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LOCUST SPROUTS REDUCE GROWTH OF YELLOW-POPLAR SEEDLINGS

Abstract.--Dense thickets of black locust which often appear after clearcutting in the Southern Appalachians and Piedmont, can severely reduce growth of other desirable hardwoods. Released yellow-poplar seedlings were 51 percent taller and 79 percent larger in diameter than unreleased ones 6 years after treatment.

Black locust (Robinia pseudoacacia L.) is usually at least a minor component of mature hardwood stands on good sites in the Southern Appalachians and Piedmont. When cut, the species produces root suckers prolifically, and dense thickets of locust sprouts often appear after clearcutting. The sprouts soon overtop seedlings of yellow-poplar and other desirable timber species. Locust thickets usually begin breaking up after a few years and only occasionally dominate a site for an entire rotation, but the study reported here shows that they reduce growth of yellow-poplar (Liriodendron tulipifera L.) seedlings.

METHODS

The study was installed in 1966 on a 45-acre area on the Bent Creek Experimental Forest in western North Carolina. The area is at an elevation of 3,000 feet on an east-facing slope. Soil is Porters stony loam. Site index for yellow-poplar ranged from 90 to 110. In 1963 a stand of large, high-quality yellow-poplar, red and chestnut oak, and hemlock was clearcut. An average of eight locust trees per acre was also cut. However, locusts were not distributed evenly over the area. Most were concentrated on the lower slope, where site quality was highest. In 1965, locust sprouts occurred on 25 of 45 sample plots located systematically over the clearcut area. On these 25 plots an average of 1,853 locust sprouts per acre overtopped most seedlings and sprouts of other species.

In fall 1966 we chose five pairs of 1/40-acre circular plots that were dominated by very dense stands of locust sprouts and contained at least 20 yellow-poplar seedlings. Plots were paired to reduce the effect of site differences on treatment comparisons. The members of each pair were adjacent to one another and varied little in apparent site qual-

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ity. Pairs were separated by distances up to 200 yards and varied in slope position and presumably in site quality. On each of these plots 20 of the tallest yellow-poplars were permanently marked and their heights measured. Locust sprouts were counted, and the average height of the dominant sprout stand was determined (table 1). One plot in each of the five pairs was randomly chosen as a control. On the other plot in the pair all locust sprouts were treated with 2, 4, 5-T in frills. A followup treatment the next growing season completely eliminated all locust from the treated plots. Nothing was done to the control plots.

The height of the yellow-poplar seedlings was measured at the end of each growing season for 5 years after treatment. At the end of the sixth growing season all locusts on control plots were tallied, and the heights and diameters of the five largest locusts were measured. At that time, both heights and diameters of the surviving yellow-poplars, now age 9, were recorded.

Although we measured 20 yellow-poplar seedlings per 1/40-acre plots, we performed analyses on both the average of all survivals of the 20 and on the 5 tallest per plot. Results were similar for both sets of seedling measurements. In this paper we present only the results based on the 5 tallest per plot, which is equivalent to 200 seedlings per acre.

Table 1.--Plot conditions in 3-year-old stand prior to treatment of locust stems

Pair and treatment	Yellow-poplar		Locust	
	Average height of 20 tallest seedlings on a plot	Average height of 5 tallest seedlings on a plot	Occurrence	Average height
	- - - - Feet - - - -		Number/plot	Feet
Pair 1				
Treated	6.1	7.8	40	16
Untreated	3.7	5.4	65	14
Pair 2				
Treated	2.4	5.3	35	16
Untreated	3.6	4.9	26	11
Pair 3				
Treated	4.2	5.2	40	11
Untreated	2.8	4.1	40	12
Pair 4				
Treated	3.1	4.2	46	9
Untreated	2.3	3.8	50	11
Pair 5				
Treated	3.0	4.3	35	11
Untreated	3.3	4.7	30	11
Average				
Treated	3.7	5.4	39	12
Untreated	3.1	4.6	42	12

Using the t test for paired plots, we tested for differences in average height of the five tallest seedlings for each year following treatment. We also compared diameter of seedlings on treated and control plots after six growing seasons.

RESULTS

Height of Seedlings

At the time of study installation and for the first year after treatment there was no significant difference in average height of yellow-poplar between the treated and untreated plots (table 2). From the second to the sixth year after treatment there were highly significant differences in average height. Beginning with the second year after treatment there is a steadily increasing difference between height of the released and unreleased seedlings (fig. 1). Six growing seasons after treatment the seedlings released from the black locust were 51 percent taller than those that had not been released.

Table 2. --Average height of five tallest yellow-poplar seedlings, by treatment and years since treatment

Years since treatment	Treated (T)	Untreated (UT)	Average difference[1] (T-UT)
		Feet	
0	5.4	4.6	0.8^{ns}
1	7.4	7.0	$.4^{ns}$
2	11.7	9.3	2.4^{**}
3	15.8	10.9	4.9^{**}
4	19.0	13.0	6.0^{**}
5	21.8	14.1	7.7^{**}
6	24.0	15.9	8.1^{**}

[1] ** = Significant at the 0.01 level.
ns = Not significant at the 0.05 level.

Diameter of Seedlings

At the end of the sixth growing season following treatment we included a measure of d.b.h. on the five tallest yellow-poplars. In each of the five pairs of plots, diameters were significantly (P = 0.01) greater in the treated than in the untreated plot (table 3). On the average, diameter in the treated plots was nearly 79 percent greater than in the untreated plots.

