Mowing Versus Mechanical or Chemical Weed Control in Sugar Maple Afforestation

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Ten-year cumulative height increments of planted sugar maple were 156 and 366 centimeters, respectively, in plots that were mowed four times a year for 9 years or rototilled for 4 years and sprayed with simazine for 5 years. Elimination of competing vegetation with applications of propyzamide and simazine resulted in better height increments in 1 year than did mowing during the previous 4 years.

Many plantation owners mow between the rows of planted trees believing that this will improve tree growth. In farming areas, it may be mandatory to cut the weeds to prevent the spread of seeds onto adjacent agricultural fields. Mowing is also beneficial because it reduces the shelter for rabbits and mice and thereby helps to reduce browsing and stem girdling. However, mowing removes only the aboveground parts of the weeds, while the roots remain undisturbed and continue to compete actively for moisture and nutrients.

This report presents the results of a study that compared mowing with chemical and mechanical elimination of herbaceous vegetation on the 10-year survival and growth of planted sugar maple (*Acer saccharum* Marsh.) seedlings.

Methods

In spring 1973, 2+0 sugar maple seedlings were planted in two fields in southwestern Ontario with soils of sandy loam and clay loam. The fields were plowed in the summer and disked several times before spring planting. Both plantations were divided into three plots, each containing 288 seedlings. One of the following weed control treatments was applied to each plot four times per summer in each of the first 4 years after planting: (1) Rototilling between the rows and manual hoeing around the trees, (2) spraying 2.5 kilograms per hectare of active paraquat (Gramoxone) on the vegetation within a circle 60 centimeters in diameter around the tree seedlings, or (3) mowing between the rows and around the seedlings. No weed control was applied during the fifth growing season. In November of the fifth year, 2.1 kilograms per hectare of active propyzamide (Kerb) were broadcast over the mowed plot on the sandy loam soil. Starting in April of the sixth growing season, 4.5 kilograms per hectare of active simazine (Princep) were broadcast annually over all plots on both soils, with the exception of the mowed plot on the clay loam soil. This plot was mowed four times during the sixth growing season. In November of the sixth year, the plot was split. On one-half of the plot, the weeds were mowed four times annually for the next 4 years. On the other half, 2.1 kilograms per hectare of active propyzamide were broadcast in November; 2.1 kilograms per hectare of active glyphosate (Roundup) were sprayed on the vegetation in June and August of the seventh growing season; and 4.5 kilograms per hectare of active simazine were broadcast in April of the seventh to tenth growing seasons. Survival and height of all trees in all plots were recorded each autumn. Wire sleeves were placed around all stems in the rototilled and mowed plots on the sandy loam soil to protect the trees from stem girdling by rabbits. No sleeves were placed around the trees in the paraquat-treated plot.

Results and Discussion

Extensive stem girdling by cottontail rabbits (*Sylvilagus floridanus* Allen) in the paraquat plot on the sandy loam soil made treatment comparisons meaningless and the survival and growth data from this plot are therefore excluded from this report. Table 1 shows seedling survival by weed control treatments and years since planting. No single cause was responsible for the mortality. Most seedlings died from natural causes, while few died from repeated browsing or cutting with the lawnmower.

At the time of planting, all plots were completely weed-free. In autumn of the first year, however, a dense cover of quackgrass (*Agropyron repens* L. Beauv.) invaded the mowed plot on the sandy loam. On the clay loam, the mowed plot and untreated parts of the paraquat plot were invaded by ragweed (*Ambrosia artemisifolia* L.), lamb's quarters (*Chenopodium album* L.), wild carrot (*Daucus carota* L.), and quackgrass. During the next 3 years, this vegetation changed to mainly quackgrass.

In the mowed plots, height growth started in the middle of May and finished at the end of June. In the weeded plots, height growth also started in the middle of May, but continued in spurts, interspaced with short resting periods, until the end of August.

Following the suspension of the original weed control treatments at the end of the fourth growing season, sugar maple growth slowed during the fifth year in all plots. However, the growth reduction was smallest in the rototilled plots, because they were weed-free at the beginning of the year and serious competition from the invading weeds was delayed until the end of the growing season (figs. 1 and 2).

After the elimination of all weeds in the mowed plot on the sandy loam soil by an autumn application of propyzamide and a spring application of simazine, the sugar maple seedlings grew 67 centimeters the next year, while their cumulative growth during the previous 5 years had been 61 centimeters (fig. 1).

Similar results were obtained after the elimination of the competition on one-half of the mowed plot on the clay loam soil (fig. 2). Following the application of propyzamide and glyphosate during the first growing season, height growth was 65 percent greater in the chemically weeded half of the plot than in the mowed half. After the plot was split, cumulative 4-year height increments in the chemically weeded and mowed halves of the plot were 197 and 68 centimeters, respectively.

