The role of trehalose-6-phosphate in regulating resource allocation during senescence and stress

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Abstract

The sugars trehalose and sucrose are two non-reducing disaccharides which provide soluble energy in the form of stable molecules. Trehalose plays a variety of roles in organisms, but it is generally associated with protection of organisms during stress. There are five known pathways for trehalose synthesis, of which only the otsA-otsB pathway is found in plants. The content of the precursor of trehalose, trehalose-6-phosphate (T6P), increases with carbon availability and also reflects increased sugar contents during leaf senescence. In addition, T6P inhibits starch degradation during the night dependent on carbon availability.

The aims of the thesis were to determine the role of T6P during stress (cold stress and extended nights) and to explore the role of T6P in plant development by targeted manipulation in senescing leaves and in developing seeds.

In the transgenic Arabidopsis lines expressing the *E. coli* genes for T6P synthase (*otsA*) and T6P phosphatase (*otsB*) under extended night conditions, seed yield was reduced more strongly in the *otsA* and *otsB* transgenics than in wild-type plants, suggesting that disruption of T6P metabolism affects the adjustment to extended nights.

To analyse the involvement of T6P in senescence regulation and seed formation, transgenic Arabidopsis lines were created expressing *otsA, otsB* and the Arabidopsis T6P synthase gene, *TPS1*, under control of the highly specific developmental promoters. Delayed senescence was observed in transgenic lines expressing *TPS1* and further analysis indicated that this was because of increased seed sink strength.