Improving Photosynthetic Efficiency of C_4 Bioenergy Crops in Fluctuating Lights

Moonsub Lee[1*] (mlee128@illinois.edu), Fredy Altpeter[2], Ryan Boyd[1], and **Donald Ort[1]**

[1]University of Illinois at Urbana-Champaign, Urbana, IL; [2]University of Florida, Gainesville, FL

https://rogue.illinois.edu

Project Goals

Renewable Oil Generated with Ultra-productive Energycanes—or ROGUE—is engineering the two most productive American bioenergy crops—energycane and *Miscanthus*—to produce a sustainable supply of biodiesel, biojet fuel, and bioproducts.

Project goals are to:

1) Engineer energycane and *Miscanthus* to produce an abundance of natural oil that can be converted into biodiesel, biojet fuel, and bioproducts.
2) Improve how plants convert sunlight into plant matter through photosynthesis without more water or fertilizer.

Abstract

As demand for energy increases, bioenergy crops have gained considerable attention as an alternative energy source. To improve yield, previous studies have focused on breeding, soil fertility, and harvest management. However, yield potential depends on a crops ability to intercept light and the efficiency of converting light into biomass through the process of photosynthesis. It is known that fluctuations in light intensity, potentially caused by sun-leaf angle, wind or intermittent clouds, can decrease photosynthetic efficiency. Previous modeling of photosynthesis suggested that the discoordination of metabolic cycles in chloroplasts is a key factor reducing photosynthetic efficiency caused by fluctuating light. Therefore, we hypothesized that increased metabolite pool size may minimize decreases in photosynthetic efficiency by providing a buffer when cycles become asynchronous during fluctuating light. We further hypothesized that

increased chloroplast volume could increase metabolite pool sizes. For that reason, we are altering chloroplast volume by engineering chloroplast division genes in two high performing bioenergy crops sugarcane and energycane. Currently, we are confirming changes to chloroplast volume of our transgenic lines in greenhouse conditions. We will select the best performing transgenic lines for field trials.

References / Publications

Slattery, R.A., Walker, B.J., Weber, A.P., and Ort, D.R. (2018). The impacts of fluctuating light on crop performance. Plant physiology, 176, 990-1003.

Zhu, X.G., Long, S.P., and Ort, D.R. (2010). Improving photosynthetic efficiency for greater yield. Annual review of plant biology, 61, 235-261.

Funding Statement

This research was supported by the DOE Office of Science, Office of Biological and Environmental Research (BER), grant no. DE-SC0018254.