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## TREE SURVIVAL AND GROWTH ON FESCUE-COVERED SPOIL BANKS

*Abstract.*—In spoil-bank revegetation the emphasis today is on site protection. Quick cover crops overplanted to trees or shrubs are recommended on many sites. In this study we tried to determine how an established fescue cover affects tree survival and growth. We found the ground cover did not affect survival but did reduce the height growth of sycamore and sweetgum. It had little effect on growth of white pine and loblolly pine.

Recommended practices for revegetating coal mine spoil banks reflect an increasing concern for aesthetics and the quality of the water in our streams and rivers. Establishment of young tree plantations is no longer considered adequate treatment for spoils. Today the emphasis is on quick cover crops of grasses and legumes to cover the site and to minimize the amount and duration of off-site influences from open-pit mining disturbance. Overplanting the grasses and legumes with trees is also recommended to achieve permanent site protection.

However, the quick cover crops may affect tree growth. This causes particular concern when timber production is one of the revegetation objectives. Therefore we need to know how herbaceous ground covers affect tree survival and growth.

In this study, an established ground cover of K-31 tall fescue did not affect the survival of four tree species. But the grass cover did reduce the height growth of sycamore and sweet gum during the first four growing seasons after planting. No effect on the growth of white pine or loblolly pine was demonstrated.

## Methods

This study was located on spoil from the Hindman coal seam in eastern Kentucky. The coal outcrops at an elevation of 2,200 feet; and the spoil is a mixture of sandstone and shale, with pH ranging from 4.5 to 5.5. Tall fescue had been seeded when mining was completed 2 years before this study was begun. The ground cover at the time was of light to moderate density, composed primarily of tall fescue. Other volunteer herbaceous species were present in varying densities.

Three plots with essentially uniform ground-cover density were located on the outslope of the spoil. Aspect was north to east. Before planting, all vegetation was grubbed out on half of each plot. Sycamore, sweet gum, white pine, and loblolly pine seedlings were planted on each half of the plot, in two rows, with 10 trees to a row.

Once or twice during each of the next four growing seasons, all volunteer vegetation was grubbed out of those areas that had been cleared previously. Results are based on survival and height measurements at the end of the fourth growing season.

## Results

*Survival not affected.*—The ground cover did not appreciably affect survival of the trees, as determined at the end of the fourth growing season (table 1). Survival for sycamore, sweet gum, and white pine was 75 percent or more on all but one plot. The low survival for loblolly pine could be attributed to environmental factors, seed source, or stock condition at the time of planting.

Table 1.—Survival at the end of the fourth growing season, in percent

Species	Treatment	Survival			
		Plot 1	Plot 2	Plot 3	Mean
Sycamore	Grass	95	90	95	93
	No grass	85	85	85	85
Sweet gum	Grass	95	90	85	90
	No grass	90	100	80	90
White pine	Grass	65	80	75	73
	No grass	90	90	80	87
Loblolly pine	Grass	5	30	30	22
	No grass	30	20	45	32

Table 2.—Average total height at the end of the fourth growing season, in feet

Species	Treatment	Tree height			
		Plot 1	Plot 2	Plot 3	Mean
Sycamore	Grass	3.9	2.2	2.2	2.4
	No grass	6.2	3.6	2.7	4.2
Sweet gum	Grass	3.3	1.5	1.8	2.2
	No grass	5.3	2.5	2.2	3.3
White pine	Grass	1.6	1.3	1.3	1.4
	No grass	1.9	1.5	1.7	1.7
Loblolly pine	Grass	5.4	2.4	2.0	3.3
	No grass	3.8	2.9	1.8	2.8

The spoil itself probably was not a limiting factor, because the other tree species and the tall fescue grew well. Some differences between survival on treated and untreated plots do show in table 1; however, statistical analysis indicates that these are not significant.

*Effect on height growth.*— On all three plots, the total height for sycamore and sweetgum at the end of the fourth growing season was greater where the grass had been removed (table 2). Statistical analysis showed that the difference was significant on all but one of the plots.

White pines at the end of four seasons were higher on the plots without grass. However, the differences in height between grassy and cleared plots were much smaller than differences for the hardwoods, and on only one of the three plots was the difference judged significant by the statistical analysis employed. No analysis was made of height growth of the loblolly pine because of the low survival achieved.

### Conclusions

A fescue ground cover did not affect tree survival. Survival for all species was not appreciably better on plots where the ground cover had been removed.

Height growth of hardwood species was reduced by the established fescue cover. Sycamore and sweet gum were more sensitive than white or loblolly pine to competition from the fescue ground cover.

Since the results differ between species, species selection may be an important consideration when planting in a fescue ground cover. In this study, the fescue had a head start over the trees; the adverse effect might be less if ground-cover seeding and tree planting were done in the same

season. This alternative is suggested because many of the perennial herbaceous cover crops require 2 to 3 years to mature, and the planted trees might have an opportunity to become well established during this period. They could then compete more effectively for water and nutrients when the ground cover matures.

Another possibility is to use grasses and legumes other than fescue, which puts on most of its growth early in the season. Some warm-season herbaceous species make most of their growth during the summer months after completion of the spring flush of tree growth.

Further research is needed to determine which tree species should be planted in specific ground covers for a minimum effect on tree growth. Also, we need to know whether growth differences are permanent or temporary. As the trees grow and crowns close, comparative height growth may differ from that in the early stages.

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