PROMOTING WHITE OAK (*QUERCUS ALBA*) SUSTAINABILITY THROUGH A RANGEWIDE TREE IMPROVEMENT PROGRAM IN THE EASTERN UNITED STATES

Laura E. DeWald, Zachary Hackworth, Jeffrey Stringer, and John Lhotka

PURPOSE AND SCOPE

Genetic variation in white oak (*Quercus alba*) provides significant opportunities for tree improvement. The White Oak Genetics and Tree Improvement Program (WOGTIP) (DeWald and Williams 2024) is a collaborative (academia, industry, State, and Federal agencies) program to quantify white oak genetic variation, improve traits that will promote seedling survival and growth in natural forests, and improve traits that have economic and ecological value in this keystone species. WOGTIP supports the White Oak Initiative through creation of a sustainable supply of genetically improved, high-quality seedlings for reforestation.

METHODS AND APPROACH

Twenty-three white oak progeny tests have been established throughout white oak's geographic range with 85 percent of the genetic material within each test considered regionally adapted, 10 percent is from just outside the adapted region, and 5 percent of the material represents large latitudinal moves to examine responses to future climate conditions. In addition, an extensive 9-ha rangewide provenance test (500 seed sources) has been established in the center of white oak's geographic range. Material from these tests is available for research and for applied tree improvement. Superior parents of sources in the progeny tests will be grafted to form clonal seed orchards and the progeny tests will be rogued and converted to acorn production areas. Additionally, an independent seed orchard program will engage private and public landowners and organizations in the establishment of a network of certified white oak seed orchards.

Laura E. DeWald, Department of Forestry and Natural Resources, University of Kentucky, Lexington, KY 40546, USA

Zachary J. Hackworth, Department of Forestry and Natural Resources, University of Kentucky, Lexington, KY 40546, USA

Jeffrey W. Stringer, Department of Forestry and Natural Resources, University of Kentucky, Lexington, KY 40546, USA

John M. Lhotka, Department of Forestry and Natural Resources, University of Kentucky, Lexington, KY 40546, USA

FINDINGS AND IMPLICATIONS

Early results show a significant (P <0.001) positive relationship between nursery height at the time of lifting and first year height growth in the field, and these trends may continue long term. Height growth varied significantly (P <0.001) within and between half-sibling families, and at geographic spatial scales. Some of the height growth variation was related to adaptive latitudinal photoperiod + temperature responses where seed sources moved south to north tended to grow significantly more than those moved north to south. However, some seed sources exhibited superior (or poor) height growth regardless of their origins or distance moved. Clark et al. (in press) found that outplanted white oak seedlings often do not grow in height until the second growing season or they grow well initially when planted but then die back. We found similar conservative growth strategies and there appears to be some genetic control over expression of this trait. Stems of some fast-growing half-sibling families died back, some half-sibling families did not grow in height, and others had significant height growth with no dieback regardless of their initial height at the time of planting. Finally, there is lack of phenological adaptation and cold damage showing up in seed sources moved north suggesting caution in climate change movement strategies.

LITERATURE CITED

Clark, S.L.; Schlarbaum, S.E.; Schweitzer, C.J. [In press]. Refining the artificial regeneration prescription for white oak (Quercus alba L.) using pedigree and advanced nursery practices [Abstract]. In: Martens, C., Clark, S.L.; Schweitzer, C.J.; eds [In Press]. Proceedings of the International Oak Symposium. Gen. Tech. Rep. SRS-278. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.

DeWald, L.E.; Williams R. 2024. White Oak Project. https://white-oak-genetics.ca.uky.edu/. [Date accessed: 17 July 2024].

ACKNOWLEDGMENTS

Initial funding for WOGTIP was provided by the University of Kentucky Department of Forestry and Natural Resources, Kentucky Agriculture Experiment Station, Kentucky Division of Forestry, and the U.S. Department of Agriculture, Forest Service, Southern Research Station. In addition, we thank over 2,000 volunteers and over 75 organizations including the many acorn collectors, progeny test partners, and collaborators who have helped make WOGTIP a success including: the Forest Service, State forestry and natural resources agencies, city and county governments and organizations, US Army, public and private academic institutions, public and private botanical gardens and arboretums, State and county extension programs, Master Gardener and Master Naturalist programs, state tree nurseries, private woodland owners, nongovernmental organizations, bourbon distilleries including Maker's Mark, citizen scientists, and youth groups (4-H, Future Farmers of America).