ABSTRACT

"Engineering lignin for biofuels"

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Lignin is an aromatic polymer that is abundantly present in secondarily-thickened plant cell walls. It confers rigidity to the wall and allows transport of water and solutes through the vascular system. However, lignin plays a negative role in a number of agro-industrial processes, such as pulping and forage digestibility and it is also one of the most important limiting factors in the conversion of plant cell walls to fermentable sugars in the process to liquid bio-fuels. Hence, significant research efforts have been devoted to understand the lignin biosynthesis pathway and the effects of down-regulation of individual steps of this pathway on lignin amount and composition, and on wood properties. These studies have shown that lignin amount and composition can be altered, often without apparent negative consequences for plant health. The first results obtained from poplar field trials will be used to illustrate how lignin engineering can improve biomass processing. Furthermore, we have taken a systems biology approach involving transcriptomics and metabolomics in Arabidopsis to study how the plant, as a biological system, copes with perturbations in the lignin biosynthesis pathway, to reveal regulation within this pathway and to identifying novel genes with potential economic value. Finally, an example will be presented how natural variation in the poplar germplasm can be exploited in a reverse genetics strategy to identify gene function and to accelerate tree genetic improvement.