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Project title: CRISPRing trees for a climate-friendly economy

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Abstract (approx. 200 words)**:**

Climate change is one of the major global challenges and is heavily driven by the depletion of fossil resources for the production of energy, fuels, and chemicals. A shift towards a bio-based circular economy is therefore desirable and can be achieved by employing lignocellulosic biomass, such as poplar wood, rather than fossil resources, as feedstock. However, valorizing the carbohydrate fraction of cell walls to pulp or fermentable sugars requires the removal of lignin, a polymer that poses a significant challenge towards biomass deconstruction, due to its recalcitrance. To overcome this problem, attempts are undertaken to engineer trees with lower lignin content. Here, we report the generation of *Populus tremula* x *alba* CRISPR knock-out mutant lines, deficient in *TRANSALDOLASE2*, a key enzyme acting upstream of the monolignol-specific pathway at the inter-phase of primary and secondary metabolism. Upon knock-out of both homologues (*TRA2A* and *TRA2B*), the mutant plants displayed no significant differences in growth parameters such as height and stem diameter when compared to wild-type plants. Cell wall analysis revealed a reduction of up to 17% in lignin amount, an increase of cellulose content of up to 9%, and an increased enzymatic processing efficiency of up to 31% in the *tra2a tra2b* mutants compared to wild type. In summary, our approach yielded trees with highly interesting properties for the biorefinery, which we currently further test in the field.

Key words:
Lignin engineering, CRISPR, Sustainability