

Metabolic Profiling of *Populus trichocarpa* Family 1 UDP-Glycosyltransferases

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Abstract : Uridine diphosphate-glycosyltransferases (UGTs) are enzymes that catalyze sugar transfer to a variety of plant metabolites. UGT substrates, which include plant secondary metabolites involved in lignification, demonstrate new activities and incorporation when glycosylated. Knowledge of UGT function, substrate specificity, and enzyme products is important for plant engineering efforts, especially related to increasing plant biomass through lignification. UGTs in *Populus trichocarpa*, a biofuel feedstock, and model woody plant, were selected from a pool of gene candidates using rapid prioritization strategies. A functional genomics workflow, consisting of a metabolite genome-wide association study (mGWAS), expression of synthetic codon-optimized genes, and high-throughput biochemical assays with mass spectrometry-based analysis, was developed for determining the substrates and products of previously-uncharacterized enzymes. A total of 40 UGTs from *P. trichocarpa* were profiled, and the biochemical assay results were compared to predicted mGWAS connections. Assay results confirmed seven of 11 leaf mGWAS associations and demonstrated varying levels of substrate specificity among candidate UGTs. *P. trichocarpa* UGT substrate processing confirms the role of these newly-characterized enzymes in lignan, flavonoid, and phytohormone metabolism, with potential implications for cell wall biosynthesis, nitrogen uptake, and biotic and abiotic stress responses.

Keywords : *Populus*, metabolite-gene associations, GWAS, bio feedstocks, glycosyltransferase

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