The Relationship Between Douglas-Fir Graft Compatibility And Wood Specific Gravity

ABSTRACT—The linear correlation between graft compatibility and wood specific gravity was computed for 50 Douglas-fir clones. No significant correlations at the 0.05 level were found between graft incompatibility and juvenile wood (rings 4-11), adult wood (rings 50-57), or approximate tree average (rings 4-11 plus 50-57). Lack of correlation discourages use of specific gravity as an aid in selection of graft-compatible plus-trees.

EARLY DETERMINATION of average graft compatibility of a clone is important to operators of Douglas-fir seed orchards. Hahn (2) found that wood specific gravity was highly correlated with graft survival in the Row River seed orchard and suggested that increment cores might be used for quickly screening plus-trees for graft incompatibility. Since his data were based on only 15 clones and on survival rather than graft compatibility (mortality resulted from a combination of causes including graft incompatibility, grafting technique failures, planting failures after bench grafting, etc.), he suggested that further studies be made on a larger number of clones to check the relationship between wood specific gravity and actual graft compatibility. The following report compares the specific gravity of 50 Douglas-fir ortets with the graft compatibility of their scions when grafted on 2- to 3-year-old seedlings.

Methods

Fifty ortets (average age 88 years) selected for Siuslaw National Forest's seed orchard near Corvallis, Oregon, were grafted for a compatibility check in April, 1967 by the method described by Copes (1). Seventeen months after grafting, the 8 to 20 grafts available for each clone were sacrificed and microscopically examined for compatibility. With this method, both early and delayed incompatible grafts were detected and all other causes of graft failure deleted.

Wood specific gravity for the 50 ortets was measured on increment cores (5 mm.) taken at breast height on the uphill side of each tree. The maximum moisture method of specific gravity determination described by Smith (3) was used. No resin extraction from the cores was needed. Specific gravity was determined on four segments from each core: annual rings 4-7, 8-11, 50-53, and 54-57. Specific gravities of segments 4-7 and 8-11 were averaged to obtain a measure for juvenile wood, segments 50-53 and 54-57 for adult wood, and all four segments for an approximate tree average.

Results and Discussion

Average compatibility of all 50 clones was 61 percent. The least congenial clones were compatible with only 10 percent of the rootstocks, but the best clones were successful on all the rootstocks upon which they were grafted. Actually, no Douglas-fir clone is 100-percent compatible. Figures such as 100 percent are merely a result of sample variation and indicate that the 100-percent clones are highly compatible with most rootstocks.

Specific gravity for juvenile wood (rings 4-11) averaged 0.40 and ranged from 0.32 to 0.54. The 0.54 value probably resulted from compression wood, as core segments from rings 50-57 from the same tree averaged only 0.49. Specific gravity of adult wood (rings 50-57) averaged 0.48 and ranged from 0.39 to 0.56. Average-tree specific gravity (rings 4-11 plus 50-57) averaged 0.44 and ranged from 0.37 to 0.54.

The small-core method of determining specific gravity proved to be highly reliable. Only 6.1 percent of the variation among core segments was found between segments of the same approximate age (4-7 vs. 8-11 and 50-53 vs. 54-57). The confidence interval of 99 percent for mean specific gravity of a tree was ± 0.0247.

The lack of linear relationship between specific gravity of adult wood (rings 50-57) and graft incompatibility was also clearly indicated by test results. The relationship between juvenile or tree-average specific gravity and compatibility showed a similar lack of correspondence. Correlation estimates between average compatibility and juvenile, adult, and tree-average specific gravity at the 5-percent level were 0.1360, — 0.0070, and 0.0809, respectively; none were significant.

Specific gravity of individual trees based on one 5-mm. increment core is subject to valid criticism as being inferior to multiple-core sampling with larger diameter cores. This study's limitation can be largely overcome by grouping clones into two classes: 0- to 50-percent and 51- to 100-percent compatible. Thus, a multiple-core sample for each group is obtained. Average specific gravity of clones 0- to 50-percent compatible was 0.45 (22-core sample), whereas average specific gravity of clones 51- to 100-percent compatible was 0.44 (28-core sample).

The conclusion is that specific gravity cannot be used as an aid in selection of compatible clones for orchard grafting.

Literature Cited