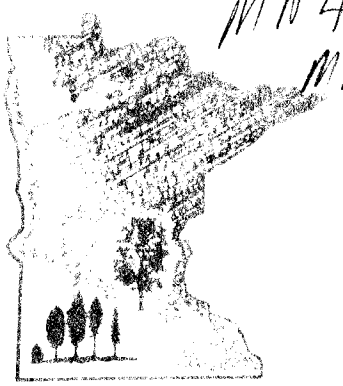

Minnesota Forestry Research Notes

SUCCESSFUL ESTABLISHMENT OF RED PINE TUBELINGS IN MINNESOTA

No. 260
January 1977

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ABSTRACT

Irrigation and weeding treatments were imposed during 1972 and 1973 on a red pine tubeling plantation established in June, July and August 1971. After 5 years, mean survival for the three planting dates was 78.7 percent and mean height 16.8 inches. Survival was not affected by the treatments but height growth was increased by weeding. Irrigation had no effect probably because precipitation was plentiful. The results confirm that with proper site preparation, vegetation control and soil moisture, red pine tubelings can be successfully established.

Evaluation of containerized seedings as an alternative method of reforestation has been underway in Minnesota since 1967. Efforts were directed primarily toward use of the tubeling[#] system with jack pine (Pinus banksiiana, Lamb.) and red pine (Pinus resinosa, Ait) until about 1972 when attention was shifted to other systems such as the Spencer-Lemaire Rootrainer, British Columbia/Canadian Forest Service (bc/CFS) styroblock plug and the Japanese paper plot.

Tubeling research plantings in 1967, 1968, 1970 and 1971 had a number of objectives, the most important of which was evaluation of planting during the growing season. Plantings were made on a number of sites with varying degrees of site preparation and different seedling age classes (Alm and Schantz-Hansen, 1974). Greatest success was achieved with jack pine with its relatively rapid juvenile growth. Red pine proved much more difficult to establish as tubelings. Some of the specific conclusions drawn from the above plantings were:

1. Jack pine can be successfully planted during the growing season until about mid-August.
2. Adequate site preparation was extremely critical with most mortality being related to vegetative competition.
3. Site preparation trials indicated that scalp scarifying resulted in best survival.
4. The minimum greenhouse cultural period should be 16 weeks.

In contrast to jack pine, the feasibility of using red pine tubelings was still questionable after analyzing results from the above plantings. A red pine tubeling planting was established in 1972 under carefully controlled conditions to make a further evaluation of red pine tubeling use during the growing season.

Methods

An area which was full-tree logged during the 1971 growing season was selected for the study. The area has a sandy loam soil and is considered a good site for red pine. Site preparation consisted of scalping two-foot squares at five foot spacing. Planting dates were June 15, July 15, and August 15. Ten trees were planted on each planting date in four replicated treatments as follows:

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[#]Seedlings grown in 9/16 inch diameter x 3 inch plastic tubes (Ontario tubes).

[*]Minn. Agric. Experiment Sta. Sci. Journal Series Paper No. 1648.

Published by the School of Forestry, University of Minnesota, St. Paul, Minnesota 55101, cooperating with the Division of Forestry, Minnesota Conservation Department, and Forest Industries of Minnesota

1. Irrigate during first two growing seasons each time there were seven days without rainfall.
2. Weed scalps of all vegetation for first two growing seasons.
3. Combination of irrigation and weeding as above.
4. Control - neither irrigation nor weeding.

The plots were irrigated by spraying 0.5 inch of water onto the scalp from a back pack sprayer. Weeding was done by hand. Treated plots were kept free of competing vegetation for the first two growing seasons.

Seedling dates for the tubelings were staggered so all stock was sixteen weeks old on the designated planting date. The trees were grown in an environmental growth chamber. Germination temperatures were 85 F. Growing temperatures after germination were maintained at 75 F during a 14-hour day under a combination of fluorescent and incandescent light. Lights were off during a 10-hour night period at 55 F. At the beginning of the 8th week the trees were given 23-19-17 water soluble fertilizer once each week. After 12 weeks in the growth chamber the trees were taken outside for the remaining 4 week period until planting.

