# Pine tubeling survival varies with vegetative competition

by
**A. A. Alm**[1]

In 1968, a planting was established to test the success of red pine and jack pine tubelings planted under varying degrees of vegetative competition. The seedlings were grown in open-ended plastic tubes, 9/16 inch in diameter and 3 inches long (Ontario tubelings). This planting was a followup to a 1967 study designed to determine the feasibility of using tubelings throughout the growing season (1).

Results from the 1967 study indicated that selection of planting site and site preparation were especially critical in tubelings survival success. Survival after five growing seasons on plantings from June 1 to August 1 ranged from an average of 90 percent for jack pine and 80 percent for red pine on a planting site with very little vegetative competition to 60 percent and 40 percent on planting sites with relatively severe competition. Much of the mortality was buted to vegetative covering or "smothering" from hardwood shrubs, herbaceous vegetation, and grasses. Leaves and dead vegetation covered the small seedlings in the fall and they were unable to recover the following spring. Red pine with its relatively slow juvenile growth was especially susceptible to this problem.

The 1968 study described in this article consisted of plantings made under several vegetative removal treatments to determine the effect on survival and growth. Plantings were made throughout tic growing season from June to September. Results after five growing seasons are reported here.

## Methods

Twenty-five red pine tubelings were planted on four vegetative treatment plots on each of four dates-June 1, August 1, and September 1. Twenty-five jack pine tubelings were planted on the same plots on two dates-August 1 and September 1. The tubelings varied from 6 to 8 weeks old at planting time. They were cultured in reed-sedge peat with sand covering the seed. Plantings were made on four replications of each of the following treatments:

A. Check- no disturbance to vegetation

B. Shrubs removed- all shrub1 stems were clipped at ground line.

C. All vegetation removed- All vegetation, woody and herbaceous, was clipped at ground line

D. all vegetation was clipped and the plot raked to remove ground litter and the duff layer.

1—Shrubs are defined here as woody vegetation other than forest tree species that are capable of attaining 2 feet or more in height at maturity.

A 3-foot buffer strip around each plot was treated the same way as the plot itself. One quadrant of each plus was planted on each selected planting date. The plots were treated about 2 weeks prior to each planting date. The soil on the planting site is an Omega sandy loam. This is a deep, ex-cessively drained sandy soil with rapid Permeability, and is low in water holding capacity, organic matter content, and fertility.

Vegetative stem counts of shrub species were taken on the area in June prior to treatment. There was an extremely dense shrub understory consisting of beaked hazel, serviceberry, and cherry. The area had been clearcut of jack pine in 1952, and is classified as a good site for jack pine and medium for red pine.

## Results and Discussion

Survival

Differences in survival between planting dates were nonsignificant ($p = 0.05$) for both red pine and jack pine. This differs from the results of the 1967 study (1) where survival for September plantings was found to be significantly poorer than for earlier plantings. Part of the reason for the relatively good survival for the Sept-ember 1968 planting might he that there was ample precipitation during

1 Assistant professor , College of Forestry, University of Minnesota. The author would like to acknowledge the assistance of Mr. David Olsen, forest technician, in collection of field data for their study, and the Northwest Paper Co., Cloquet, Minn. For furnishing the tubelings. This is Sci. J. Series Pap. No. 7011, Univ. Minn. Agr. Exp. Sta.

that month-4.30 inches compared to a normal of 2.83 inches.=

Survival for both the red pine and jack pine varied directly with the amount of vegetative competition removed (table 1). The best red pine survival rate was 72 percent, which was the mean for the "bare" plots with mineral soil exposure and no vegetation. This rate was followed by an average of 43 percent survival on the plots with all vegetation removed but no mineral soil exposure. The plots with only the shrubs removed averaged 29 percent survival. Poorest survival (13 percent) was on the check plots with no vegetative treatment. The above differences were all significant at the .05 level.

