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JACK PINE TUBELING TRIALS IN MINNESOTA UNDER FOUR SITE PREPARATION TREATMENTS

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A container planting system for forest stock, employing a small, open-ended plastic tube was developed in Canada about ten years ago (McLean, 1959). The tubes are slit along one side to permit stem expansion and root egress, have a 9/16-inch diameter and are three inches in length. The tubes are loaded with soil, seeded and placed in a greenhouse for about four weeks or longer, depending upon species used. They are then conditioned for field planting during a hardening-off period. The tree, tube and all, is planted with the aid of a planting dibble.

The tubed seedlings, often referred to as "Ontario Tubelings", have been planted extensively in Canada since about 1966 (MacKinnon, 1970). Small-scale planting trials with jack pine (*Pinus banksiana*) and red pine (*Pinus resinosa*) were established in Minnesota in 1967. Survival success with the early Minnesota plantings varied directly with the degree of site preparation and vegetative competition (Alm and Schantz-Hansen, 1970). The results indicated that the normal planting season can be extended into the summer months, possibly into August, with reasonable success if site conditions are suitable. There is a need for more information relating to what constitutes a suitable site and what site preparation methods are most desirable. This study was designed to test the effect of several site preparation treatments on tubeling survival.

Methods

Two cut-over jack pine areas (A and B) on Omega loamy sand soils on the University of Minnesota Cloquet Forestry Center were used. Area A had a 60-year-old jack pine stand that was clearcut six years prior to establishment of the study. There was scattered aspen (*Populus* spp.) and birch (*Betula papyrifera*) in the original stand. At the time the treatments began there were approximately 65,000 hardwood shrub stems (primarily *Corylus cornuta*) per acre and about 4,000 aspen stems per acre in the area. It was determined that some type of site preparation would be required if tubelings were to be used successfully. Therefore, a control planting was not deemed necessary. The following site preparation treatments were tested:

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1. Burning - the site was burned in April, about two months prior to the first planting. This burn was quite thorough and consumed all but the large-size debris.
2. Spraying - the site was sprayed in August of the growing season prior to planting. A 50-50 mixture of 2,4-D and 2,4,5-T at the rate of 2 lbs./acre was used. Tubelings were planted in a small scalp made by a planting hoe on both the sprayed and the burned site.
3. Mechanical discing - the site was prepared about two months before planting. An Athens single disc pulled by a caterpillar tractor was used. There was considerable mixing and loosening of the soil with complete mineral soil exposure.
4. SFI twin scarifier - the site was prepared with a Swedish Forest Institute twin scarifier about two months before planting. This unit was pulled with a rubber-tired, 4-wheel-drive skidder (Figure 1). The SFI unit weighs about 3300 lbs. and has scarifying arms which make a scalp about 2 feet by 3 feet and 6 inches deep at a selected spacing ranging from 6 to 10 feet. The tubelings were planted on one of the slopes of the scalp and not in the bottom.

On Area A, 25 jack pine tubelings, from 8 to 12 weeks old were planted in four replications on each treatment on June 20, July 20 and August 20, 1970.



Figure 1. SFI twin scarifier unit used to prepare planting scalps.

Area B was a portion of a 90-year-old jack pine stand that was clearcut under the full-tree system the summer prior to planting. The only treatment on this area was use of the SFI twin scarifier. A 2-acre tract was scarified in late April and planted on June 5. A 200-tree random sample was staked for survival and height determinations. Immediately adjacent to the scarified tract, a 4-acre tract was planted with 2-0 jack pine on May 7-11. These were hand planted with a planting bar with no site preparation other than the full-tree logging. A 200-tree random sample was staked so a comparison could be made with the tubeling planting. The area had an average of about 4,000 stems per acre of hardwood shrubs at time of planting. By the end of the second growing season, the number of hardwood shrubs had increased to about 58,000 stems per acre.

Results and Discussion

Survival results after two growing seasons for the tubeling plantings on Area A are given in Table 1.

Table 1. Mean percent survival after two growing seasons by planting date and site preparation treatment on Area A.

