BUD-BREAK ON RED OAK SEEDLINGS VARIES WITH ELEVATION OF SEED SOURCE

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Observation of northern red oak *(Quercus rubra* L.) seedlings for three growing seasons has indicated a probable relationship between elevation where the seed source grows and the time of budbreak. Seedling survival and growth following late spring frosts in the second and third growing seasons showed that time of bud-break may be a critical factor in selecting planting stock for a given site.

These observations add to our knowledge about the importance of the source of seed in forest planting.

Open-pollinated seed from three trees were collected in the fall of 1965 and placed in cold storage. In the spring of 1966, 270 seedlings from each mother tree were established in nursery beds at Bent Creek Experimental Forest in western North Carolina, at an elevation of 2,100 feet. One of the mother trees was located at an elevation of 5,000 feet, the second at 3,300 feet, and the third at 2,700 feet. The mother trees and the planting site were within 40 miles of each other.

Dates of seed germination were not observed. At the end of the first growing season, survival was good for all sources, but seedlings from the two lower-elevation trees were considerably taller than those from the tree at 5,000 feet. The difference in first-year heights was not surprising because acorns from the two lower-elevation trees were much larger than those from the tree at 5,000 feet.

In the second growing season, seedlings from the two lower-elevation trees were well into bud-break by April 7. About 2 weeks later seedlings from the tree at 5,000 feet began bud-break (fig. 1). Some of the seedlings from lower-elevation trees had grown 6 inches or more before the higher-elevation seedlings began bud-break. It appeared as though the seedlings from the two lower-elevation trees would increase their height advantage over those from the higher-elevation trees. This advantage came to an abrupt end, however, because an unseasonable frost occurred April 28. The freeze severely damaged many seedlings from the lowerelevation trees and damaged fewer seedlings from the tree at 5,000 feet.

Figure 1.—Northern red oak seedlings from three seed sources on April 19 of the second growing season: Left, seedlings developed from acorns collected from a tree at 2,700 foot elevation; center, from a tree at 5,000 feet; right, from a tree at 3,300 feet.

The order of bud-break was similar in the second and third growing seasons, but all plants were about a week later in leafing out the third season. By May 6, 1968, the seedlings from the two lower elevation trees again had a head start on height growth (fig. 2), and again nature intervened with a frost on May 22. This frost, though not nearly as severe as the early one the year before, caused some damage to seedlings from all sources but mostly damaged those from the lower-elevation trees.

At the end of the growing season, there was no difference in height between seedlings from the three seed sources.

Plants generally break dormancy later at higher elevations than they do at lower elevations. The three mother trees used in this study probably follow the same elevation-dormancy pattern. If so,

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Figure 2.—Northern red oak seedlings on May 6 of the third growing season. Seedlings in the center are at least 2 weeks behind the others in leaf development.

these observations suggest the red oak seedlings retained the dormancy breaking characteristics of their parents, even though they were planted some distance away at a different elevation.

A question can be raised: Do the differences in bud-break result from elevation, from characteristics of individual mother trees, or from a combination of the two? Because few trees were used in this study and because replication of trees at each location was lacking, no definite assignment of cause and effect can be made at this time. However, further study may prove the relationship of date of bud-break to elevation to be generally applicable to red oak seedlings. Such a finding could have tremendous impact on artificial regeneration of red oak by limiting the areas where seed from a particular source may be planted. Meanwhile, planters are urged to consider the potential for loss in transferring red oak seed and seedlings from one elevation to another.

At the end of the second growing season, seedlings from the two trees at lower elevations had lost most of their height advantage and had poorer survival than those from the higher elevation.