Alteration of *KNAT7* transcription factor expression in poplar changes cell wall characteristics and increases saccharification efficiency

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Background

- KNAT7 transcription factors are known to regulate *Arabidopsis* and tobacco biomass secondary cell wall (SCW) biosynthesis although results and impacts have been contrasting. The role of *KNAT7* gene expression in woody biomass, such as poplar, has not previously been studied. *KNAT7* may impact cell wall physiology and compositional traits in poplar biomass, which may then improve properties for production of bio-derived products

Approach

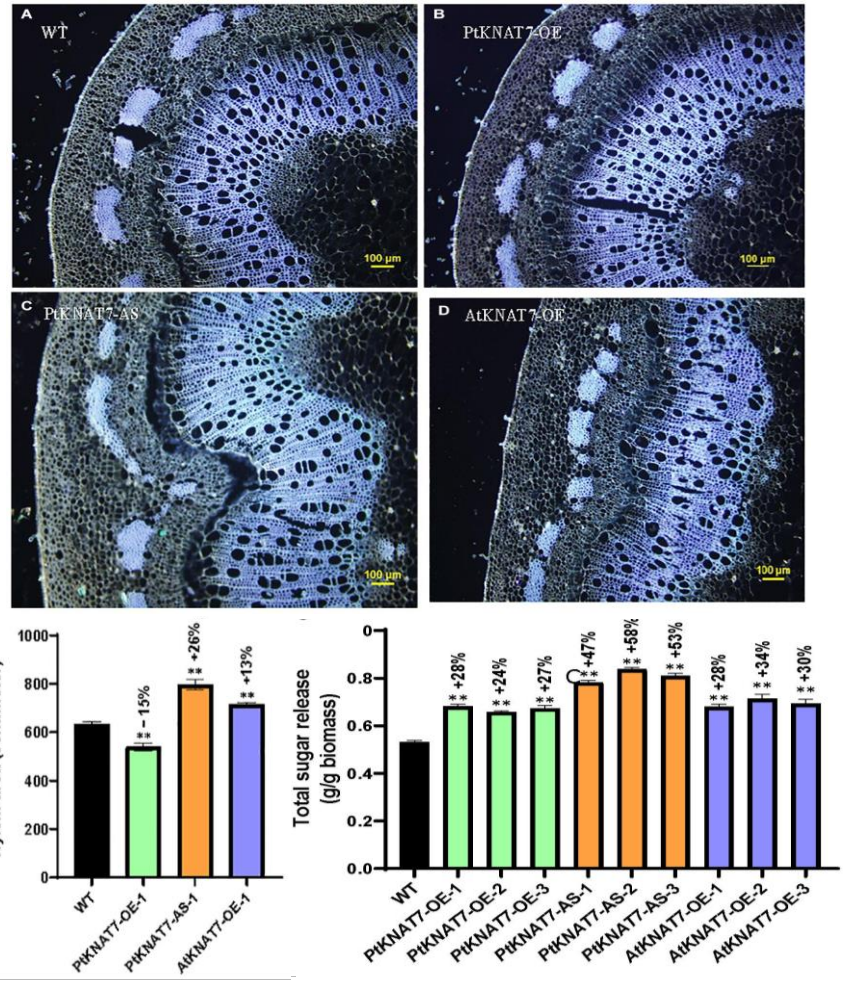
- Overexpression (OE) and antisense suppression (AS) transgenic lines were generated using Agrobacterium in *Populus tremula x P. alba* 717-1 B4 to investigate role of *PtKNAT7* genes in (SCW)
- Heterologous overexpression of *AtKNAT7* in transgenic poplar was also studied to circumvent co-suppression
- Gene expression, microscopy, growth measurements, lignin analysis, and saccharification studies were used to monitor affects of modification of *KNAT7* expression on transgenic poplar biomass

Outcome

- Expression of KNAT7 transgenes was driven by developing xylem-specific promoter DX15. Many SCW biosynthesis genes downstream of *KNAT7* were highly expressed in homologous and heterologous OE lines; many genes showed reduced expression in *KNAT7* AS or knockdown lines
- No changes in lignin content were observed in OE lines, although knockdown transgenic lines had reduced lignin content compared to WT. All transgenic lines had higher lignin S/G than WT.
- No growth phenotypes were observed in transgenic lines compared to WT
- *PtKNAT7*-OE lines showed 15% decrease in xylem cross-sectional area and 26% increase in *PtKNAT7*-AS lines over WT while *AtKNAT7*-OE lines showed 13% increase in xylem area
- Saccharification efficiency was significantly higher in all *KNAT7* transgenics compared to WT

Significance

- Modification of *KNAT7* expression represents a strategy to improve ethanol production through altered lignification and improved saccharification efficiency of poplar without sacrificing biomass growth and yield potential



Autofluorescence cross-section images show differences in xylem area and improved sugar release are observed in transgenic poplar in comparison to wild type (WT).

Ahlawat, Y. K. et al. "Genetic Modification of *KNAT7* Transcription Factor Expression Enhances Saccharification and Reduces Recalcitrance of Wood Biomass in Poplars". *Frontiers in Plant Science* 2021, 12:762067, doi:10.3389/fpls.2021.762067.

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