

Analysis of genetic and environmental effects on hybrid poplar rooting in Central and Northern Minnesota, USA

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We studied genetic and environmental effects on adventitious root initiation and growth because rooting is biologically prerequisite to the establishment of hybrid poplar plantations. Six clones from two pedigrees (pure *Populus deltoides* "cottonwoods" and *P. deltoides* x *P. maximowiczii* hybrids) were tested at two sites (Alexandria and Fertile, Minnesota, USA) and three planting dates (mid-May, late-May, mid-June, 1999). The experimental design was randomized complete blocks with two replications of five cuttings per clone. Individual trees were harvested 2 weeks after planting. Lateral roots, callus roots, callus, shoots, and leaves were dissected from each cutting and oven dried to determine dry weight (mg) of each component. Aboveground and belowground temperatures (°F) were recorded at 5-minute intervals throughout the experiment. Analyses of variance indicated that the most important factors influencing root initiation and growth were pedigree and clone-within-pedigree main effects, and the pedigree x planting date interaction.

Pedigrees differed for total root dry weight per cutting and mean number of roots per cutting ($p < 0.0001$, $p < 0.0001$, respectively). Overall, root dry weight of the hybrids was almost double that of the cottonwoods (25.37 mg, 13.95 mg, respectively). Likewise, root number was twice as much for the hybrids as for the cottonwoods (6, 3, respectively). The pedigree x planting date interaction was significant ($p < 0.0001$) for root dry weight. Root dry weight of the hybrids was greater than for the cottonwoods at the earliest planting date (31.78 mg, 6.66 mg, respectively). Root number was also higher for the hybrids than for the cottonwoods for planting date 1 (8, 2, respectively). However, root dry weight and root number decreased for the hybrids and increased for the cottonwoods with later planting dates. Root dry weight of the hybrids was lower than that of the cottonwoods at the end of the experiment (20.23 mg, 24.46 mg, respectively) despite a slight root number advantage for the hybrids over the cottonwoods (4, 3, respectively).

Belowground growing degree days (GDD) increased with planting date (104.7, 252.8, 283.1, respectively). However, attempts to relate root initiation and growth to soil temperature or air temperature met with uncertain results. Thus, neither linear nor curvilinear regressions of root dry weight on aboveground or belowground GDD were significant for either pedigree. But the relationship between root initiation and growth to soil temperature or air temperature was stronger for the cottonwoods than for the hybrids ($r^2 = 0.6808$, $r^2 = 0.5897$, respectively). Our current hypothesis is that the relationship between root dry weight and temperature is curvilinear and of different shape for the cottonwoods and hybrids we have tested. We believe a more extensive experiment with increased sampling of dates and clones would be needed to adequately test our hypothesis.

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Research results and ongoing research activities on poplar and willow breeding, diseases, insects, production, and utilization are described in 220 abstracts from the International Poplar Commission meeting in Vancouver, Washington, September 24-28, 2000.

KEY WORDS: *Populus*, *Salix*, phytoremediation, genetics, plantations, pests and disease, tree physiology.



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