The detrimental effects of weed competition on hardwood tree growth are well documented (1, 2, 3, 4). However, insufficient information is available on the relative importance of competition for light, moisture, nutrients, or the possible interference with tree growth by allelopaths or toxins produced by the weeds. In our plantations, the sugar maple foliage in the mowed plots was yellowish (Munsell color chart value 5.0 Y, 7/6), while that in the

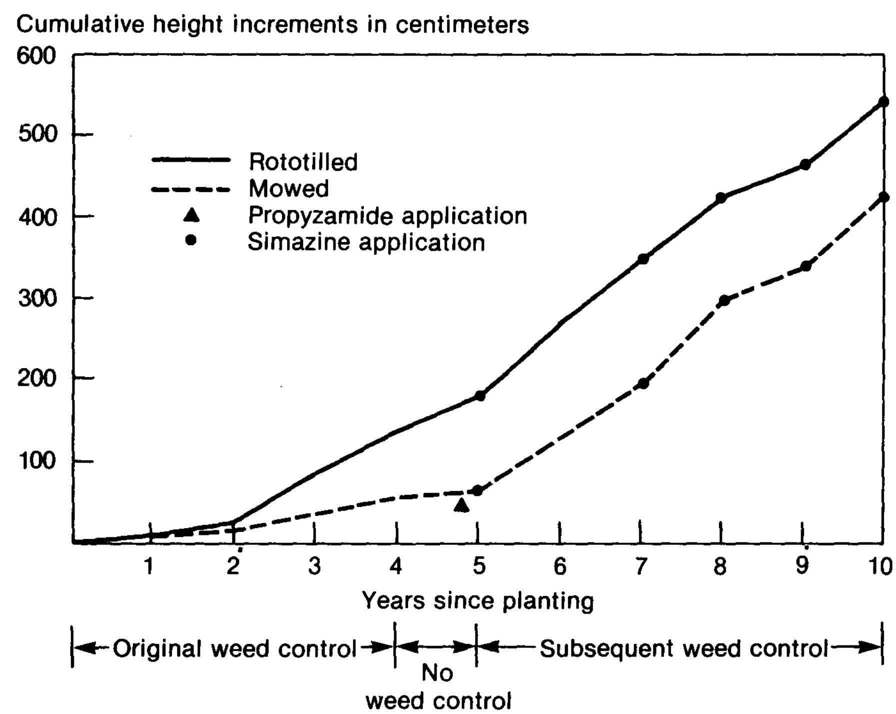

Figure 1—*Cumulative height increments since planting of sugar maple seedlings (2+0) by weed control treatments and by years since planting (sandy loam soil).*

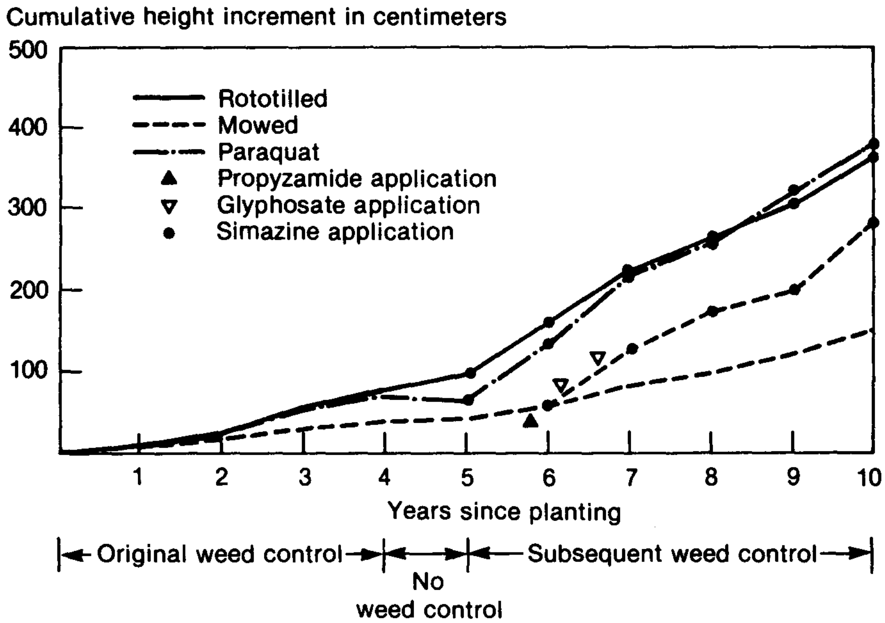

Figure 2—*Cumulative height increments since planting of sugar maple seedlings (2+0) by weed control treatments and by years since planting (clay loam soil).*

Table 1—*Percentage of survival by weed control treatments and years since planting*

	Sandy loam			Clay loam			
Years since planting	Rototilled plus simazine	Mowed	Mowed plus propyzamide and simazine	Paraquat plus simazine	Rototilled plus simazine	Mowed	Mowed plus propyzamide, glyphosate, and simazine
1	96	92	—[1]	98	99	98	—
2	89	85	—	97	94	95	—
3	87	83	—	96	93	94	—
4	87	80	—	95	92	93	—
5	85	78	—	95	90	88	—
6	85	—	78	95	90	88	—
7	85	—	78	94	90	88	88
8	85	—	78	94	90	87	86
9	85	—	78	94	90	87	86
10	85	—	77	94	90	87	84

[1]— = not applicable or not available.

rototilled and chemically weeded plots was dark green (Munsell color chart value 5.0 GY 4/4). Before the mowed plot was split, the N contents of the sugar maple leaves in the rototilled and mowed plots were 1.91 and 1.31 percent, respectively. Elimination of the weed competition increased the N content of the leaves to 2.11 percent, while the N content of the leaves of trees growing in the mowed half remained at 1.31 percent.

Conclusion

More research is needed to determine the processes by which the weeds interfere with tree growth. Nevertheless, the results of this study clearly show that mowing is no substitute for mechanical or chemical elimination of weeds, because it fails to remove the negative influence of the herbaceous competition on tree growth.

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