The Effect of Damaged Radicles of Presprouted Red Oak Acorns on Seedling Production

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Breaking the radicles on presprouted Shumard and cherrybark acorns sown in the spring did not adversely affect seedling production. Fall sowing of unsprouted acorns was as good as or better than sowing stratified acorns in the spring.

Even though acorns of most southern red oak species can be stored for up to 3 years (*3*), their tendency to sprout during storage has discouraged some nursery managers from storing acorns. These nursery personnel have believed that presprouted acorns could not be sown without excessive damage to the tender, emerged radicles. The study reported here was undertaken to assess the significance of such damage to nursery seedlings of two southern red oaks: cherrybark oak *(Quercus falcata* var. *pagodaefolia)* and Shumard oak *(Q. shumardii).*

Methods

Acorns were collected from stands in central Mississippi in November 1979. Each species collection was from a minimum of five trees. The acorns were floated in water on the day of collection, and all acorns that floated and those with visible damage were discarded. The remaining sound acorns were stored at 3° C until sowing. Standard germination tests (*9*) and tetrazolium chloride staining tests were run on samples of each species soon after collection. Tetrazolium staining methodology was the same as reported by Bonner (*4*), except that the incubation period was only 24 hours.

Each species lot was divided into 18 sublots of at least 75 acorns each. These sublots were randomly assigned to one of three treatments: fall sowing (treatment A); spring sowing, radicles undamaged (treatment B); and spring sowing, radicles damaged (treatment C).

Fall sowing (treatment A) consisted of sowing unsprouted acorns with no pretreatment. These acorns were sown on December 12, 1979 (cherrybark), and January 3,1980 (Shumard), in the nursery at the Forestry Sciences Laboratory in Starkville, Miss. A treatment plot consisted of three rows of 25 acorns each across the bed. The acorns were placed 1 to 1.5 centimeters deep and mulched with pine straw. The entire bed was covered with a chicken wire cover to exclude birds. Overhead sprinklers kept the bed moist.

Sublots for treatments B and C were returned to storage, but at 8° C. This elevated storage temperature was used to stimulate sprouting of the acorns during storage. Four weeks before sowing, these sublots were soaked overnight in tapwater at room temperature and then returned to 8° C storage. This step insured full hydration, an aid to sprouting.

The two spring treatments (B and C) were sown on April 11,1980. Acorns for treatment B were carefully placed in a shallow furrow and covered. Only sprouted acorns were used. Acorns for treatment C had the terminal half of each emerged radicle pinched off by hand before sowing. All acorns in these treatments were also covered 1 to 1.5 centimeters deep and mulched with pine straw.

In spite of the warm storage temperature, presprouting was not as widespread as desired, especially for cherrybark oak. Only 50 acorns were sown in these plots (two rows of 25 each), and some acorns with extremely short radicles (2 to 4 mm) had the entire length removed to simulate the damaged condition for treatment C.

The nursery plots were watered all spring, summer, and fall by overhead sprinklers. No other cultural treatments, except for handweeding, were employed.

The seedlings were lifted by hand in late January and early February 1981. All taproots were deep, and they were cut to a standard 10-inch length. Seedling survival, seedling height, shoot dry weight, and root dry weight were measured. The latter three measurements were taken on 10 plantable seedlings chosen at random from each plot. (Obvious culls were discarded.) Dry weights were determined after drying the shoots and roots separately for 24 hours at 90° C.

Results and Discussion

Cherrybark oak. Fall-sown seedlings emerged first and made the best early height growth. At the end of the growing season, however, there were no significant differences in survival, height growth, shoot dry weight, or root dry weight (table 1).

Survival ranged from 54.9 to 64.0 percent, somewhat below laboratory test data. The germination test gave 91.0 percent and the tetrazolium test yielded a score of 87 percent. A small, but undetermined, percentage of seedlings were lost to birds who got underneath the wire cover, and 3 to 4 percent were killed by insects.

Shumard oak. Just as for cherrybark oak, the fall-sown Shumard oak emerged first and made the best early height growth. In contrast to cherrybark, the fall-sown Shumard maintained an advantage throughout the season (table 2). Fall-sown Shumard averaged 66.5 centimeters, which was significantly taller than both spring treatments (54.3 and 51.5 cm). This same relationship held for shoot and root dry weight. Fall-sown acorns produced seedlings averaging 7.5 grams in shoot dry weight, as opposed to 4.4 and 3.7 grams for the spring treatments. In root dry weight, fall-sown acorns yielded seedlings with an average 14.0 grams, while the spring treatments averaged only 10.3 and 9.5 grams. In all three growth parameters, there were no significant differences between damaged and undamaged radicles in spring-sown acorns.

