

High Throughput Phenotyping and Quantitative Genetics for Biomass Production in a C4 Grass Model

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Project Goals:

Genetically tractable model systems closely related to bioenergy grasses need to be developed to drive the crop improvement required for large scale, ecologically sustainable bioenergy production. *Setaria viridis* is an ideal candidate C₄ panacoid grass. The objectives of this project are to utilize genomic, computational and engineering tools to begin the genetic dissection of drought and density response in *S. viridis*. This will be achieved through: 1) Quantitative trait and Association genetics; 2) novel controlled environment and field phenotyping combined with molecular and chemical profiling; 3) development of metabolic and gene networks; 4) development of transformation technologies; 5) reverse genetic testing of candidate genes.

Abstract:

Phenotyping has become the rate-limiting step in using large-scale genomic data to understand and improve agricultural crops. Our project has used the Bellwether Phenotyping platform for controlled-environment plant growth and automated, multimodal phenotyping to study how plant biomass traits change temporally in response to water availability and identify the genetic loci underlying those changes. We have analyzed two independent genetically structured populations of *Setaria* sp.: an interspecific *S. italica* x *S. viridis* recombinant inbred line population and two grow outs of a *S. viridis* natural diversity panel. We developed Plant Computer Vision (PlantCV) as an open-source, platform independent quantitative image analysis community resource and have used it to quantify height, biomass, water-use efficiency, color, plant architecture, and near-infrared traits. Our studies identified several major genetic loci associated with variation in plant height. However, the contribution of these loci differs depending on environment and developmental time. We are currently extending our analysis to the other measured traits.

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