1 February 2017

**Reducing the flavone tricin in grasses results in increased lignification and decreased digestibility**

These findings are instructive for lignin engineering strategies to improve biomass processing and biochemical production.

**The Science**

By studying a naturally silenced maize mutant defective in chalcone synthase, a key enzyme involved in the biosynthesis of flavonoids, we demonstrated that levels of tricin-related flavonoids were significantly reduced, resulting in strongly reduced incorporation of tricin into the lignin polymer. These plants also had increased total lignin content and, consequently, demonstrated significantly reduced saccharification.

**The Impact**

These findings are instructive for lignin engineering strategies to improve biomass processing and biochemicals production.

**Summary**

Lignin is a phenolic heteropolymer that is deposited in secondary-thickened cell walls where it provides mechanical strength. A recent structural characterization of cell walls from monocot species showed that the flavone tricin is part of the native lignin polymer, where it often initiates lignin chains. In this study, we investigated the consequences of altered tricin levels on lignin structure and cell wall recalcitrance by phenolic profiling, nuclear magnetic resonance, and saccharification assays of the naturally silenced maize (*Zea mays*) *C2-Idf* (*inhibitor diffuse*) mutant, defective in the *CHALCONE SYNTHASE Colorless2* (*C2*) gene. We show that the *C2-Idf* mutant produces highly reduced levels of apigenin- and tricin-related flavonoids, resulting in a strongly reduced incorporation of tricin into the lignin polymer. In addition, the *C2-Idf* mutation resulted in strikingly higher Klason lignin levels, especially in the leaves. As a consequence, the leaves of *C2-Idf* mutants had significantly reduced saccharification efficiencies compared with those of control plants. These findings are instructive for lignin engineering strategies to improve biomass processing and biochemical production.

**Contacts (BER PM)**

N. Kent Peters  
Program Manager, Office of Biological and Environmental Research  
[kent.peters@science.doe.gov](mailto:kent.peters@science.doe.gov), 301-903-5549

**(PI Contact)**

John Ralph  
University of Wisconsin - Madison  
[jralph@wisc.edu](mailto:jralph@wisc.edu)

Wout Boerjan  
VIB, Ghent Belgium  
[wout.boerjan@psb.vib-ugent.be](mailto:wout.boerjan@psb.vib-ugent.be)

**Funding**This work was supported by Petrobras and the Agency for Innovation by Science and Technology (IWT) through the IWT-SBO project BIOLEUM (grant no. 130039) and the IWT-FISCH-SBO project ARBOREF; by the Department of Energy Great Lakes Bioenergy Research Center (Office of Science grant no. DE-FC02-07ER64494); by the China Scholarship Council (Ph.D. scholarship at the University of Wisconsin, Madison); by the Research Foundation Flanders (postdoctoral fellowship); and by FAPESP (BIOEN Young Investigator Award grant no. 2015/02527–1).

**Publications**

Eloy, N.B. *et al.* “Silencing *CHALCONE SYNTHASE* in maize impedes the incorporation of tricin into lignin and increases lignin content.” *Plant Physiology* **173**, 998-1016 (2017) [DOI: 10.1104/pp.16.01108].

**Related Links**

<http://www.plantphysiol.org/content/173/2/998.full.pdf+html>

**PM Recommendation for SC Web Publication**

[Yes or No]