BOREAL SPECIES ON SHORT ROTATION 1/

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Abstract.--The forests in Nova Scotia have been logged over for more than two hundred years and until recently very little silviculture work has been carried out. This has resulted in a badly depleted growing stock and growth rates which are far below the potential.

As part of its silviculture program Nova Scotia Forest Industries began experimenting with container grown seedlings five years ago. After experimenting with 9/16" plastic tubes and multipots, a decision was made to adopt the Fh 408 Paperpot as an acceptable container.

Production has been expanded gradually from 700,000 plants in 1972 to 1,700,000 in 1974. The main problem is to get consistent high survival and quick development after outplanting.

INTRODUCTION

"Necessity, who is the nether of invention"
- Plato.

This familiar quotation explains very well why a rather small Pulp and Paper Company located on the eastern Canadian seaboard somehow found itself carried along on the container wave which swept across North America and Europe during the past several years.

Nova Scotia Forest Industries produces pulp and newsprint and requires steady forest production to remain in business. Silviculture which includes reforestation is recognized as a means of guaranteeing the raw material supply.

Most small and medium size forest industries do not have the resources to carry out basic forest research or for that matter applied research if it involves long range projects. Their time, energy, and money are for the most part channelled into the things which industry can do best, that is, to carry out logging and silviculture on an operational scale with emphasis on productivity, efficiency, cost control and similar criteria which are dictated by the competitive situation in which each company exists.

As raw materials become scarce and more valuable the Industrial Silviculture Forester will be busier than ever trying to carry out silviculture and grow more wood. This in turn will make him more and more dependent on the research agencies and the research scientists to not only carry out the basic research but to provide knowledge which he can apply without prolonged trials and evaluation.

My paper entitled "Boreal Species on Short Rotation" is about the Nova Scotia Forest Industries experience in container operations and while it may be light on scientific proofs it will explain how sore Industrial Foresters reacted when faced with the practical prcblem of trying to grow and plant better trees at a lower cost.

Nova Scotia Forest Industries operates a sulphite pulpmill and a newsprint mill at Port Hawkesbury, Nova Scotia, Canada and is a division of Stora Kopparbergs A.B. of Falun, Sweden. The Swedish parent company has had a strong influence on the Company philosophy and actions in the field of silviculture.

1/Paper presented at North American Containerized Forest Tree Seedling Symposium, Denver, Colorado, August 26-29, 1974.

2/Assistant Woodlands Manager - Nova Scotia Forest Industries, Port Hawkesbury,N.S., Canada.

The Company's wood procurement area is located within latitude 45 00' and 46° 30' North and longtitude 58° 30' and 63° 00' West. This is the latitude of southern France it the climate is quite different due to a maritime location and the cold Labrador current.

Being located in a meeting place of warm moist air from the south and cold air masses from the north, Nova Scotia receives about 50 inches of precipitation distributed fairly evenly throughout the year.

The soils in eastern Nova Scotia show considerable leaching due to high rainfall and the cool temperate climate but they are general-capable of good tree growth.

The rotation age for fiber production in plantations is approximately 40 years and M.A.I. for native spruce and pine plantations ranges from 50 to 150 cubic feet depending on site conditions.

The forests in Nova Scotia have been logged over for more than two hundred years and until recently very little silviculture work has been carried out. This has resulted in a badly depleted growing stock and growth rates which are far below the potential.

Faced with this set of conditions Nova Scotia Forest Industries and the Province of Nova Scotia decided about five years ago to embark on a fairly intensive silviculture program for the 1.5 million acres of woodland leased by the Company from the Province. The program is financed from the stumpage paid by the Company and the silviculture fund consists of $1.75 per cord harvested or about $500,000.00 per year.

The Silviculture program is based on clear cutting of mature and overmature stands followed by treatments to develop fast growing new stands as quickly as possible.

Natural regeneration of balsam fir and white spruce is adequate on about 80% of the cutover areas. These areas where natural regeneration is accepted will be cleaned or spaced at around age 15 to control the number of trees and accomplish fast individual tree growth.

About 20% of the cutover areas will require planting and it is probable that the Company will increase the percentage in plantations because of the advantage of species and spacing control, inherent in plantations.

