ROOT PRUNING CONIFERS IN NURSERY BEDS: DOES IT INCREASE SURVIVAL POTENTIAL?

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Forest nurserymen commonly root-prune seedlings of most tree species in the beds in hope that a bushier root system will develop before lifting. However, no one has convincingly shown that a bushy root form intrinsically promotes seedling survival. Scattering a seedling's energy to multitudes of rootlet tips might actually be detrimental, if initial survival after outplanting hinges on rapid, far-reaching, and deep extension of a relatively few, major roots, as is common with undisturbed conifer seedlings.

In this context, the meaningfulness of top/root ratio to seedling survival needs study. The literature relating T/R ratio to seedling survival and growth is conflicting. Very possibly, pattern of root growth means more in terms of seedling survival than root volume or T/R ratio. A root system best suited to rapid extension might conceivable have a relatively high, "unfavorable," T/R ratio.

The nurseryman's job would be greatly simplified if one pattern of root system was best for survival of all planting stock. However, different plants have different requirements. Even when a particular pattern of root system proves best for several species, a single nursery technique may not produce such roots on all species. Again we contend with variety, as illustrated by observations incidental to studies of other aspects of Douglas-fir nursery stock.

We lifted 30 seedlings each of *Pseudotsuga menziesii* var. *menziesii* (Mirb.) Franco (seed source: Willamette National Forest, Oreg.) and var. *glauca* (Beissn.) Franco (seed source: Wenatchee National Forest, Wash.) in October, 1962, at the end of their second growing season in the USDA Forest Service Wind River Nursery at Carson, Wash. Root systems were washed and pruned to a 6-inch maximum length. All remaining, nondormant root tips were removed. Seedlings were then potted individually in quart cartons of nursery soil and placed in a growth cham ber programed to simulate overwinter air temperatures at Wind River. Containers were watered whenever the soil surface showed signs of drying. Root systems were reexamined on March 19, 1963.

Seedlings of the two sources differed distinctively in subsequent root development. Seedlings of the var. *glauca* consistently initiated clusters of new long roots immediately above pruning wounds on woody roots. The newly initiated roots tended to grow down rapidly with no lateral branching. Because relatively few roots developed above these end zones of initiation, the residual root system was no bushier.

In contrast, seedlings of var. *menziesii* initiated few new roots; some apparently initiated none. Instead, small rootlets that were dormant at the outset of the experiment began to grow. Many mycorrhizae burst their mantles and grew in a manner characteristic of long roots. Consequently, the number of major branch roots increased in the upper root system, while on most seedlings none grew rapidly downward.

In these circumstances, then, roots of Douglasfir from two different seed sources grew in two very different patterns after pruning. Whether or not operational pruning in nurseries produces similar results remains to be seen, but the physiological potential is there.

The continuing plantation failures that plague most extensive regeneration efforts accent, among other things, the inadequacy of our present knowledge on the best kind of seedling root system and how to produce such roots.

The forms of root system that best equip nursery stock for survival after outplanting and the meaningfulness of top/root ratios in evaluating seedling survival ability are open to question. Observations on two varieties of Douglas-fir indicate that no single nursery technique can be guaranteed to produce a given form of root system on all species or even varieties.