ABSTRACT

"Sensing and signaling plant carbon and energy status"

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Plants are constantly challenged by changes in their environment that affect photosynthesis, respiration and carbon allocation and by a changing tissue- and developmental stage-dependent physiology during development. Therefore, they have evolved mechanisms to constantly monitor their metabolic status and adjust their growth accordingly. The KIN10/11 SnRK1 protein kinases, for example, function as conserved 'fuel gauges' that trigger extensive metabolic reprogramming upon carbon and energy depletion, in part through a network of bZIP transcription factors. SnRK1 activity is controlled by the micromolar levels of trehalose-6-P (T6P), the metabolic intermediate of trehalose metabolism. While Arabidopsis does not accumulate this disaccharide, its genome encodes a large family of T6P synthase (TPS)-like and T6P phosphatase (TPP) proteins. Yeast functional complementation studies, however, suggest that most of the TPS-like proteins are catalytically inactive and expression studies reveal extensive regulation at the transcriptional level. Therefore, they might function as metabolic sensors of plant carbon status.