WHY CONTAINERS?

Because of the good natural regeneration and a very limited demand for nursery stock in Nova Scotia the Company found it almost impossible to purchase even the small quantities of suitable seedlings required for its early efforts in reforestation.

In 1965 and 1966 the Company's Chief Forester Mr. John Weslien tried to remedy the situation by building a greenhouse in his backyard where he seeded spruce and pine in beds of peat moss. With the aid of a few thermostatic controls and a conscientious wife he managed to get fairly good germination and temporary good results until he was wiped out each year in the first heat wave to pass our way.

SUMMARY OF SILVICULTURE OPERATIONS

Treatment	Acres							
	1961-67	1968	1969	1970	1971	1972	1973	Total
Controlled Burning	900	-	-	-	-	-	-	900
Site Preparation	103	162	104	53	635	941	1,573	3,571
Seeding - Manual	7	-	10	-	-	-	-	17
Seeding - Machine	-	-	9	7	-	-	-	16
Planting - bareroot	720	142	149	227	225	286	10	1,759
- tubelings	-	3	47	91	-	-	-	141
- multipots	-	-	7	57	80	160	-	304
- paperpots	-	-	-	-	-	300	675	975
Spacing - Manual	118	252	249	696	1,627	1,304	1,770	6,016
- Machine	-	-	151	77	78	-	-	306
Hardwood Control	212	1,622	2,634	212	508	-	-	5,188
Improvement Cutting	-	-	-	3,015	2,581	8,155	5,907	19,658
Total Acres Treated	2,060	2,181	3,360	4,435	5,734	11,146	9,935	38,851

These unsuccessful attempts were followed in 1968 by an experiment with a few thousand red pine and black and white spruce seedlings grown in 9/16" plastic tubes by the Province of New Brunswick in their greenhouse operation. These ninety day old plants were put out in September on burned cutover which resulted from a forest fire in August of the same year. The good survival and development surprised everyone and we were suddenly hooked on containers.

From 1969 through 1971 the Company experimented with plastic tubes and the Swedish multipot container while relying mainly on bareroot stock. About 300,000 plants were produced in containers over that period.

In 1971 after observing large scale paperpot operations at Stora Kopparberg, A.B., Falun, Sweden, Nova Scotia Forest Industries decided to change over to Fh 408 paperpots and to accelerate the container production to supply a good percentage of our seedling requirements. A seeding line, trays, inserts, etc. were ordered from Lannen Sokeri Oy, Finland and 700,000 paperpots seedlings were produced in 1972.

In 1973 the production was increased to 1.0 million and it is planned that 1.7 million paperpot seedlings will be grown in 1974. During the period 1972 to 1974, Nova Scotia Forest Industries has seeded an additional 1.5 million paperpots for the Provincial Department of Lands and Forests and other Companies.

THE GREENHOUSE OPERATION

Following a well established tradition of using contractors for road building, logging and other forestry activities, Nova Scotia Forest Industries decided to try to interest commercial greenhouse operators in growing container seedlings on a contract basis. Because trees are a relatively trouble free crop in a greenhouse, it was not too difficult to get growers interested and two corsrercial tomato growers now look after the Company's requirements for greenhouse space.

In this arrangement the Company seeds the trays, provides fertilizers and other materials and works out schedules and instructions with the grower. The contract is based on a price per square foot of greenhouse space with the grower receiving 50% of the agreed price upon placement of the seeded trays in the greenhouse. The remaining 50% is paid at the end of the growing season and is adjusted in accordance with seedling survival during the time they are under the growers care.

Our present system for growing the paperpot seedlings is to use simple, unheated, plastic covered greenhouses. New plastic is installed each spring and is removed after about sixty days to allow the plants to harden off. The plants remain in the greenhouse through t fall and overwinter. They are removed for planting in May of the following year after which the house is covered with plastic and filled again with newly seeded trays.

The paperpots are filled with commercial peat moss and seeded mechanically using a seeding line purchased from Lannen Sokeri Oy. In our application the seeding line is operated by one man and six women. who can put through about 35,000 paperpots per hour.

