A 50-YEAR RACIAL STUDY OF DOUGLAS-FIR IN WESTERN OREGON AND WASHINGTON

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ABSTRACT

On the assumption that exact racial adaptation within each locality should have occurred in Douglas-fir west of the Cascades, the question was asked, "Do local seed sources really perform best 50 years after planting?" Primary source of information was the 50-year-old study of the U.S. Forest Service consisting of 13 races ranging elevationally from 100 to 3,850 feet and planted at 5 elevations ranging from 1,100 to 4,600 feet in western Oregon and Washington.

No simple, clear superiority of local or near-local seed sources was displayed in a preliminary analysis of 50-year, diameter-growth and survival data. Most of the results published when the study was 17 years old were reversed by age 50. At 17 years, two races were generally superior at all five planting sites; two others were distinctly inferior. At 50 years, this ranking had disappeared. At 17 years, races that matched the planting site elevationally were superior in average height to races elevationally removed from their sources. This trend had also disappeared at 50 years. At 17 years, survival of all races was similar; at 50 years, racial survival was greatly different and followed a significant elevational trend, with poorest survival associated with races most elevationally different from the planting site. At neither 17 years nor 50 years were local sources best in diameter or height, except at one or two plantations. At the five plantations, the most local race, ranked by average diameters, placed 1st, 2nd, 3rd, 5th, and 13th.

To gain insight into the question of this inconsistent performance of local sources demands revised concepts about racial superiority. Much more emphasis must be placed upon survival than on rate of growth, even though survival differences seldom are expressed in a clear pattern before the second quarter century.

A hypothesis was proposed to help explain the differing pattern of results at each planting site, based on survival, inherent rates of growth, planting site exposure, weather extremes, and time. The hypothesis was that inherent growth rate of a race had developed toward the maximum that could be sustained in each locality against impacts of long-term weather

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extremes. Further, these inherent differences in rates of growth for each environment are expressed until climatic extremes intervene at an unpredictable frequency to reduce growth, or damage, or kill.

Climatic extremes occur at greater frequency with increasing elevation. However, exposure of the planting site is more important than elevation in determining frequency of climatic extremes. This relationship is evident from half-century survival differences among races which are least at protected sites and most at exposed sites, irrespective of elevation. The hypothesis explains why some races are outstanding and others poor on most sites in the first decade or two before climatic extremes cause large differences.

Time also entered the hypothesis. At the most severe site in this study, both survival and growth rate began to strongly favor the adapted local race by the end of the second decade. At the most sheltered site, where most planted trees have survived, the growth patterns displayed during the first decades were maintained to age 50, with nonlocal races superior in growth. At the other three sites, the most local sources were generally favored more as severity of the site increased, although not necessarily favored in growth rate. For example, at one site the local race averaged smallest, but now has best survival. Under this hypothesis, nonlocal races might outproduce local races at short rotations on protected sites. Local Douglas-fir races would guarantee a good stand on most sites at any time and probably maximum survival; i.e., maximum volumes after a number of decades.