Results

Table 1 shows that overall survival after five growing seasons averaged about 80 percent. Analysis of variance indicated that neither the weeding nor the watering treatments had any significant ($p = 0.05$) effect on survival. Moisture was not a critical factor during the establishment period of the seedlings because of the well distributed precipitation during the first two growing seasons. Water was added three times in 1972 and only twice in 1973. The irrigation treatment made no difference in survival. The weeding treatment proved unnecessary in terms of survival as site preparation by full-tree logging and scalping was adequate in controlling vegetation on this particular site.

Planting date did have a significant ($p = 0.05$) effect on survival. The August plantings had the poorest survival, averaging about 62 percent compared to the June and July survival of about 87 percent. It was noted that 65 percent of the August mortality occurred during the first overwinter period which indicates that the trees simply did not get established prior to the end of the first growing season. The first frost in the area in 1972 was on September 4, only twenty days after the August planting date.

An effort was made to determine cause of mortality. About 35 percent of the dead trees did not have roots growing out of the bottom of the tube when they were examined. Nearly 70 percent of these were August plantings. Another important cause of mortality was the cutting of the stems (17%). Most of this was attributed to vegetation pressing the stem into the tube edge and cutting it. The other large source of mortality was from smashing (9%) either by humans or animals stepping on the small trees. The cause of about 27 percent of the mortality could not be determined. A noticeably missing cause of mortality which was predominant in previous studies was vegetative smother. Again, the site preparation treatment was effective in preventing this.

Analysis of the height data (table 2) revealed that the weeding or weeding plus irrigation treatments resulted in significantly ($p = 0.05$) larger trees than the control or the irrigation treatment without weeding. The differences ranged between 2.6 and 5.0 inches. There was no difference between the control and irrigation treatments which indicates that the weeding treatment rather than the irrigation resulted in the increased height growth. This was probably due to more light availability on the weeded plots. This indicates that even though survival may not be affected on well prepared sites, subsequent vegetation control can be important in attaining maximum height growth.

Planting date also affected height growth. The trees planted in July were tallest on the average (18.5 in.), followed by June (16.8 in.) and August (15.2 in.). An interesting comparison for height growth was made between the tubeling plantings and an adjoining red pine plantation. The plantation was machine planted in 1974 with a 2-2 stock. There was no site preparation other than the 1971 full-tree logging. At the end of the 1976 growing season the plantation trees averaged 18.3 inches in height based on a randomly selected 200-tree sample. This compared to an overall average height of about 16.8 inches for all treatments in the tubeling study. Therefore, even though the tubelings were only five years old from seed compared to seven years for the nursery stock they compared quite favorably in terms of height growth.

Conclusions

Results from this study reinforce knowledge gained from previous work. It was shown that full-tree logging followed by scarifying does a good job of site preparation for containerized systems such as tubelings. Satisfactory results with jack pine were attained under this same combination (Alm, 1972). Also the results show that the sixteen week greenhouse cultural period suggested in an earlier study for red pine tubelings (Alm, 1974b) is realistic. The importance of controlling vegetative competition for good survival and growth of tubelings was also previously established (Alm, 1974a). The study indicates that if all recommended procedures are followed, red pine tubelings can be successfully established.

The same results found for tubelings should be valid with some of the more recently developed containerized systems noted in the first paragraph. Actually, because of increased rooting volume and elimination of the plastic tube barrier, the other systems should result in easier seedling establishment. With the larger rooting volume of the newer systems the minimum cultural period for red pine will likely be increased. The site conditions under which these systems can be used may be less restricted than for the small tubelings. However, to get optimum benefit from any containerized seedling system the need remains to describe limiting criteria and then to operate within the prescribed set of conditions.

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Table 1. Mean survival (percent) of red pine tubelings after five growing seasons.

	Planting Date			
Treatment	June	July	August	Mean
Control	75.0	87.5	65.0	75.8a +
Irrigate	85.0	80.0	57.5	74.2a
Weed	92.5	90.0	57.5	80.0a
Weed & Irrigate	97.5	90.0	67.5	85.0a
Mean	87.5a +	86.8a	61.9b	

+Means followed by the same letter do not differ significantly at the .05 level

Table 2. Mean height (inches) of red pine tubelings after five growing seasons.

	Planting Date			
Treatment	June	July	August	Mean
Control	14.0	16.2	13.6	14.6a +
Irrigate	14.6	16.6	14.0	15.1a
Weed	19.9	23.2	16.7	19.9b
Weed & Irrigate	18.7	18.0	16.4	17.7b
Mean	16.8ab +	18.5a	15.2b	

+Means followed by the same letter do not differ significantly at the .05 level