Dolomite is added to the peat moss at the rate of one ounce per cubic foot to raise the pH and fertilization is carried out using IL 440 liquid fertilizer which is purchased from A.B. Valco, Stockholm, Sweden. IL 440 is applied at the rate of two ounces per cubic foot of peat moss at the time of seeding and after germination is completed it is applied weekly at the rate of .5 fluid ounce per cubic foot of peat moss. This fertilizer is mixed with water and applied through the watering system.

WALLCO PLANT NUTRIENT IL 440

Wallco plant nutrient IL 440 contains 100 grams (3.2 ounces) of nitrogen (N)/1 and other chemicals to the following proportions:

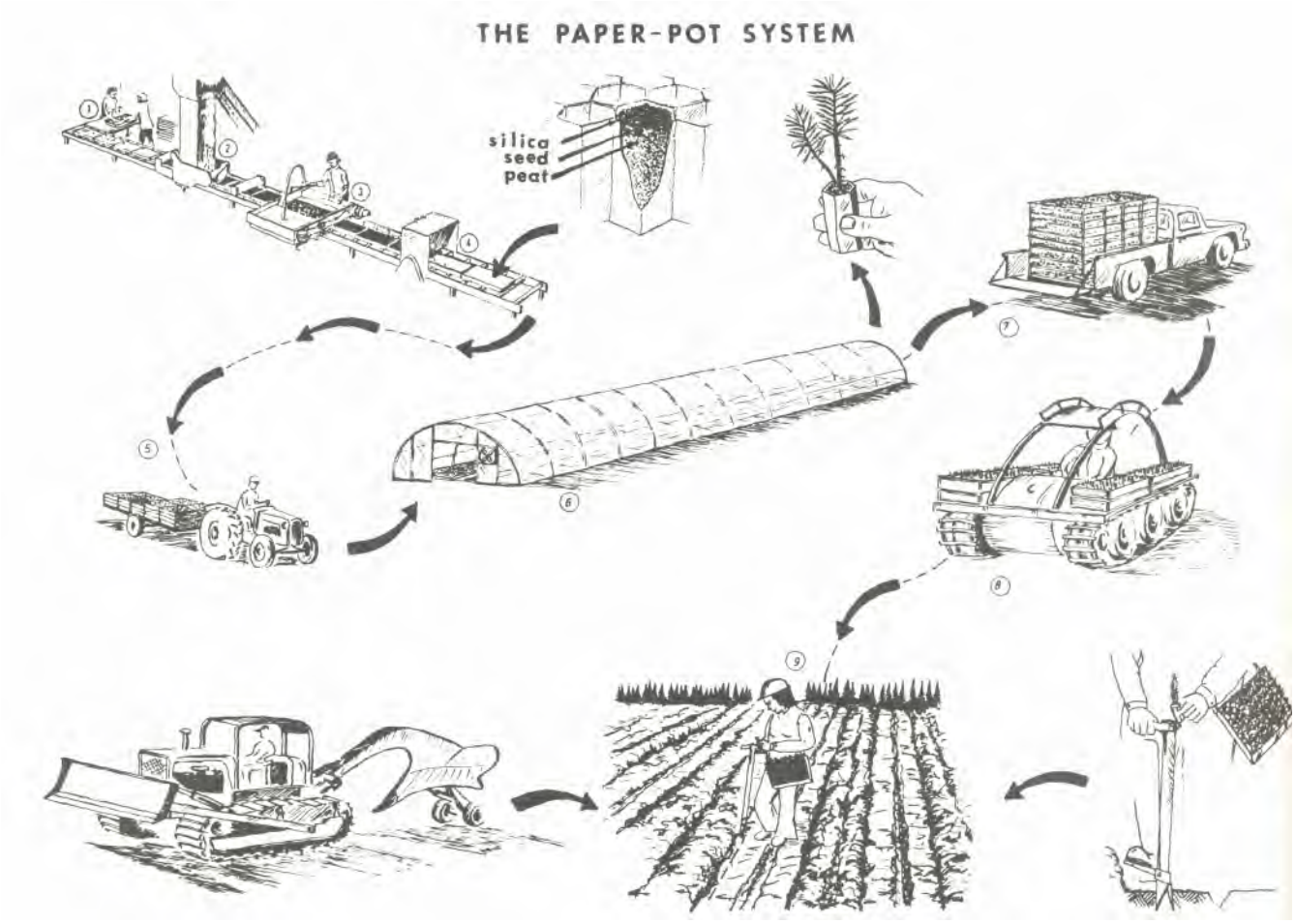
Nitrogen	(N)	100
Phosphorus	(P)	13
Potassium	(K)	65
Sulphur	(S)	9

and micro nutrient:

