PLANTED YELLOW-POPLAR GROWS WELL AFTER ESSENTIAL SITE PREPARATION

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Ten years after establishment, tree heights on one yellow-poplar plantation averaged 30, 25, and 12 feet according to intensity of site preparation. Some hardwood forests now being cleared and planted to pine appear suitable for yellow- poplar.

In 1966 a yellow-poplar plantation was established on an apparently mediocre site on the Cumberland Plateau near Sewanee, Tenn. The 1-0 seedlings were planted under a degraded stand of mixed hardwoods. The purpose of the planting was to observe how the yellow-poplar would perform on this site and to determine the effect of controlling the competing mixed hardwoods.

The soil is a Hartsells fine sandy loam, a type that covers millions of acres and is predominant in the Cumberland Plateau. On this site the depth to bedrock is 32 inches, and the soil has a 7 inch A horizon, slightly better than average for Hartsells.

The area had been cut and burned repeatedly over the last hundred years. The overstory contained 40 square feet of basal area in trees over 4 inches d.b.h. and included about 200 stems per acre. There were few merchantable trees in the overstory although there were many culls. The stand contained about 650 stems per acre smaller than 4 inches d.b.h. but larger than 1 inch d.b.h. and in addition from 5,000 to 10,000 stems per acre smaller than 1 inch d.b.h. Species included various oaks, hickories, red maple, sourwood, and an occasional yellow-poplar.

Preparation and Planting

Three treatments were applied to the residual stand in 1966.

Treatment I.	*Complete*. All stems injected with 2,4-D Amine and some small stems close to the planting spot were cut. Repeat injections were applied if necessary the following year to achieve complete control.
Treatment II.	*Partial*. All stems above 2 inches d.b.h. were injected. This treat is comparable to the intensity of treatment often recommended for natural regeneration after a com mercial clear-cut.
Treatment III.	*Minimum.* Stems above 6 inches d.b.h. were injected. This treatment is comparable to the way a site would be left after a commercial logging job in which pulpwood and sawlogs were removed.

The success of the above treatments for controlling competition is best judged by a look at the treated stand. The number of mixed hardwoods in excess of 1 inch d.b.h. now present after the complete, partial, and minimum treatments averages 792, 1728, and 1908 per acre respectively. On the areas receiving partial and minimum treatment there are 43 and 172 stems per acre respectively that are over 6 inches d.b.h. No stems exceed 6 inches d.b.h. on the completely treated areas.

Seedlings from Anderson County in east Tennessee and Madison County in west Tennessee were planted. All were stored moist at 38° F for about one month before use. In general the seedlings from east Tennessee were in better condition than those from the west. All of the seedlings from the east exceeded ¼ -inch diameter at the root collar; however, some smaller seedlings from the west had to be used and some early mortality occurred as a result of seedling condition.

Seedlings were planted in a randomized block design, with 3 replications, in 18 quarter-acre plots at a spacing of 7 by 7 feet. The central 25 seedlings in each plot were designated as measurement seedlings. The seedlings were kept moist and handled with care during the

Table 1.—*Survival, height, and diameter of 10-year-old planted yellow-poplar in relation to degree of overstory competition control*

Source	Competition Treatment								
	Complete[1]			Partial[2]			Minimum[3]		
	Survival	Height	Diameter	Survival	Height	Diameter	Survival	Height	Diameter
	Percent	*Feet*	*Inches*	*Percent*	*Feet*	*Inches*	*Percent*	*Feet*	*Inches*
East Tennessee . .	80	29	2.9	84	25	2.2	77	13	0.8
West Tennessee . .	71	32	3.5	6.9	25	2.4	64	10	0.8
Mean . . .	76	31	3.2	77	25	2.3	71	12	0.8

[1] Complete treatment included injection of all residual woody vegetation.
[2] Partial treatment included injection of all competing stems over 2 inches d.b.h.
[3] Minimum treatment represented a stand as a logger would leave it. However, all stems over 6 inches d.b.h. were poisoned.

planting process. The soil was moist and favorable for planting.

Results

At present there is no significant effect of the site preparation on survival; however, many seedlings in the least intensive treatment have low vigor and their mortality is likely to increase.

