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.

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