NURSERY-GROWN SWEETGUM PRODUCTION IMPROVED BY HYDROMULCHING

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Sweetgum *(Liquidambar styraciflua* L.) is one of the five leading hardwood tree species grown in southern nurseries (*6*). Consistently producing quality sweetgum seedlings on a commercial scale is a difficult task. Even the best hardwood nursery workers experience years when seedling production is unsatisfactory.

Some major factors affecting seedling growth are the physical properties of nursery soil, such as texture, structure, drainage, and organic matter. Sweetgum seedling growth has been shown to be significantly better on heavily textured soils than on sandy soils (*7*). However, one problem with heavy soils, such as silty loams, is the tendency to crust, which creates moisture stress on germinating seeds.

The most critical time in the growing period for sweetgum is between germination and true leaf development. Total germination and rate of germination are optimum when there is no osmotic stress (*1*). Successful seed germination and seedling establishment may depend on the type and quality of mulch applied to the seedbeds for moisture retention. Types and amounts of mulches, such as pine straw, sawdust, bark, and wood-fiber hydromulches, all vary in particle size and moisture holding capacity (*5*).

Generally, nurseries use the most readily available and economical mulch. In an effort to determine the best of available seedbed mulches for the Natchez Forest Research Center Nursery, hardwood bark was compared to each of two levels of hydromulch (Turfiber, Superior Fiber Prodcts).

Methods

Prior to plot establishment, seedbed areas were fall-fumigated (1977) with approximately 400 pounds per acre of methyl bromide (Dowfume MC-2). Soil samples were taken and nursery soil supplemented to achieve optimum levels of available nutrients (*2*). The pH values ranged from 5.3 to 5.7.

Seeds were collected in 1975 from a bottomland seed production area along the Mississippi River, near Natchez, Mississippi. Planet, Jr. (International Fastener Research) planters were used to sow seed in four drills, 12 inches apart, to allow for six plantable seedlings per square foot.

Three mulch treatments consisting of two levels of hydromulch at 1300 and 2600 pounds per acre and .25 inches of hardwood bark were utilized. Hydromulch is a wood-fiber mulch applied in water slurry. The average size of the bark particles was between 0.25 and 4 inches. Treatments were replicated four times in a randomized complete block design. The treatment plots consisted of 30 linear feet of standard 4-foot wide nursery seedbed. Hydromulch treatments were applied with an 800-gallon capacity hydroseeder. Hardwood bark was applied using a manure spreader with a flail type distributor.

Germination counts were made on the middle 10 feet of all plots—20, 30, and 45 days after planting. Data were collected from the middle 5 feet of the plots to determine the number of plantable seedlings, cull percentages, plantable seedling heights, and root collar diameters.

Generally, the minimum acceptable root collar diameter for hardwood seedlings is.38 inches (*3, 4*). However, nurseries have not been able to produce enough .38-inch sweetgum seedlings to meet the needs of various companies. For this reason, seedlings in this study were considered plantable with a root collar equal to or greater than .25 inches.

Results

Hydromulched sweetgum seed produced significantly more seedlings after 30 and 45-day germination counts than did the barkmulched seed (table 1). Barkmulched seed showed acceptable germination after 20 days, but the number of surviving seedlings decreased 42 percent by the 45th day. Seed hydromulched at the rate of 1300 pounds per acre also reached peak germination at 20

days and fell 9 percent after 45 days. Seed with 2600 pounds per acre of hydromulch showed increasing numbers of seedlings throughout the first 45 days.

Sweetgum seed hydromulched at 2600 pounds per acre produced 68 percent and 253 percent more plantable seedlings per unit area than did the 1300-pounds per acre rate of hydromulch and hardwood bark respectively (table 2). Seed germination in the 2600-pound-per-acre treatment was more uniform, and initial seedling growth was noticeably better during the first 3 months of growth.

No significant differences were found in the cull percentages or mean heights and root collar diameters of plantable seedlings at the 95 percent confidence level. Visual observations, however, gave the impression that seedlings grown in the hydromulched treatments produced a more uniform and vigorous crop.

Table 1.—*Analysis of mulch treatments on sweetgum seed germination*

Germination Count Day	Seedlings/ft^2 Hydromulch 2600 lb/acre	Hydromulch 1300 lb/acre	Hardwood bark .25 in
20	12.5	11.4	9.4[1]
30	13.6	11.2	6.7
45	14.1	10.4	5.5

[1]Numbers connected by a straight line are not significantly different at 95-percent confidence level using Tukey's *w*-procedure.

Table 2.—*Analysis of mulch treatments on sweetgum seedling development*

Variable	Hydromulch 2600 lb/acre	Hydromulch 1300 lb/acre	Hardwood bark .25 in.
Plantable/ft^2	6.7	4.0	1.9[1]
Cull percent	32.0	37.0	45.0
Plantable[2]			
s heights	31.0 in.	27.0 in.	26.0 in.
Plantable			
x root collar	0.4 in.	0.4 in.	0.4 in.

[1]Numbers connected by straight line are not significantly different at 95-percent confidence level using Tukey's *w*-procedure.

[2]Seedlings were considered cull if root collar diameters were less than 0.25 inches.

Discussion

The silty-loam soil type of the Natchez Forest Research Center Nursery may have been the reason the heavy rate of hydromulch significantly increased germination and the number of plantable seedlings. Although seeds were watered twice a day during germination, it is possible that surface crusting caused enough moisture stress to reduce germination. The high rate of hydromulch produced a more dense fiber mat than the lower rate of hydromulch. The barkmulch was loose and allowed for greater aeration and surface drying. It is suspected that the thicker mat of the heavier hydromulch rate reduced moisture loss and prevented the shrink-swell effects of the soil from affecting the seed germination.

There were no statistical differences between treatments in terms of mean heights, root collars, and percentages of plantable seedlings. However, an interesting trend indicates that seedlings grown at lower densities did not produce larger seedlings and actually had more culls per square foot than higher densities. It has been stated that, in general, the lower the nursery bed density, the larger the seedlings (*3*). The results of this study, along with personal observations of operational sweetgum crops, suggest that within limits, sweetgum seedlings grow better at higher seedbed densities. One explanation may be that competition in seedbeds encourages production of root exudates or growth hormones which stimu-

late seedling growth. Sweetgum may not be limited in growth by fertility alone; at least not until seedling numbers become excessive (25 to 40 seedlings per square foot). If this is true, then nursery workers need not continue using excessive rates of fertilizers in trying to produce more plantable seedlings per square foot.

Conclusions

When growing sweetgum seedlings on nursery soils that are subject to moisture stress, different mulches should be evaluated. Hydromulch levels thought to be too high in the past have proven to give the best results on silty loam soil at the Natchez Forest Research Center Nursery.

Sweetgum seedlings grown at a density of 14 per square foot produced more plantable seedlings and a lower cull percentage than seedlings grown at 5 or 10 per square foot. This data suggests that nursery workers should plant at the rate necessary to achieve an initial seedbed density of 10 to 15 seedlings per square foot.

The illogical development of sweetgum seedlings in nursery seedbeds suggests that further research is needed to determine the factors that affect seedling growth.

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