ASSESSMENT OF A LARGE-SCALE REFORESTATION SYSTEM WITH CONTAINERIZED SEEDLINGS ON THE BASIS OF 5-YEAR EXPERIENCE AT THE WOODLAND DIVISION OF GEORGIA-PACIFIC CORPORATION IN MAINE AND NEW BRUNSWICK

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ABSTRACT.--Large-scale artificial reforestation programs are frequently initiated for the purpose of achieving higher yields through species conversion and through the use of genetically improved planting stock. These programs are especially attractive to a landowner who is facing the task of re-establishing a forest which has been or is in the process of being devastated by insect epidemic. Five years of experience have been now accumulated in large-scale artificial regeneration by the Woodland Division of Georgia-Pacific Corporation while battling to replace its spruce-fir forests which have been totally or partially lost to the spruce budworm.

WOODLAND DIVISION AND THE PRESENT SPRUCE BUDWORM EPIDEMIC

This division is composed of four different kinds of manufacturing plants producing presently softwood lumber and plywood in addition to its well established line of pulp and paper products. A new waferboard plant will be coming on stream next October. Land ownership consists of 900,000 acres of forest land within 50 mile radius from the plants. These lands are located in the State of Maine and in the Province of New Brunswick and approximately 60 percent of them are spruce-fir dominated, and it is this portion of forests which have been under continued attacks by spruce budworm since 1970. At the moment all spruce-fir stands are severely infested and in spite of repeated aerial applications of different insecticides and epidemic is still running strong and sizable mortality is taking place.

Natural or artificial reforestation?--In order to maximize the volume recovery from the dead and dying spruce-fir forests a highly mechanized clearcutting system was developed and rapidly applied over a large portion of the infested forest. As soon as this easier part of the problem was solved it was found out that the question of reforestation of the clearcuts was far more complicated than expected.

On the basis of limited but detailed observations of older clearcuts of spruce and fir it was concluded that both of these species, and balsam fir particularly, regenerated naturally to uniform stocking only along the edges of larger clearcuts but left quite a bit to be desired anywhere else. Particularly alarming was its lack of uniformity. In general it consisted of overstocked islands of young growth with practically nothing between them. In order to have the clearcuts uniformly stocked a large-scale artificial reforestation was needed. Due to the urgency of the problem only the container-type reforestation systems could be considered.

POLYSTYRENE QUARTERBLOCK CONTAINER SYSTEM

This containerized seedling system was originally developed for the Forest Service of British Columbia by Mr. J. Kinghorn and modified into a quarterblock system by Philip F. Hahn of Georgia-Pacific Corporation, Eugene Oregon. It lends itself quite well for semi-automatic handling in the greenhouses and has excellent field handling characteristics. Mainly for these reasons it has been the backbone of Georgia-Pacific Corporation's artificial reforestation systems since 1972 on the west coast and since 1974 in the east.

The quarterblocks are taped together into full blocks (four quarters) in the nursery prior to filling of cavities and their subsequent seeding. Cleaned and disinfected blocks are reusable and by recycling them sizable savings can be effected.

After 20-22 weeks in the greenhouse the seedlings are ready for hardening and the field planting normally takes place when they are 26-30 weeks old.

The Woodland Division in Maine and New Brunswick presently produces 2.0-2.1 million seedlings annually.

This production is concentrated in two separate locations and presently a total of eight greenhouses are in production. The first two greenhouses were built in 1974 and two more houses per year were added in 1975-77.

PLANTING SITE PREPARATION

In order to improve the planters access to the sites and to reduce the competition from woody shrub species, several mechanical site preparation methods have been tried during the past five years. These have included Marden Brushcutters, Sharkfinned Barrels and Fesco V-plows. Some chemical site preparation has been carried on sites which had re-vegetated to undesirable weed species. At the moment we are very much in favor of the Fesco V-plows because of their reliability and the high rate of productivity.