The jack pine plantings had a similar survival pattern with bare plots averaging 84 percent; plots with all vegetation removed, 64 percent; plots with shrubs only removed, 61 percent; and check plots, 16 percent. Survival differences between treatments were significant (p = 0.05) except between the plots with all vegetation removed and shrubs only removed.

Height

Height measurements data for jack pine were not just for comparison purposes because of heavy deer browse on most 4thc plots.

There was no browsing of the red pine. Analysis revealed that the average height of the red pine on the bare treatment plots (x = 9.7 in.) was significantly (p = 0.05) higher than those of any of the other treatment plots (table 2). There was no significant difference between the average heights of the other treatments which ranged from 3.5 to 4.6 inches.

Planting date also influenced height growth. The trees planted on June 1 and July 1 averaged 7.9 and 7.5 inches, respectively. These averages were significantly (p = 0.05) higher than the August 1 and September 1 averages of 6.3 and 5.7 inches, respectively.

**TABLE 1.—*Survival rate for red pine and jack pine after five growing seasons (percent)***

| Planting Date | Vegetative Treatment[1] A | B | C | D | Mean |
|---|---|---|---|---|---|
| | — — — — — — — — — — Red Pine — — — — — — — — — — | | | | |
| June 4 | 6 | 23 | 42 | 60 | 33(a)[2] |
| July 2 | 17 | 32 | 46 | 79 | 44(a) |
| August 1 | 19 | 25 | 40 | 80 | 41(a) |
| September 1 | 10 | 36 | 43 | 67 | 39(a) |
| Mean | 13(a)[2] | 29(b) | 43(c) | 72(d) | |
| | — — — — — — — — — — Jack Pine — — — — — — — — — — | | | | |
| August 1 | 19 | 60 | 68 | 83 | 58(a)[2] |
| September 1 | 13 | 61 | 61 | 86 | 56(a) |
| Mean | 16(a)[2] | 61(b) | 64(b) | 84(c) | |

[1]A = Check
B = Shrub stems removed
C = All vegtation removed
D = Mineral soil exposed

[2]Means followed by different letters are significantly different at the 0.05 level.

*Mortality*

At least 80 percent of the mortality of both species under all treatments had occurred by the beginning of the third growing season. By the end of the fifth season, mortality had leveled off to about 3 percent for the red pine and 1 percent for the jack pine.

Most of the mortality that could be attributed to a definite cause was the result of "smothering." The percentage varied directly with the type of treatment (table 3). Almost all the smothering on the check plots was caused by leaf shed from the dense, relatively tall shrub canopy. However, where the vegetation was clipped but the duff layer was not disturbed, much smothering resulted from rapid reinvasion by numerous lesser vegetative species, mainly blueberry (Vaccinium angustifolium). bracken from (Pteridium acquilinum), sweet fern (Comptonia peregrina),

**TABLE 2.—*Height of red pine after five growing seasons***

| Planting date | Treatment[1] A | B | C | D | Mean[2] |
|---|---|---|---|---|---|
| June 4 | 3.5 | 5.3 | 4.6 | 11.7 | 7.9(a) |
| July 2 | 3.2 | 4.4 | 4.9 | 11.2 | 7.5(a) |
| August 1 | 4.0 | 4.6 | 3.8 | 8.5 | 6.3(b) |
| September 1 | 2.9 | 4.4 | 4.7 | 7.5 | 5.7(b) |
| Mean[2] | 3.5(a) | 4.6(a) | 4.5(a) | 9.7(b) | 6.8 |

[1]A = Check
B = Shrub removed
C = All vegetation removed
D = Mineral soil exposed

[2]Means followed by different letters are significantly diferent at the 0.05 level.

