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ESTABLISHING SUGAR MAPLE PLANTATIONS IN SOUTHERN ONTARIO

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KEY WORDS: planting stock, site preparation, post-planting weed control, potato leafhopper, pruning

INTRODUCTION

In southern Ontario, sugar maple (*Acer saccharum* Marsh.) is a common component of most hardwood woodlots. Natural regeneration is nearly always abundant under forest conditions but attempts to establish plantations on abandoned farmland have met with only limited success (Yawney and Carl 1970, von Althen and Webb 1980, von Althen 1990).

When a questionnaire was distributed to landowners in southern Ontario in 1969, the results revealed that sugar maple was one of the preferred species for the afforestation of former farmland, and a series of studies was initiated to determine the relative importance of the factors that affect successful plantation establishment. This technical note presents the 15-year results of a comparison of the survival and early growth of sugar maple planting stock of various ages and sizes (Fig. 1).

METHODS

In the spring of 1976, 2-, 3- and 4-year-old (2+0, 3+0 and 4+0) seedlings and 3- and 5-year-old (2+1 and 2+3) transplants were planted in a former agricultural field with a soil of well-drained, gravelly loam. The field was plowed

Figure 1. Sugar maple growth 15 years after planting.

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in the early summer of 1975 and was disked several times during the same summer to destroy the original weed cover and all regrowth. All sugar maple seedlings and the 2+1 transplants were machine-planted, whereas the 2+3 transplants were planted in auger holes, 30 cm in diameter, made with a post-hole auger attached to a farm tractor. Spacing was 3 m between rows and 1.5 m within rows. Weed control was maintained for the first 3 years after planting by rototilling between the rows and spraying the unwanted vegetation within the rows with 4.7 L/ha of Roundup in 400 L of water (0.5 gal/ac of Roundup in 160 L of water). Tree survival and height were recorded in the first and fourth years and survival, height and diameter at breast height (DBH) were recorded in years 10 and 15.

RESULTS

Table 1 shows the characteristics of the stock at the time of planting. Although there were relatively small size differences among the three seedling classes and the 2+1 transplants, the 2+3 transplants were much larger.

Table 2 contains the survival and height increment (total height minus the stem length at the time of planting) data at 4, 10 and 15 years after planting and the DBH at 10 and 15 years. Survival was 96% or higher for all age classes 15 years after planting, except for the 2+1 transplants, of which 85% survived. This lower survival is difficult to explain, because most of the mortality occurred between 10 and 15 years after planting.

Fifteen years after planting, height increment of the 2+3 transplants was significantly greater than that of the 2+0 seedlings and 2+1 transplants. The DBH of the 2+3 transplants was significantly higher than that of all other age classes.

WEED CONTROL AND ATTACKS BY THE POTATO LEAFHOPPER

Newly planted sugar maple trees are very sensitive to competition from weeds and grasses. Effective weed control during the early years after planting is therefore a prerequisite for high survival and rapid height growth. However, sugar maple is subject to attack by the potato leafhopper (*Empoasca fabae* [Harr.], Fig. 2), which feeds on young foliage and causes the tree to produce multiple leaders ("cabbage heading", Fig. 3). The potato leafhopper does not overwinter in Ontario (D.P. Webb, Ontario Forestry Research Institute, Sault Ste. Marie, Ont., unpublished report). Each year, this insect migrates north across the Great Lakes. This migration delays its arrival in southern Ontario until the end of June. Without weed control, most sugar maple trees finish their height growth by setting their terminal bud at the end of June. Since the potato leafhopper feeds only on new growth, trees with a set terminal bud are not attacked. However, elimination of the herbaceous competition allows the trees to continue their height growth until the end of August. These trees are therefore subject to leafhopper attacks.

Table 1. Characteristics of the sugar maple planting stock size at the time of planting.

Stock age	Root collar diameter (mm)	Stem length (cm)	Oven-dry stem weight (g)	Oven-dry root weight (g)	Shoot:root ratio
2+0	5.6	44	3.4	3.9	0.87
3+0	8.4	60	9.7	10.3	0.94
4+0	9.7	64	13.7	18.3	0.75
2+1	6.2	42	4.4	7.6	0.58
2+3	19.5	109	108.0	97.0	1.11

Table 2. Survival, height increment and DBH of the sugar maple 4, 10 and 15 years after planting.

