The Potential of Acoustics to Determine Family Differences for Wood Quality in a Loblolly Pine Trial

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Breeding and selection for desirable wood properties will be a key factor in determining the global competitiveness of the U.S. forest industry. Loblolly pine (Pinus taeda L.) breeders are currently able to select for differences in wood specific gravity, microfibril angle (MFA), and Modulus of Elasticity (MOE) by colleting and analyzing wood increment cores and bolts. However, the methodology required to do this can be time-consuming, cost-prohibitive and in the case of MOE, destructive. The use of acoustics in determining wood quality has merit as an alternative to traditional methodology in that it is non-destructive and relatively fast. Acoustic velocity is directly related to MOE and closely related to MFA so it can act as a surrogate for wood stiffness. Before acoustics can be used as a selection criterion, a number of questions must be answered. Can data be collected efficiently on the large numbers of trees required to estimate parental breeding values? Are there differences in transmission of sufficient magnitude and repeatability to allow heritable differences to be detected among families? Are there significant genotype by environment interactions that need to be considered when making selections? Is the equipment robust enough to be used by different field crews?

To begin answering these questions, the Southern Institute of Forest Genetics, in collaboration with the Western Gulf Forest Tree Improvement Program, collected acoustic velocity data in three control-pollinated loblolly pine progeny tests. All three tests were established by International Paper Company and located in southeast Texas. Acoustic velocity was measured across breast height using the Fakopp Stress Wave Timer. Measurements were collected on two sides of each tree and then averaged together to estimate stiffness. Trees with forks and obvious signs of disease were excluded from measurement. Variance components were estimated for each location using the software packages DIALL and DIALLC. Results showed that single-location individual heritabilities for the averaged acoustic velocity were moderate yet large enough to be useful in an applied breeding program. Single-location individual heritabilities for volume were twice as large as expected but those for specific gravity were slightly smaller than expected. Multiple-location analyses still need to be completed to estimate the genotype by environment component and the relationship between acoustic velocity, volume, and specific gravity also needs to be determined. In addition, field protocols need to be refined to avoid data outliers and to arrive at easier methods of collecting observations. The ultimate goal is to incorporate breeding values for stiffness, volume, straightness, and wood specific gravity into a sawlog index so breeders can rank candidates for inclusion in seed orchards.