Iron	(Fe)	0.700
Manganese	(Mn)	0.400
Zinc	(Zn)	0.040
Copper	(Cu)	0.040
Boron	(B)	0.200
Molybdenum	(Mo)	0.007

SPECIES

Depending on the planting site, black spruce and red pine are the species most conmonly used in Company planting operations. These species have been relatively free of insect and disease problems and develop well both in the nursery and after outplanting. Due to the discovery of Scleroderris canker and an apparent increase in the incidence of European Pine Shoot Moth in red pine plantations in Nova Scotia, red pine has become suspect as a species for the future.



White spruce and scotch pine have been grown in paperpots with fair results and it seems certain that larch and other softwood species can be grown in paperpots.

OUTPLANTING

The paperpots like other containers are easy to handle from the nursery to the planting site and can be stored and moved around in the planting operation much easier than bareroot stock.

With the present program of 1 - 1.5 million seedlings per year planting is completed in a six week period beginning early in May. In 1973 male university students carried out the planting and averaged 1800 seedlings planted per man day. In 1974 girls carried out all the planting and they averaged 1100 seedlings planted per girl day.

In all silviculture operations the Company has managed to get the work carried out on a piece rate or partial piece rate basis to encourage high production and earnings. For container planting the planters are paid 1.5 - 2 cents per tree with a guaranteed minimum during the training period.

SITE PREPARATION

Cutover areas in eastern Nova Scotia and especially on the best sites are quickly invaded by a luxurious growth of grasses, herbs, and shrubs. These plants respond very quickly to the cutover condition which provides an abundance of light and nutrients and become very stiff competition for planted stock for a hunter of years.

Large bareroot plants are best able to cope with the competition but the small container seedlings have a very difficult time.

In conjunction with the experiments with paperpots plants Nova Scotia Forest Industries introduced the Marttiini KIM 240 Plow as a site preparation tool. It was hoped that by plowing shallow furrows the competition could

be set back for a year or two or give the container plants an opportunity for quick development.

The plow, from a mechanical and economical point of view worked exceptionally well. Problems have developed with frost heaving on soils which retain a lot of moisture and there are questions to be answered about the effects of plowing on the soil.

SUMMARY

From our limited experiences at Nova Scotia Forest Industries we can draw some conclusions about the suitability of container grown seedlings for Company reforestation operations.

Containers can be grown by commercial greenhouse operators with satisfactory results.

Containers can make very efficient use of good quality seed.

Containers are easy to handle and store, in the nursery, in transport, and on the planting area.

Containers can be planted easier and cheaper than bareroot stock.

Containers can be planted over a longer season and with less people involved.

The main problem with containers in our area is to get consistent high survival and quick development with these small plants, after outplanting.

The solution to this problem is not immdiately evident but will likely come from the development of a suitable site preparation method, through the production of larger container plants, or perhaps through a combination of developments of this type.

Reforestation with container seedlings in Nova Scotia is not a perfect operation at this stage of development. The obvious good features about containers, however, dictate that work must continue until the limitations in the system are removed and we can receive the full benefits of this important development in forestry technology.

Question: Do you have any problems with soil slumping and water ponding in the ditches left by the Marttiini plow?

Routledge: A hydraulic cylinder behind the drawbar adjusts plow height. Normal depth is 1 ft. in the center sloping up to form a bench 22 ft. wide. This exposes mineral soil in the center, but leaves some humus on the benches. We plow the furrows 1 year before planting. We are planting experimentally at close intervals across the furrows to find the best microsite. Currently, we believe the tree should be planted on the edge of the bench where there is some duff, but our planters don't seem to understand. Planting in bare mineral soil at the bottom of the ditch increases frost heaving. However, the erosion potential is more dangerous; the plow makes beautiful ditches.