EFFECTS OF SEEDBED DENSITY ON NURSERY-GROWN CHERRYBARK OAK

Richard O. Barham

Research Forester, Nursery Research,
International Paper Company
Natchez, Miss. Forest Research Center

Cherrybark oak acorns were sown to achieve seedbed densities of 4, 6, 8, and 10 plantable seedlings per square foot. The lowest density produced a significantly larger percentage of plantables, suggesting it may be the most desirable for regeneration programs.

Cherrybark oak (*Quercus falcata* var. *pagodaefolia* Ell.) is one of the most desirable southern red oaks for plantation management (*1,4*). Forest industries are showing an increasing interest in planting high-value oak species back to oak-type sites. Plantation management offers the best opportunity for maximizing production of these species. As interest in plantations increases, the demand for quality seedlings will accelerate.

Nursery managers have a hard time consistently producing quality seedlings, even after following recommended rates for fertility, irrigation, and seedbed density. Generally, as the seedbed density decreases, seedling size increases along with production cost. Recommended nursery bed densities for oaks are 8-10 (high) and 6-8 (low) per square foot (*3*).

Nurseries at various locations appear to have different capacities for growing high-quality hardwood seedlings. This study was instituted to determine the optimum seedbed density for growing quality cherrybark oak seedlings at the newly established Natchez Forest Research Center Nursery in Mississippi.

Methods

Seed areas were fall-fumigated 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 soil type was Memphis silty-loam with a pH of 5.5.

Acorns were collected in the fall following a logging operation in the Little Missouri River bottom in southern Arkansas. Planting was done in November, by hand, in four 3/4-inch deep drills, 12 inches apart on standard 4-foot wide nursery beds. After planting, the beds were rolled and mulched with approximately 3000 pounds per acre of hydromulch (Turfiber).

A randomized complete block design was used with blocks consisting of four 13-foot treatment plots replicated four times. Treatments consisted of sowing rates to yield final seedbed densities of 4, 6, 8, and 10 plantable seedlings per square foot. Sowing rates were determined by dividing the desired density by the expected germination percentage (.85) and survival percentage (.50). This provided initial sowing rates of 9, 14, 19, and 24 seeds per square foot.

After seedlings became dormant and dropped their leaves, the middle 4 feet of each treatment plot were lifted. Seedlings were analyzed to determine cull percentage, root collar diameter, total height, and number of plantable seedlings per square foot.

Generally, the minimum acceptable root collar diameter for hardwood seedlings is 3/8-inch (*3,5*); however, nurseries have not been able to produce enough 3/8-inch seedlings to meet company needs. Therefore, seedlings in this study with a root collar of 1/4-inch were considered plantable. Also, root collars were measured 1 inch above the groundline, which approaches the desirable 3/8-inch diameter.

Results

The number and percentage of plantable seedlings produced per square foot were significantly affected by seedbed density (table 1). The number of plantable seedlings increased with seedbed densities, but the difference was significant only at the 10-seedling density. The most efficient use of the cherrybark seed was achieved at the lowest seedbed density (fig. 1). The cull percentage of 34 for the 4-seedling density was 22, 31, and 32 percent better than the 6-, 8-, and 10-seedling densities, respectively.

Seedling heights and root collar diameters were not significantly affected by seedbed densities (table 1). There was a slight trend toward larger root collars as densities decreased.

Table 1.—*Analysis of seedbed density effects on cherrybark oak seedling development*

	Seedling/ft^2			
Variable	4	6	8	10
Plantable/ft^2	3.5a[1]	4.1aß	4.1aß	5.0ß
Cull percent[2]	34.0a	56.0 ß	65.0ß	66.0a
Plantable)x heights (in.)	32.5a	33.1a	32.9a	33.9a
Plantable)x root collar (in.)	0.35a	0.34 a	0.34a	0.32a

[1]Values not designated by the same letter are significantly different at the 0.05 level of probability using Tukey's *w*-procedure.

[2]Seedlings were considered culls if root collar diameters were <1/4, inch at 1 inch above the groundline.

There were no observable differences in the seedlings while they were in the seedbeds once the foliage had closed together.

Discussion

Cherrybark seedlings appear to react in a logical fashion to reduced seedbed densities. As seedbed densities increased, seedling sizes generally decreased and cull percentages increased. Seedlings grown at densities of 6 per square foot or greater had over a 50 percent cull factor, which suggests that cherrybark should be grown at lower densities. Optimum seedbed densities will vary between nurseries, but will probably be lowest in predominantly pine nurseries where nursery managers fail to compensate for the additional nutrient and water requirements of cherrybark oak.

