Field performance of container systems in British Columbia

by Charles M. Johnson, R.P.F.

In the Province of British Columbia, the container forest seedling program has truly been a success story. It is worth examining the reasons for this success and providing some of the early history to the program. Certainly in British Columbia the rapid expansion of the planting program over the past ten years could not have been effected without the aid of containerization.

Containerization of forest seedlings was started in 1957 with seedlings grown in milk cartons. In 1961, Jack Walters provided significant impetus to container seedlings when he published "The Planting Gun and Bullet: A New Tree-Planting Technique". Between 1961 and 1967, a large amount of trial work was done on various container types, and from this work a general acceptance of the "plug" concept, and a commitment by the Ministry of Forests (M.O.F.) to the testing of container planting was established.

Between 1967 and 1970, a Liaison and Development Section of the Pacific and Yukon region of the Canadian Forest Service (formerly called the Pacific Forest Research Centre), in cooperation with the Silviculture Branch, Ministry of Forests, was organized to investigate containerization. The Silviculture Branch, Ministry of Forests, built a pilot container facility at Koksilah Nursery, Duncan, British Columbia. At the same time, the BC/CFS styroblock plug mould was designed and container growing production was started. By 1970, production at the Duncan facility increased to one million styroblock cavities. Growth and survival rates encouraged the Silviculture Branch, Ministry of Forests, to begin the production of the styroblock on a production basis and to construct a new container production and nursery at Surrey, British Columbia to produce 7,000,000 container seedlings. The initiation of this federal-provincial "Liaison Group" was a very significant development in what was to prove to be a large success in bringing containerized planting and growing to British Columbia.

The "Liaison Group" involved a number of researchers and operationally oriented staff who developed a process that worked operationally, and that laid the foundation for container culture. A great deal of credit is due to individuals such as Jim Kinghorn, Nils Sjoberg, Ev Van Eerden and Glen Matthews. Through their hard work on researching and developing cultural and container concepts and procedures, the container program was launched and grew to the level today where we are growing 220 million seedlings in containers annually in British Columbia.

In British Columbia, there have been a number of key policy decisions that have also led to the achievement of our containerized nursery and planting systems. The major policy changes were:

- The Pearce Royal Commission on Forest Resources, 1976
- New Forest Act, 1978
- Policy Statement Regarding Tree Seedlings, 1980
- Privatization of Silviculture Activities, 1987

The first three changes put in place the opportunity for a private forest nursery base in British Columbia. The largest policy change was in 1987 when the Government of British Columbia made the forest industry responsible for all silviculture costs including nursery costs for forest seedlings. At the same time, the government privatized eight of its eleven forest nurseries. With these changes, there has been a greatly expanded program to 250 million container seedlings in 1993. This reforestation program has created a tremendous expansion in greenhouse and open compound capacity as shown in Figure 1. The decision in nursery stock types was no longer controlled by government budgets or decisions, and stock type changes shifted to 93% of all stock types being containerized (Figure 2); in addition, the 3% of transplant stock was started in containers. There was also a major shift to increased container sizes and changes in the age classes sown (Figure 3).

In British Columbia, we are currently harvesting annually 175,000 hectares of forest land (Figure 4). Approximately 50% of the harvested area is artificially reforested through planting. There has been considerable public concern in recent years that all we are doing in British Columbia is establishing monocultures. The Ministry of Forests undertook a special study of this concern.

Figures 5 and 6 illustrate clearly that in British Columbia, the areas we plant do not end up with a larger number of mono-

Figure 1. Number of blocks, 1987-1991 (by facility type). ■, greenhouse; □, open compound.

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Figure 2. Summary of stock type changes, 1986-1991. ■, container 1+0; ■, container 2+0; ■, bareroot; ■, transplants.

Figure 3. Container stock size, 1986-1991. ■, 415D; ■, 415B; ■, 3131; ■, 313A; ■, 211A.

Figure 4. Reforestation/harvest.

Figure 5. Tree species diversity of British Columbia. ■, deciduous mixed forests; ■, coniferous mixed forests; ■, coniferous monocultures.

Figure 6. Tree species diversity of Prince George. ■, deciduous mixed forest; ■, coniferous mixed forests; ■, coniferous monocultures.

cultures than what we have in natural forests.

With 93% of our reforestation being carried out with the use of containers, what has the survival performance been in British Columbia? Figure 7 provides a very positive picture on how survival has improved over the past ten years. Presently, average survival after two years is 95%.

With containerization, planting costs have also improved. With our planting company, Tawa Enterprises Ltd., planting containers is generally five cents less per seedling than for planting bareroot or transplants.

The positive increase in two year survival rates is, to a large degree, due to the high quality of nursery stock being produced in British Columbia. There have been six significant advances made in the growing of container stock:

1. Improved fertilizers have provided more balanced feeding to seedling crops with the result being much higher quality crops using less fertilizer (30%).

Figure 7. Survival.

2. Environmental greenhouse control systems have allowed us to better understand what occurs in the greenhouse environment. With this tool, we have learned to use temperature more effectively to regulate plant growth and reduce pesticide use.
3. Blackout allows growers to control height and initiate bud development when appropriate.
4. New container block types such as the styro 410 have allowed the nursery industry to respond to field demands to produce a shorter, stockier plant with a root system that is cultured to egress well into cold soils at higher elevations. Copper treated blocks have greatly improved the root egress for lodepole pine.
5. Water management of all crops has greatly improved ensuring that seedlings are grown under a no stress regime compared to ten years ago when drought stressing was used as a major growing practice;
6. Early sowing schedules have provided greater flexibility to the field forester for ordering their stock requirements.

These nursery management practices are constantly being fine tuned so that specific stock types are developed to meet specific site and seasonal planting needs of the field practitioner.

In British Columbia, the success of the container program has been the result of:

- an active development and research program to ensure the

Figure 8. Volume. Treatments: 1, control; 2, Gromax 12-5-8, 1 teabag; 3, Growmax 12-5-8, 2 teabags. *Volume calculated using $(22/21 \times (RCD/20)^2 \times \text{height})$ formula. ■, 1st Season; ■, 2nd Season.

success of this reforestation system;

- a very dedicated group of nursery growers working with-in a highly competitive nursery industry to produce a quality product at a competitive price to meet the needs of the field practitioner and planting contractor; and
- a group of industrial and government foresters who have worked closely with the nurseries to ensure planting stock is being grown to meet field demands.

We still have a number of challenges to face in the container industry to further improve both the quality and use of container seedling products:

- there are opportunities to use longer term slow release fertilizers to improve initial field growth performance (Figure 8);
- field foresters must continue to be educated on the smorgasbord of stock types that is available to meet specific site requirements and seasonal planting needs;
- in the nurseries there are opportunities for further mechanization to improve productivity and costs; and
- with seed development, embryogenesis offers a great opportunity for producing clonal material with higher yield potentials.