

### **Natural Variation of Abiotic Stress Tolerance for Biomass Production in a C4 Model Grass**

Malia A. Gehan<sup>1</sup>, Todd C. Mockler<sup>1\*</sup> ([tmockler@danforthcenter.org](mailto:tmockler@danforthcenter.org)), Tracy Ficor<sup>1</sup>, Stephanie Turnipseed<sup>1</sup>, Erica Agnew<sup>1</sup>, Andy Lin<sup>1</sup>, Noah Fahlgren<sup>1</sup>, Pu Huang<sup>1</sup>, Maximilian Feldman<sup>1</sup>, Ivan Baxter<sup>1,2</sup> ([ibaxter@danforthcenter.org](mailto:ibaxter@danforthcenter.org)), and **Thomas P. Brutnell<sup>1</sup>**

<sup>1</sup> Donald Danforth Plant Science Center, St Louis, Missouri and <sup>2</sup> USDA-ARS, St Louis, Missouri

<http://plantcv.danforthcenter.org/>

**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.

To tackle the daunting challenge of producing more fuel with fewer inputs, a variety of strategies to improve and sustain crop yields are necessary. Plans for crop improvement may include mining natural variation of wild crop relatives to breed crops that require less water or increasing crop tolerance to temperature extremes to expand the geographical range in which they grow. We are examining natural variation in the low-temperature tolerance of *Setaria viridis* accessions collected throughout North America using low-cost phenotyping technologies. Improving the low-temperature tolerance of a plant could not only increase its geographical growth range, but accessions that germinate earlier in the growing season could avoid late season drought and heat stress. Further, with overlapping stress response mechanisms, improving the low-temperature tolerance of a plant may also increase drought tolerance. To capture emergence and growth phenotypes under low-temperature we are using low-cost Raspberry Pi microcomputers and cameras. To quantify growth traits, we use Plant Computer Vision (PlantCV), which we developed to be an open-source, platform independent quantitative image analysis community resource.

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