Sorghum Dw2 controls stem growth by regulating PLDδ/endomembrane activity and cell proliferation

Joel Oliver[1]*(joel.aoliver@tamu.edu), Mingzhu Fan[3,4], Brian McKinley[1], Starla Zemelis-Durfee[2,4], Federica Brandizzi[2,3,4], Curtis Wilkerson[3,4,5], and **John E Mullet**[1]

[1]Department of Biochemistry & Biophysics, Texas A&M University, College Station, Texas 77843; [2]MSU-DOE Plant Research Lab, Michigan State University, East Lansing, Michigan, 48824; [3]Department of Plant Biology, Michigan State University, East Lansing, Michigan, 48824; [4]Great Lakes Bioenergy Research Center, Michigan State University, East Lansing, Michigan, 48824; [5]Department of Biochemistry and Molecular Biology, Michigan State University, East Lansing, Michigan 48824

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Project Goals: The C4 grass *Sorghum bicolor* has shown promise as a dedicated bioenergy crop due to its ability to accumulate large amounts of biomass within its stem with low inputs on marginal lands. The goal of this project is to identify the molecular pathways responsible for controlling stem growth in Sorghum to aid in the continued breeding and engineering of *Sorghum* for greater biomass yield and better biomass composition.

Abstract

Stems of the C4 grass sorghum are comprised of nodes and internodes that are produced and elongated sequentially during plant growth impacting sink strength, biomass yield and composition. Stems of high biomass bioenergy sorghum can accumulate up to 50 internodes that together span 4-5 meters and account for ~84% of harvested biomass. An AGCVIII kinase (*Dw2*) has been identified that regulates sorghum stem internode growth, but the underlying signaling network is unknown. Here we provide evidence that mutation of *Dw2* reduces cell proliferation in internode intercalary meristems, inhibits endocytosis, and alters the distribution of heteroxylan and mixed linkage glucan in cell walls. Phosphoproteomic analysis showed that Dw2 signaling modulates the phosphorylation of proteins involved in lipid signaling (PLD δ), endomembrane trafficking, hormone, light and receptor signaling, and photosynthesis. Together, our results show that Dw2 modulates endomembrane function and cell division during sorghum internode elongation providing insight into the regulation of monocot internode development.

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