

Computer-aided Engineering of Biomass Production under Drought in Sorghum and Setaria

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Project Goals: This project (www.foxmillet.org) aims to leverage *Setaria viridis* as a model system to develop novel technologies and methodologies to redesign the bioenergy feedstock *Sorghum bicolor* to enhance water use and photosynthetic efficiencies.

In this study, we performed comparative metabolic network analysis under well-watered and water deficient conditions, using Flux Balance Analysis (FBA) to investigate how plants allocate metabolic resources for biomass production in response to drought. First, we collected biomass composition data for *Setaria* and sorghum shoot and root under well-watered and water-limiting conditions at multiple time points, using ¹³C solid state NMR. Second, we generated genome-scale metabolic models of *Setaria italica*, *Setaria viridis*, and *Sorghum bicolor* by an automated computational pipeline, converting pathway genome databases to metabolic network reconstructions. The biomass composition will be used to describe the objective function in the *S. bicolor* model. We will constrain the models by the transcriptome data generated from the consortium to further adjust the upper and lower bounds of each reaction. We will perform Flux Variability Analysis for determining the maximum range of flux that every reaction can possibly take on while the network is optimized for biomass production to identify the key reactions that limit biomass production under drought conditions.

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