Sorghum Secondary Cell Wall Nanoarchitecture Can Be Revealed By Solid State NMR

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Project Goals: Establish the scientific knowledge and new technologies to transform the maximum amount of carbon available in bioenergy crops into biofuels and bioproducts.

Lignocellulosic biomass (i.e. the plant secondary cell wall) is a promising sustainable feedstock for the production of biofuels and bioproducts. The cell wall is a complex material composed of lignin, diverse polysaccharides, and proteins that assembles outside of the cell membrane. Our goal is to develop a physical model of bioenergy crop cell walls which will guide engineering and breeding strategies.

Understanding the biosynthesis and nanoarchitecture of plant cell walls is key for the predictable engineering of bioenergy feedstocks. Multi-dimensional solid-state NMR (ssNMR) facilitates the close investigation of the native nanoarchitecture of plant cell walls[(1–4)]. By successfully generating mature plants with high ^{13}C incorporation (~90 %) in a customized growth chamber, the effect of modifying the cell wall on cell wall polysaccharide arrangement was investigated. Here, we present data on the nanoarchitecture of sorghum stem, root and leaf cell walls. We explore the effects of sample preparation (dried material vs. fresh), and propose a model for xylan-cellulose interactions. Future work will include testing the model using bioenergy crops with engineered cell walls.

References

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