BRC Science Highlight
January 2021

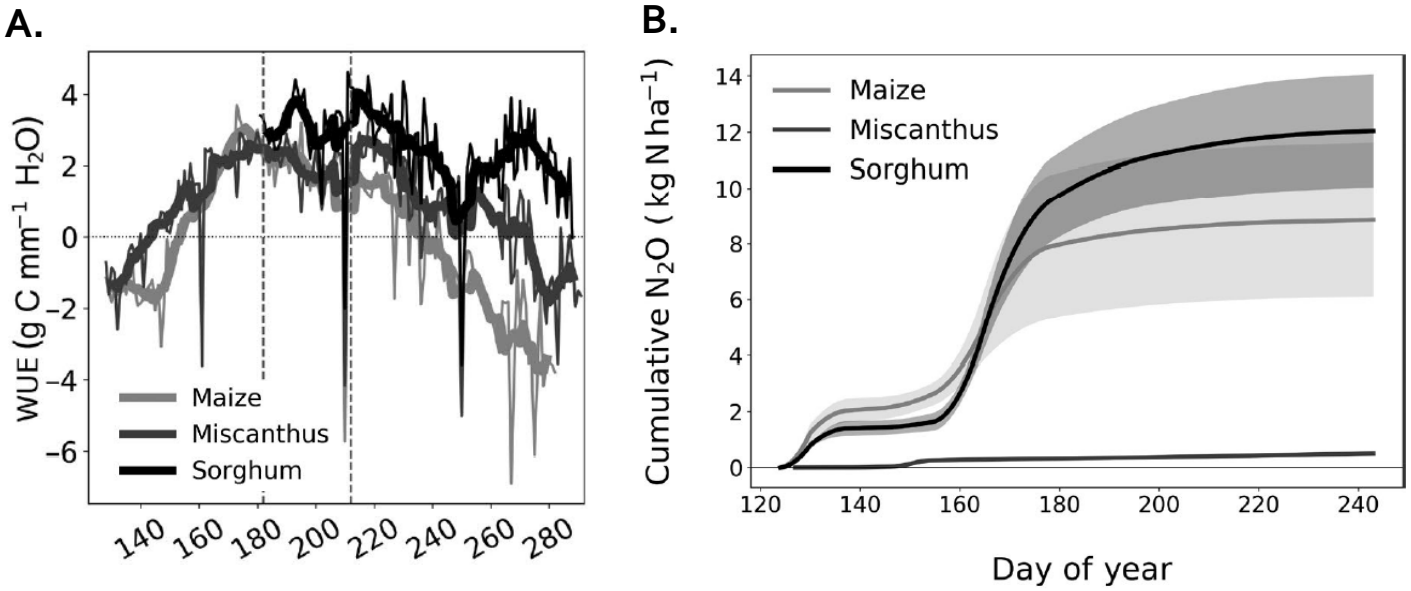
Ecosystem-Scale Biogeochemical Fluxes from Three Bioenergy Crop Candidates: How Energy Sorghum Compares to Maize and Miscanthus

Objective

Perennial bioenergy crops have been a major research focus due to their sustainability benefits, but these benefits may be negated by reverting land-use to annual crop rotations. A potential alternative, annual energy sorghum, may be more sustainable than maize and easier to integrate into annual crop rotations than perennials such as miscanthus. However, a comprehensive ecophysiological comparison of these three crops is lacking. Here, researchers present an ecosystem-scale comparison of carbon (C), nitrogen (N), water, and energy fluxes from energy sorghum, maize, and miscanthus.

Approach

- Eddy covariance flux towers measured aboveground carbon, water and energy flux in a 4 ha plot from each crop.
- Belowground carbon and nitrogen fluxes were measured using four smaller replicated 0.5 ha plots for each crop.
- Measurements were made during the 2018 growing season.



Sorghum exhibited higher WUE (A) than maize or miscanthus over the course of the growing season. Cumulative N_2O emissions for both sorghum and maize were similarly high and much greater than miscanthus emissions (B).

Results

- Sorghum fell between maize and miscanthus on most measured ecophysiological parameters.
- Sorghum and maize displayed similar N dynamics, but sorghum behaved more like perennial miscanthus in terms of C, water, and energy fluxes.
- Sorghum demonstrated high water use efficiency (WUE), which provides climatic flexibility, allowing it to grow non-irrigated in a wider region of the U.S.

Significance

This quantitative comparison of ecophysiological characteristics of candidate bioenergy crops will inform biogeochemical and ecological models. Researchers will be able to better predict crop growth, productivity, and sustainability and to strategize bioenergy cropping systems that maximize environmental and economic benefit.

Moore et al. 2020. "Ecosystem-Scale Biogeochemical Fluxes from Three Bioenergy Crop Candidates: How Energy Sorghum Compares to Maize and Miscanthus." GCB Bioenergy. DOI:10.1111/gcbb.12788.

CABBI CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION
U.S. DEPARTMENT OF ENERGY