IDEAL NURSERY BED DENSITY FOR SWEETGUM SEEDLINGS

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The effects of variable seedling density in the nursery bed are well documented for numerous coniferous species, but we found nothing in the literature on the effects of seedling density on sweetgum seedlings. Because of increasing interest in planting this species, some guidelines are needed.

In a recent study, we found that the best density lay between 15 and 25 seedlings per square foot. Within this range, we produced the maximum number of plantable seedlings per square foot of nursery bed, achieved good seed utilization, needed less time for culling unplantable seedlings, and produced seedlings small enough to plant easily yet large enough to grow rapidly after planting.

Methods

In the fall of 1962, we collected wind-pollinated seed from 15 random mother trees near Athens, Ga. The seeds were sown the following April at the Morgan Memorial Nursery of the Georgia Forestry Commission at Byron. Sowing was arranged in a lit-plot design replicated four times; seed from each mother tree was sown on one whole plot. Four seedling densities-10, 20, 30, and 40 seedlings per square foot-were arranged within each whole plot by thinning in July.

In November 1963, we lifted seedlings from sample plots of 1 to 4 square feet in the center of 238 subplots. Heights were measured to the nearest centimeter, and root-collar diameters to the nearest 0.01 inch. All seedlings in the sample plots were measured, regardless of how small they were.

Results

Seedlings grown at the lower densities had larger root collars and well-developed root systems; at higher densities, root-collar diameters were small and root growth was severely restricted. This negative relationship was very strong and consistent (fig. 1). But height decreased only slightly and inconsistently with increasing seedling density.

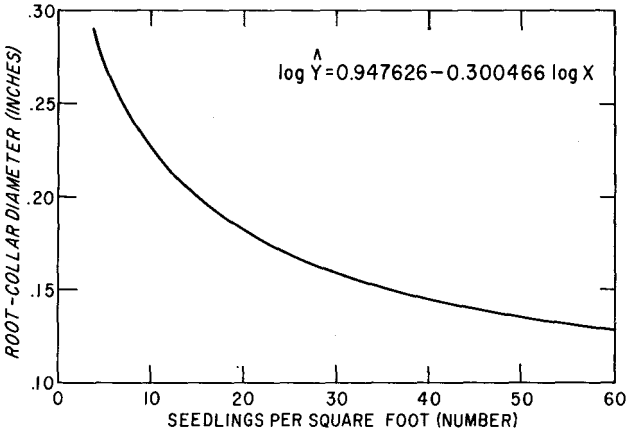

Figure 1.—A very strong negative relationship between root-collar diameter and numbers of seedlings per square foot ($r^2 = .73$, $df = 236$).

Plot families ranged in height from 15 to 53 cm. (or 5.9 to 20.9 inches), but the variation was not statistically significant. Family differences in rootcollar diameter were weakly significant (10-percent level) when corrected for actual seedling density in an analysis of covariance. Soil variability within the rather large replications may have confounded family differences; each replication was 240 feet long. Excessive soil variability within a replication will increase the error term in an analysis of variance and reduce the precision of the test of significance.

Because the objective of the study was to produce seedlings for successful planting, we culled unplantable seedlings on the basis of root-collar diameter. Experience with other species has shown that root-collar diameter is better than seedling height as an indicator of potential survival and growth. Only seedlings with diameters greater than 0.18 inch (three-sixteenths) were considered plantable; those with diameters less than 0.18 inch were culled.

As seedling density increased from 10 to about 18 per square foot, the average number of plantable seedlings per square foot increased to a maximum of 10 (fig. 2). Between densities of 18 and 45, the number of plantable seedlings remained relatively constant (nine to 10), but densities higher than 45 produced few plantable seedlings. At den-

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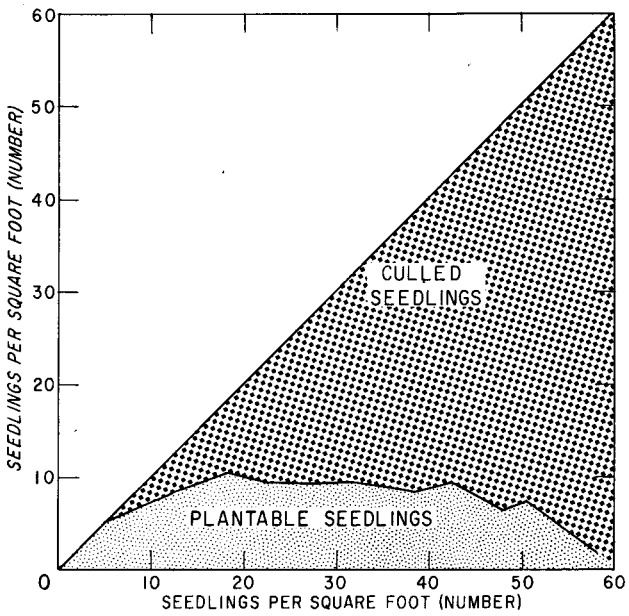

Figure 2.—Number of plantable seedlings reached maximum densities around 18; beyond 18, the number of plantable seedlings did not increase, but the number of seedlings culled increased rapidly.

sities of 20 per square foot, 50 percent of the seedlings were culled; beyond 20, the proportion of seedlings culled increased rapidly (about five ovof six at a density of 45).

Best Density

The best density for producing plantable seedlings was found to be between 15 and 25 seedlings per square foot. Although the number of plantable seedlings did not begin to lessen until densities of 45 were reached, the root-collar diameters, and, hence, vigor, of the seedlings was not as good between 25 and 45 as below 25. Densities higher than 25 not only severely reduced the efficiency of seed utilization, but also drastically increased the costs of grading seedlings and culling the unplantable ones.

The effects of varying seedling density, and therefore seedling grade, on subsequent survival and growth are currently being investigated in a related study. Some of the seedlings produced and reported here were graded into four root-collar sizes and planted near Athens, Ga. The results of that study should soon give additional information of the effects of nursery bed density on the growth of sweetgum.