Improving water-use efficiency under fluctuating light

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Project Goals:

This project 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.

Abstract

In leaves, efficient water-use requires coordination of photosynthetic CO_2 assimilation with the activity of stomata, specialized cellular complexes which regulate CO_2 and water fluxes between the leaf and atmosphere. Stomata are slower than photosynthesis to respond to changes in light, and poor coordination between stomatal and photosynthetic processes can diminish productivity and water-use efficiency. Therefore, acceleration of stomatal responses has been hypothesized to improve water-use efficiency in fluctuating light conditions, which predominate in field crop canopies.

We used high-throughput thermal imaging to assess the speed of stomatal closure following a drop in light in a diversity panel of 667 accessions of *Sorghum bicolor* L. Different accessions showed various speeds of initial stomatal closure after the light was dimmed, and varying responses of stomatal re-opening at low light. The initial speed of stomatal closure, and the level of stomatal conductance at low light, were moderately heritable (h_g>0.45). Mapping with SNPs and gene expression data associated stomata kinetic traits to several candidate genes.

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