 87 sowing and inoculate with the best of fungal cultures.

April - October, 1988
Establish further plantations over a variety of sites, measure performance survival and growth.

November - December, 1988
Lift, bag and record data for all seedlings.