FIELD PLANTING OPERATIONS

A dramatic change from entirely male planting crews of 1975-76 to mixed crews of 1977-78 and finally to pure femal crews of today represents the major change and modification in our quarter-block planting system. We carry out the field planting under all varieties of weather conditions and the crews are transported to the planting sites even by a helicopter, if necessary. A standard mode of transportation, however, is a school bus and the seedlings are delivered by a specially equipped three quarter ton pick-up. Occasionally random shipments of bare-root planting stock is delivered to unaccessible sites by a helicopter. A normal planting crew consists of 10-12 planters and a supervisor. The daily productivity is presently around 1,000 seedlings/person day but levels as high as 2,000 seedlings/person day have been achieved and maintained over extended periods. Each planter carries approximately 300 seedlings in the aluminum frame back-pack and in the belt back. The long handled planting tool is aptly named "a dibble". With the exception of 1976 planting season approximately 500 seedlings have been planted per acre. The major species have been jack and red pine as well as black, white and red spruces. Only very recently a modest volume of hybrid and Japanese larches have been introduced and their share is expected to go up rapidly. The pines and larches are considered to be completely resistant to spruce budworm while the resistance of spruces vary from high to medium.

PLANTATION SURVIVAL AND STOCKING

With the exception of the summer 1978 an average survival in excess of 90% have been maintained in 1-2 year old plantations. This has been mainly credited to the special features of our planting stock which allows the transportation of the seedlings from the greenhouses to the planting site in their original containers and while being planted the root systems of the seedlings go into the ground practically intact and have no exposure to drying air or sunlight. Horizontal ridges inside the container cavities prevent any curling of roots and this feature further facilitates better seedling establishment.

As previously pointed out a sizable amount of natural softwood generation exists on clearcuts prior to planting. Our site preparations systems have failed to remove it and we have been forced to learn to live with it. It consists of variety species dominated by balsam fir, and if it were not so irregularly spaced, we could consider a high portion of planting sites fully stocked.

These circumstances, however, have forced us to adopt and develop a fill-in type of planting process where only 450-500 seedlings per acre are being planted. As a rule of thumb, we seem to average out three naturally regenerated softwood seed lings per each planted seedling. No studies have been carried out about the distribution of this abundant natural softwood stocking but we estimate that it consistently covers less than one third of the clearcut areas. As far as the species distribution of this stocking is concerned it is 61 percent of balsam fir and 35 percent of spruces while hemlock and white pine hold only 5 percent. With our planting efforts we have succeeded in reducing the balsam fir to 46 percent of the total stocking and at the same time also achieved full stocking of land. Without these efforts the major portion of our clearcut would have remained understocked or would have reverted to balsam fir dominated uneven forest with high vulnerability to the future epidemics of spruce budworm.

WEED CONTROL OF PLANTATIONS

This has been carried out with systematic aerial applications of herbicides. The key herbicide in 1977 and 1978 was 2,4,5-T, which was applied at the rate of two quarts per acre in five gallons of water. In 1979 a switch over to glyphosate or Roundup was necessary due to an emergency ban on the use of 2,4,5-T. Both of these chemicals have given us nearly complete control of the local weed species in our young plantations, and without them our reforestation efforts would have failed.

The key species to be controlled by herbicides have been rubus, pin cherries and the sprouts of poplars, beeches and soft maples.

EXPECTED YIELDS AND ROTATIONS

Repeated sampling in our natural spruce-fir stands has shown that the individual trees in these stand display an average diameter growth rate of one inch for every ten years. Consequently 60-70 years are required to grow 6"-7" diameter trees. This holds especially true to the trees which have grown in stands originating from the previous outbreaks of spruce budworm. It also happens that their chronological maturity coincides with the budworm cycles and thereby a biological condition is created where the spruce-fir forests keep repeating themselves for budworm's harvest.

With our present artificial reforestation efforts we are aiming to minimize the future impacts of budworm and this will be mainly achieved through shorter rotations where the maturity of forest does not coincide with the cycles of this pest and by planting species which are known to be resistant to the attack.

Some of our older plantations and some of the similar plantations of other owners have shown that an intermediate harvest for pulpwood and small sawlogs is possbile in artificially regenerated stands at the age of 20-25 years and the final harvest for veneer and larger sawlogs can be carried out at the age of 40-45 years.