REFINING THE ARTIFICIAL REGENERATION PRESCRIPTION FOR WHITE OAK (*QUERCUS ALBA*) BY USING PEDIGREE AND ADVANCED NURSERY PRACTICES

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PURPOSE AND SCOPE

Artificial regeneration (i.e., planting) of white oak (*Quercus alba*) will become more important because forest succession, climate change, urban development pressures, and nonnative species are ever-increasing threats to this important resource. Early survival and growth of planted white oak seedlings are critical for predicting long-term responses, but these dynamics are not well understood. The goal of this study was to refine artificial regeneration techniques used to restore or enhance the white oak component in eastern hardwood forests. Our specific objective was to quantify factors affecting white oak seedling survival and planting shock in the first growing season. We specifically examined effects of stock type (1-0 versus 2-0), seedling size parameters, and genetic family on survival and dieback.

METHODS AND APPROACH

Acorn collections were made in 2020 and 2021 in Moore County, TN from seven white oak orchard trees and were then sown at the Tennessee State nursery. Collections from over a dozen trees in northern Alabama were made in 2021, bulked and sown at the Georgia State nursery. Seedlings were lifted and visually graded (Clark et al. 2000) in February 2023 as 1-0 (2021 collection) or 2-0 (2020 collection) bareroot seedlings. Height, root-collar diameter (RCD), and total weight of each seedling were measured. Trees were planted on a 3-m by 3-m spacing on the Bankhead (BH) (34.3 °N, 87.4 °W), Cherokee (CH) (36.5 °N, 82.0 °W), and Daniel Boone (DB) (37.0 °N, 82.3 °W) National Forests. The effects of genetic family and stock type on first-year survival and incidence of dieback were analyzed using general linear mixed models, and differences in treatment least-squares means (LSM) were determined. Logistic regression tested how seedling size parameters affected dieback.

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FINDINGS AND IMPLICATIONS

Survival (raw mean = 95 percent) was affected by family, but not by stock type, with one family having lower survival (LSM = 81 percent) than all others (LSMs >92 percent). Dieback (raw mean = 44 percent) was affected by family and stock type, and family dieback LSMs ranged from 25 to 36 percent. The 1-0 seedlings (raw mean = 40 percent) generally had less dieback than 2-0 trees (raw mean = 48 percent), but stock type differences were only significant for one family. Total weight and RCD interacted to explain variability in dieback though height was less predictive. Dieback increased for seedlings weighing more than 300–400 g, particularly for trees with smaller RCDs (fig. 1).

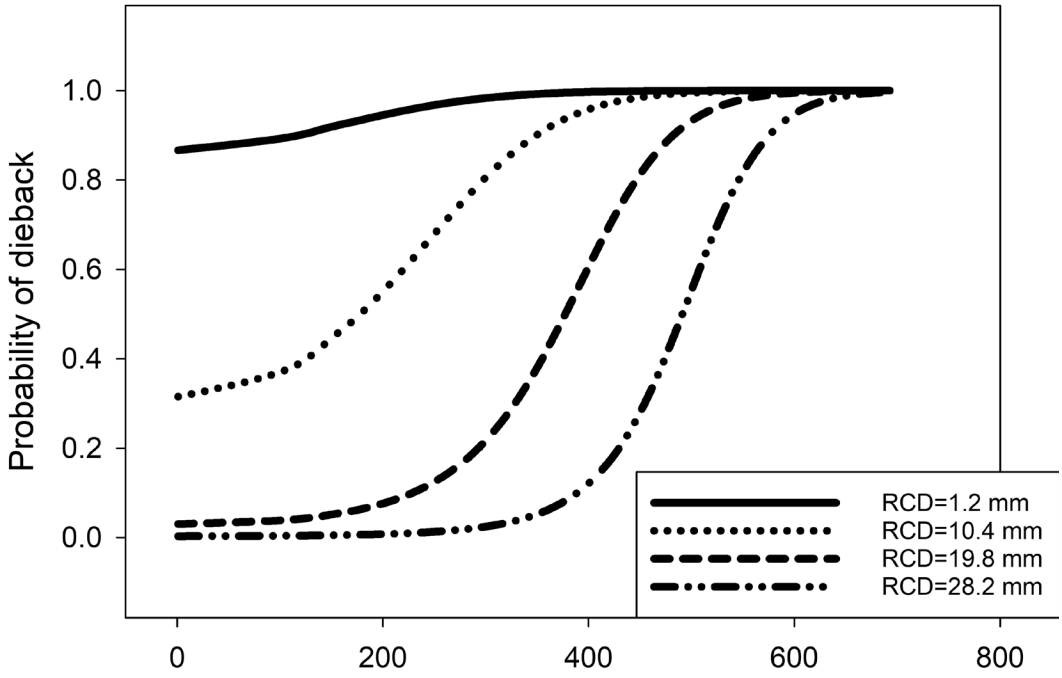

Figure 1—The probability of first-year dieback based on total seedling nursery weight and four root-collar diameter (RCD) classes for 1-0 and 2-0 white oak seedlings grown in a commercial tree nursery in Tennessee, USA.

Despite the increased planting shock in larger (i.e., heavier) and older (2-0) seedlings, previous studies have demonstrated that larger seedlings will maintain their growth advantages over time (Clark et al. 2015). Challenges with planting heavier seedlings with putatively larger root systems are temporary and could be partially mitigated by planting seedlings with larger RCD. Ideally, large 1-0 stock would be used instead of 2-0 to reduce nursery operation costs. Families could be selected to favor development of large-calipered 1-0 seedlings that have reduced dieback. Until tree improvement is more advanced, we suggest using genetically diverse seed sources and large calipered seedlings from 1-0 or 2-0 stock types.

LITERATURE CITED

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