Growth and Survival of Yellow Birch, Sugar Maple, and White Ash After Fall Planting[1]

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Yellow birch, white ash, and sugar maple can be successfully planted in the fall in Vermont. Survival rates were as high as 70 to 90 percent.

Forest tree planting is traditionally done in the spring before seedling growth begins. In this planting sequence, an assessment of survival can then be made in the fall and early decisions made on other treatments needed. Spring planting, however, can present some complications. Nurseries are usually built at low elevations, and spring activities usually occur sooner there than in the mountains. Therefore, nursery stock must often be lifted early and stored until mountain sites are ready for planting. Bud break in the spring often occurs rapidly, and there is frequently a short time interval for lifting and planting. When mid- and upper-elevation sites become open for planting, the growing season can progress rapidly. Sudden warm weather and dry periods can occur shortly after planting and pose survival problems to hardwoods that are expanding succulent new leaves. With days becoming warmer, planted trees can be subjected to severe moisture stresses during this critical root establishment time.

Planting in the fall can offer more flexibility. Plants can be lifted and outplanted beginning about the time of leaf fall. Days are getting cooler, and survival should be better when trees are entering the dormant bud stage. Though cold days and snow may occur, the soil on forest sites is slow to freeze, and we have been able to plant into December. There may be questions about how appropriate this activity is considering the fact that there may be little root growth late in the autumn. We are, in fact, uncertain about whether or not root growth occurs in our hardwoods during the warm days of September and October, as it does in some conifers. There is also concern about occurrence of frost heaving with fall planting.

Study Area and Methods

To test some of these hypotheses and determine the success of autumn-planting of northern hardwoods, a small study was begun in October 1976 with 1-1 bare-root yellow birch seedlings and 1-0 bare-root sugar maple and white ash seedlings. The objectives were to see how well the planted trees would survive the winter and grow the following spring and summer.

Seedlings were lifted from sandy soil at the Essex junction nursery site at an elevation of about 500 feet, packed, and planted on the site within a 3-day interval. The planting site was two north-south oriented clearcut strips on a west-facing slope at about 1,400 feet elevation near Chelsea, Vt. These clearcuts were made in 1974 and 1975. The soil is a well to excessively drained sandy loam of the Tunbridge-Woodstock soil series complex and has good profile development. Nutrient status on the site is controlled by the calcareous quartzite and mica schist bedrock and mixed glacial till. Seedlings were planted in two experimental blocks, one in each clearcut strip. The trees were in rows of 10 with species assigned to the rows at random, two rows for each species in each of the blocks. All seedlings were planted with a mattock using the dug-hole method. Stems were treated with arasan and roplex to minimize deer browsing or damage by rabbits and mice. Total height was measured immediately after planting and at the end of each growing season. Data were analyzed as means for 10-tree rows.

[1]Contribution of the University of Vermont, School of Natural Resources, Department of Forestry and the McIntyre-Stennis Research Program.

Results

The plantings were inspected the following spring, and survival appeared good. There were no obvious indications of seedlings being heaved out of the ground by frost action. Measurements were made in the autumn after 1, 2, and 3 years of growth.

Height growth. Initial heights of the 1-0 white ash and sugar maple were similar at the time of planting, but the 1-1 yellow birch was about twice as tall (table 1). Measurements in the fall of the first growing season, 1 year after planting, indicated survival was good and the planting could be rated a success. Yellow birch survival was 100 percent among 40 trees, and sugar maple and white ash were 95 and 90 percent, respectively (table 1). Browsing was a factor influencing total height growth the 1st year. Yellow birch was browsed most heavily and lost 13 centimeters in height during the first season, while white ash and sugar maple gained 8 to 9 centimeters (table 1).

Following the 2d year of growth, survival dropped to 77 percent among yellow birch. Most yellow birch trees were heavily browsed by deer. This browsing substantially influenced survival, as did the increased competition from *Rubus* sp. 2 years after clearcut. Survivals of white ash and sugar maple were 93 and 98 percent, respectively, after 2 years of growth. The increases in survival among ash and maple indicate that trees that had been heavily browsed the year before and thus reported as missing or dead evidently sprouted and were tallied as living the 2d year. In the 2d year, all trees increased in height; yellow birch grew about 20 centimeters despite considerable browsing. Sugar maple and white ash grew about 10 centimeters. These differences in height increments were significant.

