Evaluating Hybrid Poplar Rooting. II.
Backcross Breeding Method Exhibits Exceptional Promise

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Backcross breeding uses two crosses to create genotypes with improved traits. The first cross establishes an F_1 population, which is then used as the female parent in a set of second crosses. The male parent of the second cross is often a genotype well-adapted to local environments. A currently investigated backcross population is the result of crosses between *Populus deltoides* x *P. trichocarpa* females and *P. deltoides* males. Therefore, recombination may result in BC_1 genotypes ranging from almost 50% *P. trichocarpa* to nearly 100% *P. deltoides*. The goal of this breeding scheme is to incorporate rooting ability of *P. trichocarpa* into regional adaptability of *P. deltoides*.

We tested 21 clones from 5 pedigrees (pure *Populus deltoides* "cottonwoods", *P. deltoides* x *P. maximowiczii* hybrids, *P. deltoides* x *P. nigra* hybrids, *P. nigra* x *P. maximowiczii* hybrids, and (*P. deltoides* x *P. trichocarpa*) x *P. deltoides* backcross hybrids) at 3 sites (Ames, IA, Waseca, MN and Westport, MN) and 3 planting dates (late-April, early-May, late-May, 2002). The experimental design was randomized complete blocks with 12 blocks and 1 cutting per clone per block. 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 (g) of each component.

Analyses of variance indicated that pedigree was not significant ($p=0.478$), but clone was highly significant ($p=0.003$). Despite non-significant pedigree effects, we used 4 single degree of freedom linear contrasts to make pairwise comparisons between BC_1 and other pedigrees. We believe that our prior knowledge of expected differences among pedigrees allows us to make these tests.

The BC_1 differed significantly from the DM ($p<0.001$) and D ($p<0.001$) pedigrees but was not significantly different from the DN ($p=0.554$) and NM ($p=0.105$) pedigrees. Overall the BC_1 pedigree ranked 2nd (0.0053 g), with only the NM pedigree expressing a higher mean root dry weight (0.0062 g). However, BC_1 clones ranked 1st (NC13563: 0.0122 g) and 2nd (NC13649: 0.0078 g) overall. DN (0.0051 g), D (0.0035 g), and DM (0.0028 g) pedigrees ranked 3rd, 4th, and 5th respectively.

According to these data, gain from breeding and selecting backcross clones adapted to specific environments increases rooting ability as much as 150% over native *P. deltoides* clones. Our current hypothesis is that gains from selection can be much greater than 150%. Thus, we believe more extensive testing of the BC_1 clones is warranted. Potential areas of future testing include regional yield trials, rooting studies, and phytoremediation projects.

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