Regulation of biomass yield and composition of energy sorghum stems

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Sorghum bicolor is a resilient, sustainable, low cost source of specialty biofuels and bio-products due to the crop's high biomass yield, drought and heat tolerance, excellent genetic and genomic platform, and highly diverse germplasm. Our research is focused on increasing stem biomass yield and optimizing stem composition and value. During the stem growth phase, substantial carbon is allocated to cell wall biosynthesis associated with cell proliferation and internode expansion. Following floral initiation, stem growth and cell wall biosynthesis declines and non-structural carbohydrates accumulate in the pith parenchyma cells of sorghum stems. To better understand carbon partitioning during the stem growth phase we are investigating the function of Dw2/KIPK, a locus/gene that regulates stem growth in sorghum using transcriptomic and phosphoproteomic analyses. A better understanding of this gene and its regulatory network will facilitate the engineering of stem growth and enhance biomass yield. Energy sorghum can accumulate up to 50% of its stem biomass as non-structural carbohydrates (sucrose, starch, MLG) that can be readily converted to specialty biofuels and bioproducts. We have identified candidate genes and mapped pathways involved in the synthesis and degradation of the non-structural carbohydrates that accumulate in sorghum stems. The identification of these genes was facilitated by the collection of transcriptome data from most sorghum organs/tissues during plant development in collaboration with the Joint Genome Institute. The information obtained through these studies comprises a sorghum transcriptome compendium which is being used to design plants with higher biomass yield and improved composition.