

GENETIC MAPPING OF *Populus*

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In trees, most phenotypic traits of commercial importance are the products of gene action at several or many loci. Detailed genetic maps, now available for a few herbaceous plants, have proven useful as tools for counting and identifying genes that are responsible for quantitatively inherited traits. Application of high-density linkage mapping to problems of quantitative inheritance in trees has been delayed because of the lack of suitable pedigrees with sufficient segregating genetic and phenotypic variation. To address this problem, we have produced and begun to map a three-generation inbred pedigree founded by hybridization between a female *Populus trichocarpa* Torr. & Gray (T) and a male *P. deltoides* Bart. (D). The F₁ (TxD) contains 23 hybrid offspring. Two F₁ hybrids were crossed to produce the F₂ CLDxD, and each F₁ was backcrossed to one of the founding parents to produce the two possible backcrosses (TDxD; TxTD). Among the 612 advanced-generation offspring, there is striking variation in phenology, form, and growth. Genetic variation is assessed and linkage analysis performed using DNA markers, primarily restriction fragment length polymorphisms (RFLPs). Linkage blocks containing several markers have been assembled, and the search for correlations between RFLP alleles and quantitative traits related to productivity is underway.

Peripheral to the mapping of quantitative trait loci we have found that some TxD hybrids are not diploid, but triploid or aneuploid. This was first revealed by inheritance of *both* maternal RFLP alleles at some loci in some individual F₁ hybrids. Tri/aneuploidy in the hybrids has been confirmed by biochemical analysis of nuclear DNA content and by chromosome counts. As is typical of triploid aspen, triploid TxD hybrids have larger leaf epidermal cells and larger leaves than diploids. Other phenotypic traits, such as leaf shape, abaxial leaf color, and stomatal physiology, are skewed in the direction of the female "T" parent. At least 10 different female *P. trichocarpa* clones in our breeding program have produced one or more tri/aneuploid TxD hybrids as judged by abaxial leaf color. The ramifications of tri/aneuploidy for tree growth, wood quality, and fertility are being investigated.