Stock age	Survival (%)			Height increment (cm)			DBH (cm)	
	4 years	10 years	15[a] years	4 years	10 years	15[a] years	10 years	15[a] years
2+0	95	95	96 a	156	516	692 a	5.2	6.6 a
3+0	99	99	98 a	157	514	707 ab	5.4	7.1 a
4+0	99	97	96 a	166	516	695 ab	5.5	7.1 a
2+1	98	95	85 b	154	497	684 a	4.8	6.4 a
2+3	98	96	96 a	212	697	745 b	7.4	9.0 b

[a] Different letters within a column denote values that differ significantly at $p<0.05$ (Tukey's tests of independence).

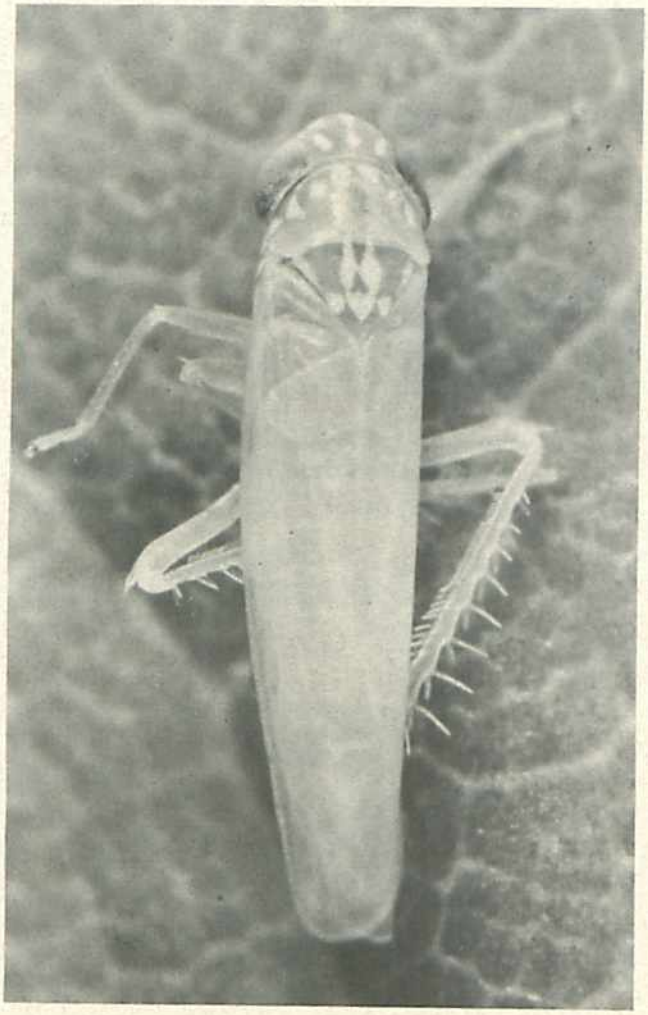

Figure 2. The potato leafhopper.

In our plantation, all trees were attacked by leafhoppers during the first 4 years after planting. Thereafter, re-establishment of even a light weed cover caused the trees to set their terminal buds in late June. With no young leaves to feed on, the attacks ceased. To correct the excessive branching caused by the leafhopper, forks and excessive side branches were pruned from affected trees during the winter at about 10 years of age.

IMPLICATIONS AND RECOMMENDATIONS

The results of this study show that the largest planting stock produced the largest trees. For the planting of small numbers of trees on golf courses, in gardens, along laneways, or at wide openings for maple syrup production, planting large transplants is recommended. The high cost of the planting stock, transportation and the digging of large planting holes will probably be justified. However, for the afforestation of former farmland planting 2+0 or 3+0 sugar maple seedlings in mixture with other hardwood species suitable for the soil and drainage conditions of the planting site is recommended. Although any sugar maple tree may be attacked by the potato leafhopper, damage is generally more serious in pure sugar maple plantations than in mixed stands. Despite the damage caused by leafhopper attacks, weed competition should be controlled during the first 3 years after planting because tree mortality is generally high and height growth is retarded when weeds are not controlled.

REFERENCES AND FURTHER READING

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Figure 3. Three-year-old sugar maple, showing bunching of leaves as a result of feeding by the potato leafhopper.

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