

Failure of Grafted Douglas-Fir Planted at Monterey, Calif.

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Grafted coastal Douglas-fir clones from Oregon were transplanted to the Monterey Peninsula of California. The grafts failed to grow properly. Winter temperature was not cool enough to satisfy bud dormancy requirements of the scion clones or of the rootstocks. Identical grafts grew normally at Monmouth, Oreg.

In the Pacific Northwest, practically all coastal Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) orchards have been established well within the indigenous range of the species. As a result, the orchards are subject to various degrees of pollen contamination from nearby native stands. It is often suggested that orchards be established in California where Douglas-fir is absent or just a very minor component of nearby stands. Such a move might reduce pollen contamination, enhance seed maturation, and stimulate earlier and more abundant seed production. The following brief report describes an attempt to establish a planting of grafted clones in an area considerably south of its place of origin.

In April 1979, Douglas-fir trees for this trial were grafted on established rootstocks at a field location near Monmouth, Oreg. Two types of rootstocks were used: Rooted cuttings of 13 highly graft-compatible clones from the Willamette Valley of Oregon and

two seedling sources from the Sierra Mountains near Placerville, Calif. All rootstocks had been transplanted into the field two growing seasons before grafting. Scions were from 50-plus trees growing in the Cascade Mountains near Sweet Home, Oreg. (760 to 1,200-m elevational zone). Four grafts of each clone were made on the Oregon cuttings and another four grafts of each clone on seedlings of the two Sierra sources. Scion leader growth the year of grafting ranged from 20 to 40 centimeters; the trees were vigorous and capable of good growth following transplanting.

In December 1979, the grafts were dug at the Oregon grafting site and 109 grafts were transplanted to a site on the Monterey Peninsula in California. Another 200 grafts of the same scion clones and rootstock combinations were retained at the Oregon site; 30 grafts were transplanted to new positions at the site and 170 grafts were left in place. Of the 109 grafts at Monterey, 46 were on Oregon and 63 on California rootstocks. The Monterey site was located less than 100 meters above sea level on a large estate within 200 meters of the Pacific Ocean. It was rototilled, irrigated, and intensively cared for by a gardener from the estate. Other native conifers such as Monterey pine grew normally at the site.

Observations on scion survival and leader growth were made in

July 1981. Grafts at the Oregon planting site were healthy and had 1 to 2 meters of accumulated growth in 1980 and 1981. Trees that had not been transplanted in 1979 were slightly larger than those whose roots were disturbed. Leader growth was nearly the same for both Oregon and California rootstocks. Only 2 percent of the Oregon rootstocks and 10 percent of the California rootstocks had died from early graft incompatibility.

The normal growth and high survival at Monmouth were not indicative of how the same scion clones and rootstocks did at Monterey. At Monterey, grafts of the same clones were either dead, dying, or had grown very little in 1980 and 1981. More than 30 percent of the scions had died of early graft incompatibility, and cumulative 1980 and 1981 leader growth of the surviving scions averaged a meager 12 centimeters (range 0 to 25 cm). Scion growth and survival were equally poor on both Oregon and California rootstocks. There was no possibility that a viable Douglas-fir orchard would develop. The Monterey planting was such an obvious failure that a decision was made in 1981 not to waste time and money on extensive measurements to prove the obvious.

An unusual pattern of shoot growth was observed in the survivors at Monterey; less growth occurred in 1981 than in 1980. The

normal shoot growth pattern for Douglas-fir would have been reduced shoot growth immediately after transplanting in 1980 and then the growth of long leaders in 1981. Poor leader growth resulted from abnormal bud flush each spring. Buds on some trees failed to burst in either year; some burst in 1980, but not in 1981; and a few trees managed to burst both years. Shoot elongation was abnormally short even when buds burst both years. Often the buds that did flush in 1981 were lateral rather than terminal buds.

The hypothesized cause of the atypical bud flush and reduced leader growth at Monterey is thought to be winter temperatures that were not cool enough to satisfy the bud dormancy requirements of Douglas-fir trees from Oregon's Cascade Mountains. Data from the weather station at Santa Cruz (30 miles north of the planting site) indicated that the average monthly temperature had varied from 9.3° to 12.2° C from November to February, while average minimum monthly temperatures were only 3.4° to 5.6° C (1). With such a mild climate, it is probable that the Oregon clones received far less than the required 1,344 to 3,016 hours at 3° and 6° C (2). Little leader growth for Douglas-fir scions from Oregon's Cascade Mountains is likely to occur in future years. It is not possible to blame the problem on salt built up

in the soil because no external symptoms of salt toxicity were evident. High salt content causes Douglas-fir scales to unfold rather than being tightly appressed; the loosening of the bud scales causes the buds to have a ragged or frayed appearance. That symptom was not seen.

Lack of adequate chilling also influenced bud burst and shoot growth of rootstocks from both Oregon and the Sierra Mountains of California. Oregon rootstocks showed the same pattern of inhibited bud flush as did the grafted scions, but they did not appear to be influenced as severely as the scions. Rootstocks from the Sierras had even less atypical bud flush than did Oregon rootstocks, but growth was abnormal enough to indicate that most seedlings would have difficulty growing normally at Monterey.

The important lesson learned from this small trial is that it is not possible to establish Douglas-fir seed orchards, at least those grafted with scion material from the Cascade Mountains of west-central Oregon, in areas where insufficient winter chilling occurs. Orchard placement must take into consideration more than just the absence of extraneous pollen or weather patterns that favor cone initiation or maturity; the climatic restraints of seed sources within a species with a large geographic range must be honored or results similar to those of this study may result.

Literature Cited

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