While deer browsing was evidently quite heavy the 2d year after planting, growth of *Rubus*

Table 1.—*Average total heights and survival percentages for yellow birch, white ash, and sugar maple planted on a forest site in Vermont*

Species and stock grade	Planted October 1976	Fall 1977		Fall 1978		Fall 1979		
	Original height	1-year height	Survival percentage	2-year height	Survival percentage	3-year height	Survival percentage	3-year height increment[1]
	Centimeters	*Centimeters*		*Centimeters*		*Centimeters*		*Centimeters*
Yellow birch 1-1	54.4	41.2	100	60.5	78	88.3	68	34.2
White ash 1-0	13.8	22.1	95	32.0	93	43.2	75	27.6
Sugar maple 1-0	14.5	23.7	90	30.0	97	47.9	90	33.5

[1]Three-year height increments were calculated for surviving trees.

on the site 3 years after cutting may be diverting or restricting deer browsing pressure. We anticipate survival should stabilize and growth steadily increase as the trees overcome the *Rubus* sp. competition.

Measurements were made in fall 1979 for analysis of 3-year growth and survival. Because of differences in original height between species, a 3-year height increment was used in the analysis. Analysis of variance indicated there were no significant differences in 3-year height increments among the three species and also no significant differences in growth between the two blocks. This block comparison is important because the clearcutting in the blocks was completed in 2 different years (1974 and 1975), and thus there are some differences in degree of competition from raspberries and blackberries *(Rubus* sp.) and other weed species.

Lack of significant differences in 3-year height increments is attributed to the large growth variation within a treatment. This large variation is a result of animal browsing, stem breakage, and dieback. Yellow birches were tallest at the time of planting, had the greatest 3-year height increment, and are still the tallest trees despite substantial deer browsing (table 1). The tallest yellow birch is 190 centimeters (5.9 ft).

White ash and sugar maple were about the same height when planted, but sugar maple is slightly taller after 3 years. Of the three species planted, white ash appears to be the preferred browse species. A small planting of large ash seedlings, 2-1 stock about 4 feet tall, had no substantial height increase in 3-years. Most trees have multiple leaders due to deer browsing.

Survival. Three-year survival was significantly better for sugar maple (90 percent) than for white ash (75 percent) or yellow birch (68 percent). Sugar maple evidently has greater tolerance to shade competition from *Rubus* and has endured less browsing pressure. Yellow birch had the lowest survival with only three trees remaining in one row near a brush pile where mouse damage was severe. It is expected that survival will now stabilize and that 70 percent survival is adequate considering the browse pressure that is occurring. Planting time and planting method have probably not significantly affected survival; all planted trees were living in the spring after planting.

Examination of the plantation in spring 1979 indicated considerable breakage of stems due to settling of crusty snow during the previous winter. This was also observed in other plantings in the area. The problem seems more acute where there is a dense stand of *Rubus* in the tall cane stage of development. It appears that, if wet snow or rain and snow occur, a crust will freeze to the *Rubus* canes. Subsequent settling of this crust breaks the *Rubus* canes. The *Rubus* canopy, including the snow crust, then settles on the seedlings, bending or breaking them. In other instances, lower branches of yellow birch have been pulled out of the stem by the settling snow crust that was frozen to them.

Conclusions

Results of this study and a field trial with larger stock in the fall of 1975 indicate that yellow birch, white ash, and sugar maple bare-root nursery stock can be successfully planted in the fall using the mattock dughole method. It may be possible to plant for an interval of 6 to 10 weeks or more in the fall, from October into December. End of the planting season may be determined by snow depth, accessibility, and access to winter-hardened nursery stock.

Fall planting of birch, maple, and ash can yield survival rates about equal to those observed in spring planting-70 to 90 percent survival or better. Seedling growth in the 1st or succeeding years does not seem to be impeded in any way by fall planting. We observed no noticeable frost heaving as a result of fall planting.