TABLE 3.—*Mean mortality rate by categories (percent)*

| Vegetative Treatment | Mortality Category: Smother | Cut-off | Smashed | Animals | Buried | Vandals | Unknown | Total |
|---|---|---|---|---|---|---|---|---|
| | Red Pine | | | | | | | |
| A[1] | 70 | 4 | 0 | 0 | 0 | 0 | 13 | 87 |
| B | 31 | 4 | 1 | 2 | 1 | 0 | 32 | 71 |
| C | 11 | 6 | 1 | 2 | 2 | 0 | 35 | 57 |
| D | 1 | 3 | 0 | 0 | 3 | 1 | 20 | 28 |
| | Jack Pine | | | | | | | |
| A | 72 | 4 | 0 | 0 | 0 | 0 | 8 | 84 |
| B | 7 | 5 | 1 | 1 | 0 | 1 | 24 | 39 |
| C | 2 | 12 | 1 | 1 | 1 | 0 | 19 | 36 |
| D | 0 | 4 | 0 | 0 | 1 | 3 | 8 | 16 |

[1]A = Check
B = Shrub stems removed
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raspberry (Pubus spp.l. honeysuckle (Diervilla lonicera), and various grasses.

Guesideraldc mortality also resulted from the stem clipping apparently mostly by grasshoppers. There was some mortality, especially on the plots with mineral soil exposure, from burying by loose soil movement into the tubes. Also, the - rude area is readily accessible to the public and there was some mortality because of vandalism.

There was evidence of spiraling root systems and, in some instances, failure of the root to leave the bottom of the tube. :Although in most cases the split plastic tube functioned as it was designed to (fig. 1) there will likely he sonic future mortality caused by poorly developed root systems.

Shrub Growth.

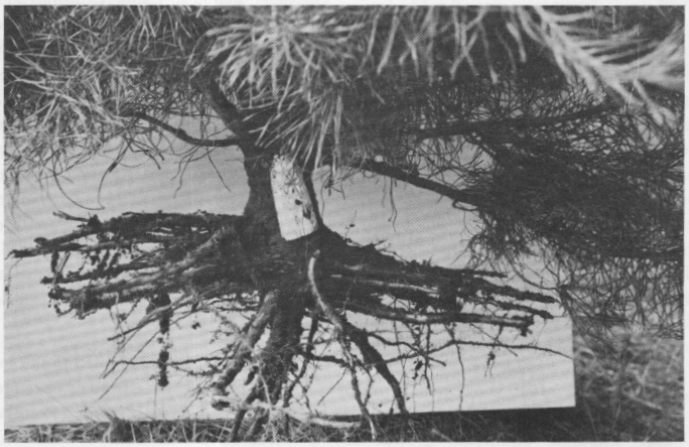
The average shrub stem density prior to treatment of the plots was about 88,500 stems per acre as determined from mil-acre quadrants on the area. Measurement of the mil-acre quadrants at various intervals after treatment indicated prolific sprouting (table 4). There is evidence of natural thinning taking place as the stem density has decreased through time. The shrub density after four full growing seasons on the plots where only the shrub stems were clipped is at about the same level as it was before treatment. (In the plot where all the vegetation was removed. both with and without mineral soil exposure, the stem density is less than half that before treatment.

An advantage was also gained in height reduction of the shrub understory. The original height averaged about 7 to 6 feet. The new shrub understorv averages less than 1 foot in height. The jack pine and mans of the red pine. especially on the plot with mineral soil exposure, have been able to compete and are at or above the height of the vegetative understory.

## Conclusions

Results from this studs point out the necessity of adequate site preparation when using tubeling or other small containerized seedlings. Vegetative competition on the planting site can result in considerable mortality. Dense. tall shrub covers such as hazel brush must be eliminated by prescribed fire. herbicide spraying, or mechanical scarification. Scarification which exposes mineral soil and disturbs the root systems of competing vegetation results in the most ideal planting site. On sites where soil erosion or exposure is a problem. removal of competing vegetation without disturbance to the litter layer would he a good compromise. In many situations. greater planting density to com1wnsate for mortality might he better both

Figure 1.—Root system on jack pine tubeling after five field seasons. (Note the split plastic tube clinging to tree stem.)



economically and ecologically than removing the litter.

