WHITE PINE SURVIVAL AND GROWTH SIMILAR, REGARDLESS OF PLANTING DEPTHS AND METHODS, IN ONTARIO TESTS

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This report indicates a uniformity of survival and height growth for eastern white pine *(Pinus strobus L.),* 10 years after hand planting of forest tree nursery stock was done during 1948-51 on abandoned farmland. Four methods (wedge, slit, cone, and T) and five depths of planting (- 2, -1, 0, +1, and +2 inches) were used. No consistent or significant effect) of method or depth of planting were found, confirming the work of Carvel and Kulow (2) and of Men and Funk (7).

A similar experiment with red pine *(Pinus resinosa* Ait.) and white spruce *(Picea glauca* (Moench) Voss), conducted in conjunction with one of the white pine tests, provided contrasting results.

Review of Literature

Much of the work reported relates to the southern pines. Results have been variable, perhaps partly because moisture conditions vary with the site or *year (5, 6, 12, 13, 15-17)*.

Depth of Planting

Deep planting has resulted in better survival of ponderosa pine (3) and red pine (8). No consistent effect of depth of planting on survival was found for white spruce (9) or white pine (10). No significant differences were found in survival of white pine at depths of 2 inches above nursery level to 3 inches below, but there was a reduction in survival at 6 inches below (2).

The effects on height growth are also varied. In red pine the greatest height growth was obtained by shallow (1 inch above) planting (8). For white spruce, height differences varied with the method of planting (9). For white pine, there were no significant differences in height growth from 2 inches above to 3 inches below, but at 6 inches below there was a depression in height growth (2).

Method of Planting

With some species and under certain planting conditions, the method of planting may have important effects on the rate of survival, the rate of growth, and even the health of the plantations (8, 9). For white pine, a study of bar, mattock, and machine planting showed no differences in survival and height growth between the two hand methods after 10 years (7). The use of slit planting for this species has been disapproved, although seemingly without supporting data (1, 14).

The Ontario Experiments

Experiment A was a nonrandomized test in which 2,000 2-2 white pine trees were planted in the spring of 1948 at Vivian Forest, about 30 miles north of Toronto. The site is well-drained, well-sorted calcareous sand. The area was mapped as Brighton sandy loam (4), which has a neutral to slightly alkaline surface soil reaction. However, at planting time, the area was almost blow sand, with a sparse grass cover, and was apparently an eroded phase of the soil type. One hundred trees were planted by each of the four methods of planting (wedge, slit, cone, and T) and five depths of planting (- 2, -1, 0, + 1, or + 2 inches).

Experiment B duplicated "A" in the spring of 1949 at the Kemptville Nursery, about 30 miles south of Ottawa. The site, mapped as Granby sandy loam, was poorly drained, slightly acid to neutral, and level (11). It had recently been a pasture and had a heavy sod cover.

Experiment C, done a year later at the same place, was larger: 3,000 2-2 trees planted with other species in a randomized block plan with three replications. The white pine was planted in blocks of 50 trees and was mixed with equal size blocks of white spruce and red pine. The area had been abandoned for farming several years earlier and contained some herbs, small willow, and birch in heavy sod.

At the end of the 10th season after planting, the heights of all living trees in the three plantings were measured. The data from Experiment C were analyzed statistically.

Results

Survival and average heights after 10 years are shown in tables 1 and 2, respectively.

The depth of planting from -2 to + 2 inches have had no consistent effects on survival and growth. Based on experiments A and B, shallow planting reduced survival. However, in the fully randomized experiment, based on 3,000 trees, the effects were not statistically significant. Similarly, there was no significant trend of the effects of depth of planting on height growth. Thus, exact regulation of planting depth apparently is of little importance (2). White pine has been more tolerant to differences in depth of planting than red pine and white spruce.

The four methods of planting-wedge, slit, cone, and T-had no consistent effect on either survival or growth in the three white pine experiments. The differences were small in all comparisons, and in C, the statistically designed experiment, they were not significant. These results confirm the work of Merz and Funk (7).

Results for the other species were different. For

TABLE 1.—*Survival in three white pine experiments 10 years after outplanting*

Experiment and method of planting	Depth of planting (inches)					
	−2	−1	0	+1	+2	Average
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Experiment A:						
Wedge	84.0	78.0	82.0	66.0	67.0	75.1
Slit	77.0	80.0	82.0	86.0	72.0	79.6
Cone	64.0	80.0	66.0	63.0	49.0	64.6
T	74.0	76.0	72.0	70.0	68.0	72.2
Average	74.9	78.2	75.8	71.2	64.0	72.9
Experiment B:						
Wedge	86.0	84.0	83.0	88.0	67.0	81.6
Slit	66.0	90.0	86.0	76.0	72.0	78.0
Cone	89.0	84.0	78.0	75.0	59.0	77.0
T	88.0	91.0	78.0	61.0	42.0	72.0
Average	82.2	87.2	81.2	75.0	60.0	77.2
Experiment C:						
Wedge	81.0	83.0	91.0	74.0	86.0	82.9
Slit	83.0	90.0	91.0	89.0	89.0	88.3
Cone	85.0	88.0	83.0	90.0	84.0	85.9
T	86.0	85.0	86.0	85.0	90.0	86.4
Average	83.5	86.5	87.7	84.5	87.2	85.9

TABLE 2.—*Average heights in three white pine experiments 10 years after outplanting*

Method of planting	Depth of planting (inches)					
	−2	−1	0	+1	+2	Average
	Ft.	*Ft.*	*Ft.*	*Ft.*	*Ft.*	*Ft.*
Experiment A:						
Wedge	8.9	9.2	9.6	9.3	9.5	9.30
Slit	9.6	9.9	10.0	10.7	9.6	9.98
Cone	9.5	9.9	9.9	11.4	9.6	10.07
T	10.8	10.3	9.6	9.9	9.3	9.99
Average	9.70	9.82	9.80	10.32	9.46	9.83
Experiment B:						
Wedge	11.6	11.9	11.1	11.7	9.8	11.05
Slit	9.7	10.4	10.7	11.3	11.3	10.68
Cone	11.8	12.0	10.4	10.5	10.4	11.08
T	11.3	11.1	9.3	9.5	9.4	10.29
Average	11.19	11.06	10.40	10.84	10.30	10.79
Experiment C:						
Wedge	5.8	4.7	7.6	5.7	5.8	5.95
Slit	5.9	7.6	6.2	6.4	7.3	6.67
Cone	6.7	5.4	6.8	6.3	7.9	6.59
T	6.2	6.4	5.7	5.7	6.8	6.16
Average	6.15	6.03	6.58	6.02	6.93	6.35

white spruce, the T method was very unsatisfactory,

(9). and the slit method was inferior to the wedge method For red pine, the T method was also inferior, and the slit method was slightly less satisfactory than the wedge method (10).

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