The overall effect of site preparation on height was highly significant. Both the complete and the partial treatment resulted in significantly taller saplings than the least intensive treatment (table 1). There was no significant difference between saplings receiving the complete and partial treatments. Seed source had no significant effect on heights nor was the seed source-release interaction significant.

The rate of height growth seems to be very stable for stems receiving the two site preparation treatments. Since 1972, treatment I saplings have grown 3.1 feet per year; those in treatment II, 2.5 feet per year. This growth rate closely matches the rate for the entire 10 years.

The number of stems of competing mixed hardwoods varied among plots having the same treatment, so the possibility existed of a correlation between the number of mixed hardwood stems present and yellow-poplar height growth. A series of plottings of yellow-poplar height over number of competing stems indicated a slight decrease in yellow-poplar height with increasing numbers of competitors, but the trend was not pronounced. Variation in the number of competing stems was not as important as size of the competitors.

As with height, the diameters of the yellow-poplar were significantly affected by the hardwood treatments (table 1). A test of treatment effects shows that the trees receiving either the

complete or the partial treatment to be significantly larger than those receiving the least intensive treatment. There was no general effect of seed source on diameter.

The distribution of diameters in 1-inch classes gives a good representation of the effect of treatment (table 2). After 10 years there are about enough saplings larger than 4 inches d.b.h. in the partial and complete treatments to provide adequate crop trees for a new stand. The extra effort applied in the complete treatment resulted in about twice as many 5-inch trees as in the partially treated stands.

Table 2.—*Diameter distribution of 10-year-old planted yellow-poplar in relation to overstory competition control*

D.b.h.	Competition Treatment		
	Complete[1]	Partial[2]	Minimum[3]
Inches	*Number per acre*		
1	29	259	512
2	238	137	29
3	230	166	—
4	202	86	7
5	86	29	—
6	—	7	—
Total per acre	785	684	548

[1] Complete treatment included injection of all residual woody vegetation.
[2] Partial treatment included injection of all competing stems over two inches d.b.h.
[3] Minimum treatment represented a stand as a logger would leave it. However, all stems over 6 inches d.b.h. were poisoned.

Discussion

The results after 10 years of observation are positive and encouraging. The study illustrates the potential of several million acres for growing planted yellow-poplar. The study shows that the more effort that is put into competition control the greater the response.

In an area where questionable forest practices have practically eliminated desirable hardwood seed sources, the opportunity to grow yellow-poplar can be considered. The current accepted practice in the area is to control the mixed hardwood overstory and plant pine. While planting pine is an obviously successful venture, this study shows that yellow-poplar establishment on this type of site is a viable alternative requiring about the same site preparation and cost as needed to successfully plant pine.

There are, however, several facts that should be considered before accepting these study results at face value and expecting similar results in large scale plantings.

Yellow-poplar plantings have a terrible performance record in the several Southern states where seedlings have been produced and planted in quantity. In the past 20 years, millions of yellow- nd planted, but with only rare success. A North Carolina survey showed that less than 50 percent of a group of sample plantings 5-30 years old could be found, and that of those that were found few were considered successes (*1*). However, both the current study and earlier research showed that with reasonable care of planting stock, good seed sources, and careful planting, a yellow-poplar stand can be artificially generated (*2*).

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Another condition that may have an important bearing on this study and similar ones is that the moisture supply during the past 10 years has been above average and generally adequate. Yellow-poplar has the reputation of requiring moist, well-drained, and fertile soil to do well. Before passing final judgment on the suitability of millions of acres of Hartsells soils for yellow-poplar planting, several years of average or below average rainfall are needed. Meanwhile tree farmers wishing to grow hardwoods as well as pines in the Cumberland Plateau can plant appropriate sites to yellow-poplar.

The prudent planter would also want to carefully judge how far to go in control of competition. This study shows the greatest response when a relatively complete type of control is imposed. However, the complete treatment required about double the amount of time and chemicals as did the partial treatment where stems below 2 inches were not treated. The average height of 25 feet and 2.3 inches d.b.h. for the partially treated plantation may be considered quite acceptable by some planters. However, it is obvious that some site preparation is needed to control the 2- to 6-inch material usually left after logging.

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