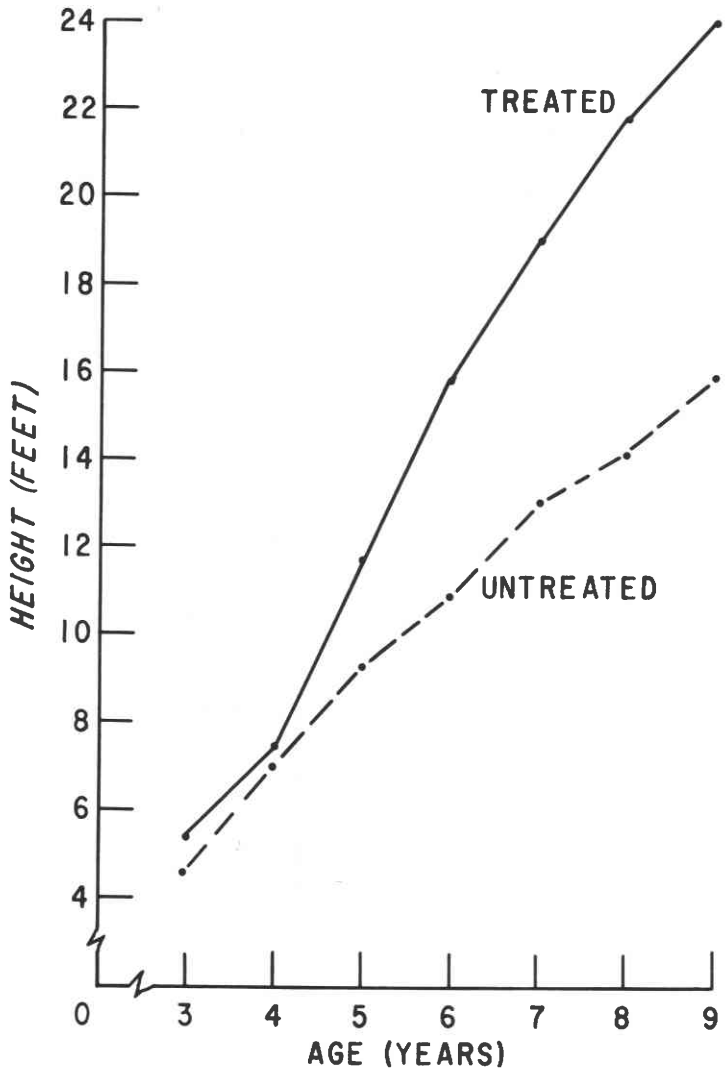

Figure 1.--Average heights of the five tallest yellow-poplars on treated and untreated plots.

Table 3.--Average diameter of the five tallest yellow-poplar seedlings 6 years after treatment

Pair	Treated (T)	Untreated (UT)	Average difference (T-UT)
	Inches		
1	3.5	1.8	1.7
2	2.1	1.0	1.1
3	2.4	1.3	1.1
4	2.2	1.5	.7
5	2.3	1.4	.9
Average	2.5	1.4	1.1

Locust on Uncleaned Plots

Table 4 shows the relative size of locust and yellow-poplar on the untreated plots when the stand was 9 years old. On the average there were 17 locust sprouts surviving at age 9 as compared to 42 when the stand was 3 years old. Locust, however, was still the dominant species on the plots. The five tallest locusts averaged almost twice as tall and nearly $2\frac{1}{2}$ times as large in d.b.h. as the five tallest yellow-poplars.

Table 4.--Status of the untreated plots at 9 years of age

Plot	Yellow-poplar (five tallest)		Locust (five tallest)	
	Height	D.b.h.	Height	D.b.h.
	Feet	Inches	Feet	Inches
1	21	1.8	32	3.5
2	13	1.0	33	3.7
3	15	1.3	25	2.7
4	15	1.5	33	3.5
5	16	1.4	31	3.5
Average	16	1.4	31	3.4

CONCLUSIONS

Dense thickets of locust sprouts can severely suppress growth of yellow-poplar seedlings. Six years after being released from locust sprouts at age 3, yellow-poplar seedlings averaged 24 feet in height and 2.5 inches in diameter while unreleased seedlings averaged 16 feet and 1.4 inches. On the untreated plots locust was the dominant species after 9 years. On some of the untreated plots it appears that a few yellow-poplars will make it into the new stand. On others, however, locust likely will continue to dominate the site for many years. To date there is no difference in average survival on treated and untreated plots. However, many of the surviving seedlings on untreated plots are unthrifty; their tops were severely damaged by the whipping action of the overtopping locust. We expect many of the yellow-poplars on untreated plots to succumb in the next few years. In contrast, yellow-poplars on the treated plots appear thrifty and able to maintain a good growth rate.

We conclude that when dense thickets of locust sprouts develop after clearcutting, they will have a large impact on yellow-poplar seedlings growing within the thicket. If the present trend of suppression of the yellow-poplar continues, a substantial reduction in yield of yellow-poplar could result. The importance of the effect in any particular case will depend on the proportion of the area covered with the locust thickets. In the case reported here, at least 15 percent of the cutover area supported locust thickets as dense as on the study plots. Observation of a number of similar clearcuts leads us to believe that the problem is of equal or greater magnitude on most clearcuts on good yellow-poplar sites.

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