Acorns are difficult and expensive to collect; therefore, efficient seed utilization can result in extremely important cost savings in a reforestation program. Costly losses can result if high-priced, site-prepared land is not planted because of a lack of seedlings. Seedling shortages could result from inefficient nursery seedbed densities, especially in years when seeds are in short supply. Seed utilization appears to be greatly increased in cherrybark oak by growing seedlings at 4 seedling per square foot. By reducing the seedbed density from 8 to 4 seedlings per square foot, the number of plantables per pound of seed could almost be doubled. Therefore, the same number of plantable seedlings could be grown with only a 17.1 percent increase in nursery bed space. Although nursery costs would increase approximately 20 percent because of the lower seedbed density, the benefits of having twice as many large, high-quality seedlings to outplant could result in savings for the overall regeneration program.

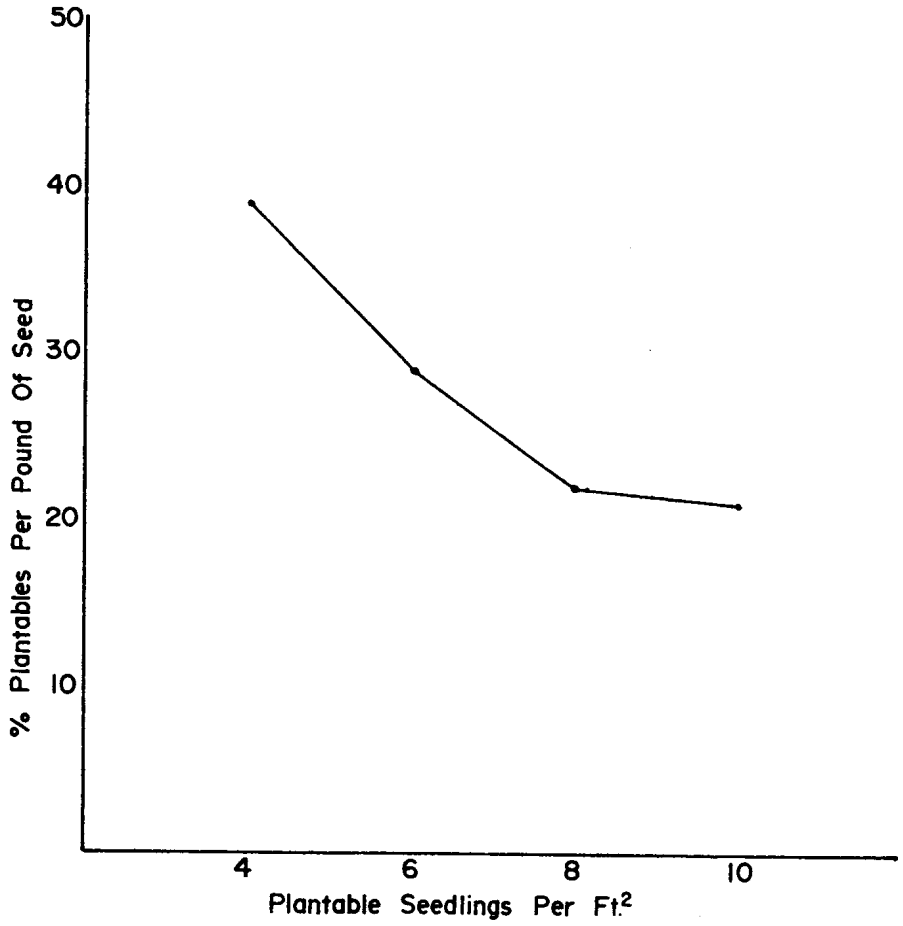

Figure 1.—*Utilization of cherrybark seed at different seedbed densities.*

Literature Cited

1. Applequist, M. B.
1959. Growth of planted cherrybark oak in southeastern Louisiana. Louisiana State University, Baton Rouge. LSU Forestry Notes 26. 2 p.

2. Davey, C. B.
1973. Artificial regeneration—nursery practice. *In* Proceedings, Hardwood Short Course. N. C. State-Industry Cooperative Tree Improvement and Hardwood Research Programs, North Carolina State University, Raleigh, p. 53-59.

3. Formy-Duval, J. G.
1976. Tree handling, seedling size, and seeding costs. *In* Proceedings, Hardwood Short Course. N. C. State-Industry Cooperative Tree. Improvement and Hardwood Research Programs, North Carolina State University, Raleigh, p. 60-62.

4. Kormanik, P. P., R. P. Belanger, and E. W. Belcher.
1976. Survival and early growth of containerized and bareroot seedlings of cherrybark oak. U.S. Department of Agriculture, Forest Service, Tree Planters' Notes 27(3):9, 10, 23.

5. Nugent, J. A.
1970. Rabbits rarely clip large hardwood seedlings. International Paper Company Technology Note 31.