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BOOK PLANTER CONTAINERIZED SEEDLING TRIALS IN MINNESOTA

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ABSTRACT

The first planting trials in Minnesota with the book planter containerized seedling system are described. Survival of red pine (*Pinus resinosa*) planted on four dates, June 7, June 26, July 26, and August 17, averaged 73 percent after the fourth year. White spruce (*Picea glauca*) planted on June 26, July 26, August 17, and August 23, averaged 61 percent survival. There were significant differences in survival between planting dates.

INTRODUCTION

Stiell (1976) defines a containerized seedling as "one which is grown individually rather than in a shared nursery bed, and is planted with the unit of soil in which the roots are embedded still intact". Containerized seedlings are part of an intensive management system which includes growing in a greenhouse under optimum cultural conditions. This provides for field planting in a few months instead of a few years as is the case with nursery-grown bare-root seedlings.

Containerized seedlings were introduced to Minnesota about 1967 with the establishment of a series of trial plantings with tubed seedlings, often called tubelings (Alm and Schantz-Hansen, 1970). Tubelings, irrespective of the species used, were grown in very short time periods. This was especially true in the initial research stages when trees were being planted into the field 10 to 12 weeks after seed germination. The short growth periods involved were somewhat dictated by the small size of the plastic tube container used (3" long x 9/16" dia.). Many of the problems involved in getting tubeling plantings established were directly related to the small size of seedlings being used. Nevertheless, under properly controlled conditions, some of the early tubeling research plantings in Minnesota were quite successful, especially the jack pine plantings.

A series of new containerization concepts were introduced about 1970. These container systems all involve a larger container or growing cavity than the tubeling system. A longer cultural period is used and a larger seedling is produced. One of these is the Spencer-Lemaire book plug system (Spencer, 1972). In this system, trees are grown in rectangular-shaped cavities in hinged plastic books which fit into a holding tray. The cavities have corrugated walls which are designed to induce the roots to grow downward and not spiral around on the inside of the cavity. This system provides the opportunity to periodically inspect the development of the roots simply by opening the books. At time of planting, the books are opened and the seedling plug is lifted out and placed in the planting hole (Figure 1).

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METHODS

Trial plantings with the Spencer-Lemaire system were established near Grand Rapids, Minnesota on two areas. One was planted with red pine (*Pinus resinosa* Ait.) and the other with white spruce (*Picea glauca* (Moench) Voss). The red pine area had been commercially clearcut in 1971. In November, 1972 the slash and residual trees were windrowed with a crawler-tractor with a dozer blade. The spruce area had been predominantly unmerchantable hardwoods sheared in December, 1972 with a K-G blade for conversion to spruce. Both of the areas had good mineral soil exposure and a minimum of vegetative competition at time of the first planting.

Plantings were made on four different dates at each area. This was done to test the hypothesis that the planting season can be extended into the summer by using containerized seedlings. Extending the planting season is one of the real potential advantages of using containerized seedlings in northern climates such as Minnesota. The four planting dates for the red pine were June 7, June 26, July 26, and August 17, 1973. For the white spruce, the dates were June 26, July 26, August 17, and August 28, 1973.

Seedling dates were staggered with the intent that for all planting dates the book planter seedlings would be about 20 weeks old. In actuality, because of problems in getting the study set up, the June 7 red pine was only 16 weeks old when planted. The 2.5 cubic inch book planter cavity was used for all of the seedlings except the July 26 and August 17 red pine which were grown in cavities with 3.5 cubic inches of rooting volume.

All of the seedlings were germinated and grown in a greenhouse. The actual amount of time they were kept in the greenhouse varied with planting date. For example, the June planted seedlings were started in the greenhouse in mid- or late February, and left to grow there until temperatures were high enough to grow them outside which was about mid-May. The seedlings planted on later dates spent a longer growing period outside than that described above because of the staggered seeding dates. In all cases the trees were fed with a fertilizer solution of 23-19-17 (NPK) twice a week beginning ten weeks after germination.

A Latin square design was used in laying out both of the plantings. The four treatments (different planting dates) were replicated four times with 50 seedlings per replicate. Analysis of variance was used with all testing done at the .05 level of significance.

RESULTS AND INTERPRETATION

The fourth-year survival data for the red pine planting is shown in Table 1. The survival of the July 26 (%=84.5) and August 17 (%=84.0) plantings were both significantly higher than the June 26 (%=62.0) and June 7 (%=70.5) plantings. At time of planting it was noted that on the June 7 and June 26 dates the root systems were not developed enough to hold together the soil plug mass when the seedlings were extracted. This resulted in crumbling of the soil plug which disturbed the root system. It also resulted in improper placement into the planting hole in some instances and consequently lower survival. Cultural techniques, such as watering procedures and shading, were better refined for the July 26 and August 17 plantings which is reflected in the higher survival for those dates. This difference in quality of seedlings did affect the objective of testing the different planting dates. However, the results did tend to reinforce earlier work with tubelings that planting with containerized seedlings could be done as late as mid-August (Alm and Schantz-Hansen, 1970). Of course, planting dates and length of planting season are largely dependent on precipitation and available soil moisture irrespective of whether containerized seedlings or bare root stock is used. Containerized seedlings do offer more flexibility in scheduling planting to coincide with available soil moisture. Bare root planting is limited to a short time period after the stock is lifted from the nursery.

