BRC Science Highlight
August 2019

Diversion of Carbon Flux from Sugars to Lipids Improves the Growth of an Arabidopsis Starchless Mutant

Background/objective

Plants break down sugars to fuel metabolism, growth, storage, and maintenance. When photosynthesis ceases at night in plants, starch is consumed as an energy source. Lipids, such as triacylglycerol (TAG), can act as alternative respiratory substrates for energy. TAG synthesis can be increased by overexpressing phospholipid:diacylglycerol acyltransferase (PDAT). In Arabidopsis, overexpressing *PDAT1* enhances carbon partitioning into lipids and improves the growth of the *ADP-glucose-pyrophosphorylase1 (adg1)* starchless mutant.

Approach

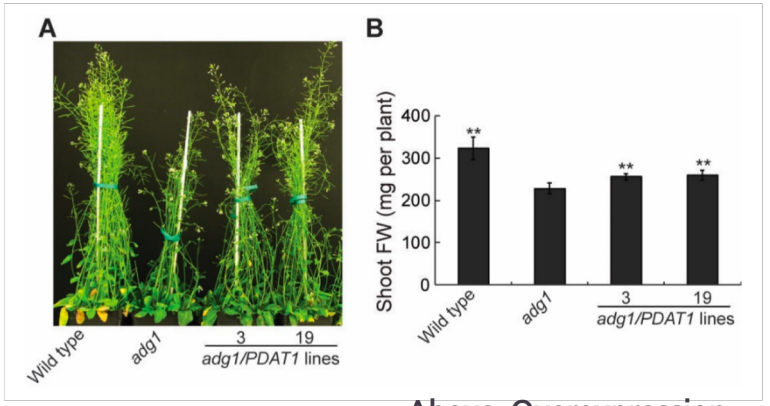
- To test the role of lipids in plant growth, transgenic plants overexpressing PDAT1 in *adg1* were generated and grown under a 16-h/8-h day/night cycle.

Results

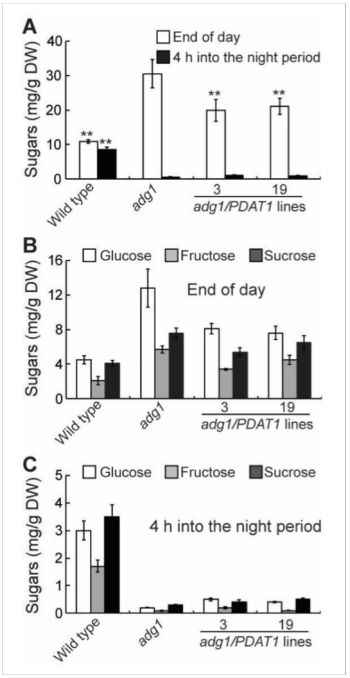
- Overexpression of PDAT1 enhances fatty acid and TAG synthesis at the expense of soluble sugars.
- Lipids in the form of TAG can partially replace the function of starch in maintaining energy homeostasis and plant growth in starchless mutants.

Significance

- This study improved understanding of how increasing TAG accumulation affects plant growth.
- Future studies will test whether TAG accumulation affects photosynthesis.



Above: Overexpression of *PDAT1* improves the growth of *adg1*: (A) 6-week-old plants grown on soil under long days; and (B) shoot biomass of 6-weed-old plants grown on soil.



Left: Sugar content in leaves of 6-week-old plants grown on soil: (A) total sugar content; (B) and (C) glucose, fructose, and sucrose levels.

Fan et al. 2019. "Diversion of Carbon Flux from Sugars to Lipids Improves the Growth of an Arabidopsis Starchless Mutant." Plants. 8(7): 229. DOI: 10.3390/plants8070229.

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