Table 1.—*Survival and growth of cherrybark oak in a nurserybed as influenced by sowing treatment*[1]

	Sowing treatment		
Parameter	Fall sowing	Spring sowing, undamaged radicle	Spring sowing, damaged radicle
Survival (%)	54.9	64.0	57.7
Total height (cm)	45.9	45.9	40.6
Shoot dry weight (g)	4.0	3.8	2.8
Root dry weight (g)	13.0	12.2	10.4

[1] Each value is the mean of six replications. No treatment effects were significant.

Table 2.—*Survival and growth of Shumard oak in a nurserybed as influenced by sowing treatment*[1]

	Sowing treatment		
Parameter	Fall sowing	Spring sowing, undamaged radicle	Spring sowing, damaged radicle
Survival (%)	65.3a[2]	79.7b	82.7b
Total height (cm)	66.5a	54.3b	51.5b
Shoot dry weight (g)	7.5a	4.4b	3.7b
Root dry weight (g)	14.0a	10.3b	9.5b

[1] Each value is the mean of six replications.

[2] For a given parameter, means followed by a common letter are not significantly different (P>0.05).

Spring-sown acorns of both treatments had a significant advantage over the fall-sown acorns in seedling survival (table 2). As in the cherrybark plot, there were small losses to birds and to insects. Overall survival was better than survival in cherrybark oak, even though the laboratory test for Shumard was only 64 percent. The tetrazolium test for Shumard gave a score of 91 percent, however.

There was also an apparent treatment effect on the shape of the root system (fig. 1). Most Shumard seedlings from treatment A (fall sowing) had a single, carrotlike taproot. Seedlings grown from spring-sown acorns with broken radicles (treatment C) had multiple roots, as expected. Treatment B seedlings were a mix of both types, although the carrotlike taproots predominated. It is assumed that damage to the emerged radicles promoted the

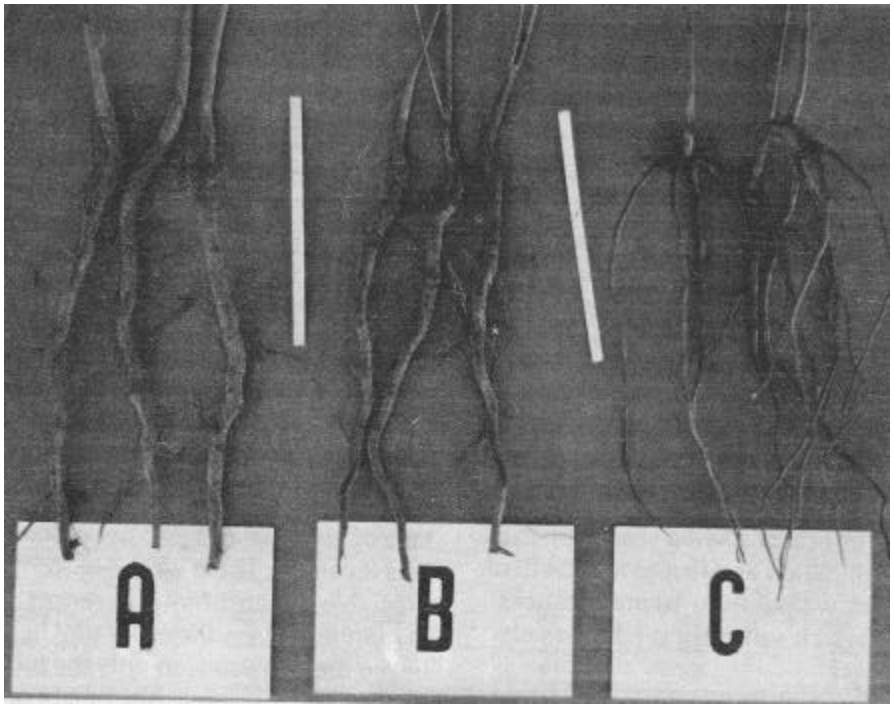

Figure 1.—*Characteristic root systems on seedlings of all treatments: A. fall sowing; B. spring sowing, radicles undamaged, and C. spring sowing, radicles damaged.*

multiple configuration. Proper root pruning in nurserybeds, which could not be done in this study, would create a similar, although not identical, effect.

Seedling density in the beds, although high, was probably not a major factor in seedling response. Random counts in November gave average bed densities of 13.2 seedlings per square foot for cherrybark oak and 12.6 per square foot for Shumard oak. These densities are considerably higher than the four seedlings per square foot recommended by Barham (*2*), which may account for the small seedling sizes in all plots.

Conclusions

Results from this study suggest that nursery personnel should not be concerned if acorns sprout before sowing. Damage to the radicles did not adversely affect seedling production of cherrybark and Shumard oaks. Fall sowing of unsprouted Shumard acorns produced significantly fewer, but larger, seedlings than spring sowing.

Literature Cited

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