The July 26 planting was significantly taller than any of the other three dates. As noted above, the June 7 and June 26 trees were of a poorer quality than the later plantings which helps to explain their lesser height growth. The smaller trees of the August 17 planting are likely related to the greater amount of vegetative competition on the site on that planting date as compared to the July 26 planting. By August 17 the area had a dense understory of aspen (Populus sp.) and hazel (Corylus americana) suckers and a reinvasion of several herbaceous species and grasses. The earlier plantings did have a head start before the reinvasion of this vegetative competition.

Fourth-year results from the white spruce planting are shown in Table 2. The survival of the June 26 planting (%=40.0) was significantly lower than the July 26 (%=74.5), the August 17 (%=71.0) and the August 28 (%=59.5) plantings. Again, as with red pine, the June 26 seedlings had poorly developed root systems that were too small at the time of planting. The same problems noted with the culture of the June 7 and June 26 red pine were encountered with the June 26 white spruce.

The July 26 planting was significantly higher than the August 28 or June 26 plantings. The August 17 planting did not differ significantly in height from any of the other three plantings. As noted previously the poor quality of the June 26 stock was probably a factor in the difference in height growth. The relatively poor performance of height growth on the August 28 planting was probably a combination of the late planting date and the dense vegetative competition that was present on the site at time of planting. This area was given a release spray in August, 1975 with 2,4-D (3 lbs/acre).

CONCLUSIONS

This study was designed to test book planter container-grown seedlings for the first time in Minnesota. The plantings should be considered pilot in nature. Problems were encountered during the initial greenhouse cultural period which affected the quality of the seedlings. This affected interpretation of survival and height differences between selected planting dates. The survival of both the red pine and white spruce plantings on July 26 and August 17 after four growing seasons is encouraging.

The increased rooting volume of the book planter cavity over the plastic tube for tubeling production is advantageous in development of a larger seedling. As was soon learned in this study, it is essential that the root system be developed well enough to adequately hold together the soil plug when it is extracted for planting.

As noted earlier there were several container systems developed about the same time as the Spencer-Lemaire book planters. Each system has its own unique characteristics and selection for use will be dependent upon the logistics of individual reforestation needs and programs.

LITERATURE CITED

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Table 1. Fourth-Year Survival and Growth of Red Pine Book Planter Planting.

	Planting Dates				Overall Mean
	June 7	June 26	July 26	August 17	
Percent Survival	70.5a ^{1/}	62.0a	84.5b	84.0b	73.3
Mean Height (inches)	7.4a	7.8a	8.6b	7.4a	7.8

^{1/} Means within the same row followed by the same letter are not significantly different at .05 level.

Table 2. Fourth-Year Survival and Growth of White Spruce Book Planter Planting.

	Planting Dates				Overall Mean
	June 26	July 26	August 17	August 28	
Percent Survival	40.0a ^{1/}	74.5b	71.0b	59.5b	61.3
Mean Height (inches)	10.0a	12.6b	11.6ab	10.6a	11.2

^{1/} Means within the same row followed by the same letter are not significantly different at 0.05 level.

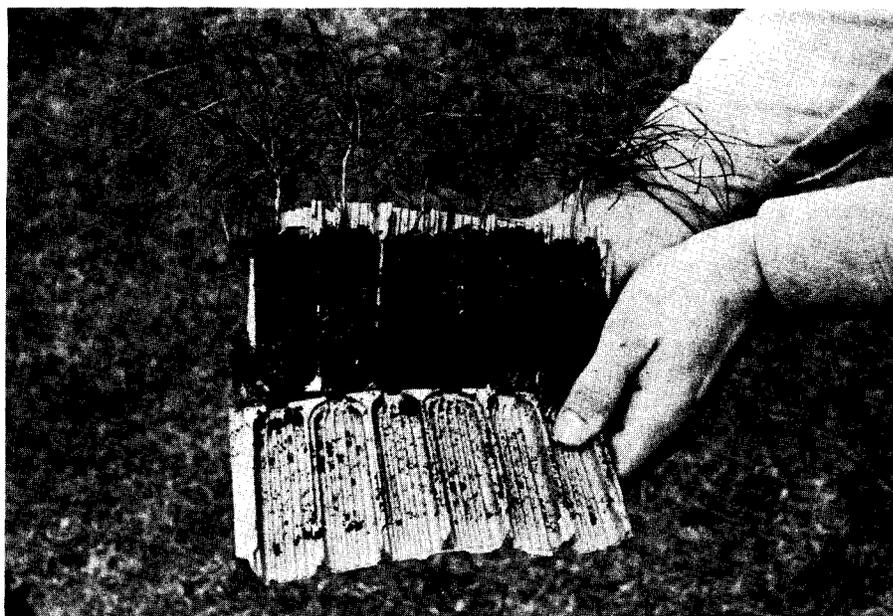


Figure 1. Opened book with red pine seedling plugs.

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