Even if the vegetation is only temporarily set back, it provides an opportunity for the small trees to successfully compete. Species with relatively fast juvenile growth-such as jack pine-will probably outgrow the reinvading vegetation in most instances. The use of species-such as red pine-with a much slower juvenile growth presents a different problem. Red pine simply does not grow fast enough to compete with the vegetation even with intensive site preparation. The current trend is toward use of a larger container-or containerless system which provides greater rooting volume. This should result in somewhat more flexibility in selection and preparation of planting sites.

TABLE 4.—*Average shrub stem density at various time intervals after treatment*[1]

| Vegetative Treatment[2] | Shrub Stem Count (Stems/Acre) By Date | | |
|---|---|---|---|
| | July 1, 1969 | July, 1970 | July, 1972 |
| B | 162,500 | 112,250 | 95,250 |
| C | 91,250 | 63,750 | 30,000 |
| D | 43,750 | 38,500 | 37,000 |

[1]Average shrub stem density on plots before treatment was 88,500. Basis = 4 mil-acre quadrats in each of four replications of each treatment

[2]B = Shrub stems removed
C = All vegetation removed
D = Mineral soil exposed

## Literature Cited

1. Alm, A.A. and R. Schantz-Hansen. 1972. Five-year results from tubelings plantings in Minnesota, J. For. 70(10):617-619.

## News & Reviews

*(Continued from p. 24)*

### *Solving Shade Tree Growing Problems*

Shade trees lead a sort of precarious existence these days because of air pollution. One of the best things that can be done to help them, other than eliminating the cause, is fertilizing them with nitrogen fertilizer every year.

Nitrogen can be applied with a lawn spreader in November after most of the leaves have fallen, or in April or May. Either should produce good results.

Fertilizing can help maintain mature trees in a vigorous growing condition, according to plant pathologists of the Illinois Natural History Survey, in a long-term report about tree fertilization experiments.

According to the report:

"Established trees weakened by leaf diseases, insect defoliation, mechanical injury, soil compaction, drought, or other causes often show poor growth or dying of branch ends. Fertilization may stimulate additional growth so that the plant can compensate for the conditions that cause decline."

Little nitrogen remains in the soil from year to *year,* most of it is used by plants or carried away by water. This is why it should be applied even year. Phosphorus and potassium fertilizers are chemically hound in the soil and become available slowly throughout several growing seasons. They should be added to the soil every 3 to S years in either spring or fall. Since phosphorus mostly remains where it is placed, and potash nearly the same, these elements should be applied down in the root zone, through holes 12 to 15 inches deep. spaced about 2 feet apart under the spread of the branches. Two level tablespoons of superphosphate (0-20-0) and one level tablespoon of muriate of potash (0-0-60) should be placed in each hole.

Nitrogen fertilizers applied to the soil surface are just as effective, or more so than those applied by any other method. With rainfall or watering, nitrogen will run readily down into the soil.

Nitrogen should be spread evenly with a lawn spreader over the area under the spread of the branches, about 2 feet away from the trunk.

Apply at the rate of 6 pounds per 100 square feet when the grass is dry to avoid risk of burning. After spreading, hose off any fertilizer that might remain on grass blades.

For 1,000 square feet use 13 pounds of Urea (45-0-0), or 18 pounds of Ammonium nitrate (33.5-0-0) or 29 pounds of Ammonium sulfate (21-0-Ol. (from Washington Post, Friday, Nov. 9. 1973)

### *Tree-Mendous success*

One of the objectives of Pennsylvania's Monroe Conservation District is to encourage tree planting, so district directors decided to have a seedling sale. Not knowing what the public response might be, the district ordered 10,000 seedlings. Boy Scouts agreed to sell and distribute. Announcements and