Planting Date	Site Preparation Treatment				Avg.
	Burn	Spray	Disc	Scarify	
	- - - - -percent- - - - -				
June 20	76	87	82	94	85
July 20	50	73	63	79	66
Aug. 20	69	33	17	57	44
Avg. all dates	65	64	54	77	
Avg. June-July	63	80	72	86	

The SFI twin scarifier provided the most effective site preparation in terms of survival. Mean survival on the scarified area ranged from 94 percent for the June planting to 57 percent for the August planting with an average of 77 percent for the three planting dates. The overall averages for the burned, sprayed and disced areas were 65, 64 and 54 percent respectively. Survival for the August planting was especially low on the sprayed and disced areas with 33 and 17 percent respectively.

Based on the averages, the June planting had the highest survival, followed by the July planting and then the August planting. It should be noted that the season of planting for this study (1970) was extremely dry as precipitation for the entire period was considerably below normal (Table 2). The small amount of precipitation received during August was a principle mortality factor especially for the July and August plantings.

Table 2. Precipitation received during the 1970 and 1971 growing seasons compared to the 30-year normal for the period 1931 to 1960.^{2/}

Year	Growing Season Period										Total
	May		June		July		Aug.		Sept.		
	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	
	- - - - -inches- - - - -										
30-year-norm	1.72	2.08	2.12	2.20	1.80	1.86	1.93	1.97	1.54	1.24	18.46
1970	0.62	2.21	0.39	1.68	1.71	1.75	0.33	0.27	1.47	0.44	10.87
1971	0.48	2.62	2.84	1.43	1.80	1.70	1.21	4.43	0.81	0.61	17.93

^{2/}PPT measured at Cloquet Forestry Center cooperating U.S. Weather Bureau Station located about one mile from study site.

An attempt was made to categorize the cause of mortality on Area A (Table 3). Many trees were placed in a "stem cut-off" category. Most of these were on the August plantings in the sprayed and disced areas. The actual cause of the "cutting-off" was difficult to determine. In many instances it appeared that the tubeling dried out from desiccation and the crown simply broke off. Desiccation was undoubtedly the primary mortality factor. Most likely, many of the trees placed in the "unknown" category also died as a result of the extreme dryness. The "smothered" category was quite high on the SFI scarified area. This was primarily caused by the covering of leaves falling from the many aspen suckers in this area. The soil in the disced area was very loose and with normal precipitation one might expect considerable mortality from soil washing into the tubelings and burying them. However, this was not a problem during the dry growing season encountered.

Table 3. Categories of mortality by site preparation treatment on Area A.

Treatment	Mortality Categories					Total
	Smothered ^{3/}	Smashed	Buried	Stem Cut-Off	Unknown	
	- - - - -number of trees - - - - -					
Burn	3	6	4	18	74	105
Spray	7	6	1	34	59	107
Disc	1	5	4	36	92	138
Scarify	24	2	4	9	31	70
Total	35	19	13	97	256	420
Percent	8.3	4.5	3.1	23.1	61.0	100

^{3/}Refers to tubeling covered by vegetative competition, does not necessarily mean that mortality was due to loss of oxygen.

Based on the 200-tree random sample at the end of the second growing season, tubeling survival in the SFI scalped plantings in the full-tree area (Area B) was 94 percent (Table 4). This compares to 86 percent survival for the 2-0 jack pine stock planted adjacent. Height of the nursery stock is about at or higher than the average height level of the vegetation competition in the area. The tubeling average height increased nearly fourfold during the second growing season.

Table 4. Mean percent survival and height of SFI scalped plantings in full-tree area at end of first and second growing seasons.

	Sept. 1970		Sept. 1971	
	Survival percent	Height inches	Survival percent	Height inches
2-0 Jack pine	88.0	9.6	85.5	24.8
Jack pine tubelings	97.0	2.6	93.5	9.7

The above results are preliminary because at least four and possibly five growing seasons should be encountered before tubelings can be considered "established". However, the relatively high survival obtained on the sites prepared with the SFI twin scarifier looks promising. The large scalps afforded some protection from the extreme drought conditions. Survival, especially for the June planting, on the other site preparation treatments was also very good considering the adverse conditions.

Literature Cited

- Alm, A. A. and R. Schantz-Hansen. 1970. Planting pine tubelings in Minnesota. Jour. of For. 68(6):353-357.
- MacKinnon, G. E. 1970. Container planting in Ontario. For. Chron. 46(6):470-472.
- McLean, M. M. 1959. Experimental planting of tubed seedlings. Ont. Dept. Lands and For. Tech. Series Res. Rep. No. 39. 13 pp.