Title: Analyzing Lipid Synthesis and Turnover Using Stable Isotopes

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Project Goals:

To metabolically phenotype the leaves of wild-type sugarcane and oilcane line 1566 to discern how much assimilated CO_2 is diverted into triacylglycerol accumulation, the rate at which lipids are turned over, and the broader metabolic effects from engineering high-oil lines.

Abstract Text:

Plant oils for food, animal feed, and industrial applications have traditionally been extracted as triacylglycerols (TAG) from seeds, but there is growing interest in genetically engineering plants to accumulate oil in stems and other vegetative organs. To compare potential engineering strategies, we have been using isotope tracer studies to measure TAG synthesis and turnover in vegetative tissues. Here, we used pulse-chase labeling to compare wildtype and transgenic (line 1566) sugarcane. Young, fully expanded leaves were labeled with $^{13}CO_2$ for 6 hr. After 0, 15, 60, or 180 minutes of a chase period in ambient air, we analyzed abundance and ^{13}C-labeling of fatty acids obtained from extracted TAG. This revealed that the genotypes had similarly high ^{13}C-TAG enrichment but differed in which fatty acids were more enriched. The data suggest the rate of TAG synthesis is countered by degradation and that fatty acid content influences at least one of these processes. Next, we will repeat the 6 hr labeling with a longer (24 hr) chase period to better analyze the degradation kinetics.

References:

Parajuli et al. (2020). Towards oilcane: Engineering hyperaccumulation of triacylglycerol into sugarcane stems. GCB Bioenergy, 12(7), 476-490.

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