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**Successful accumulation of sugars in bioenergy crops may depend on the unfolded protein response to mitigate stress**

Complex signaling via the unfolded protein response protects cells from stress and facilitates carbohydrate accumulation.

**The Science**

To improve bioenergy crop composition and yield, we seek to understand activation of the unfolded protein response (UPR) and its impact on the ability of plant cells to accumulate easily digestible carbohydrates such as mixed-linkage glucan (MLG). Here we identify a *Brachypodium* UPR transcription factor, UPR genes responsive to chemical or heat stress, and impacts of heat stress on MLG accumulation.

**The Impact**

Understanding the plant molecular mechanisms required to withstand abiotic and biotic stresses may aid in engineering bioenergy crops for maximum carbohydrate accumulation.

**Summary**

One approach to improve biomass composition for bioenergy crops is to increase the amount of easily digestible carbohydrates such as mixed-linkage glucan (MLG). Storage proteins and proteins responsible for the production of carbohydrates are synthesized in the endoplasmic reticulum (ER). Unfavorable conditions during growth that hamper the ER biosynthetic capacity, such as heat, can cause a potentially lethal condition known as ER stress, which activates the unfolded protein response (UPR), a signaling response designed to mitigate ER stress. Here, we investigated activation of the UPR in *Brachypodium*, as a model to study the UPR in seeds of a monocotyledon species, as well as the consequences of heat stress on MLG deposition in seeds. We identified a *Brachypodium bZIP60* transcription factor orthologue and determined a positive correlation between *bZIP60* splicing and ER stress induced by chemicals and heat. Each stress condition led to transcriptional modulation of several *BiP* genes, supporting the existence of condition-specific *BiP* regulation. Finally, we found that the UPR is elevated at the early stage of seed development and that MLG production is negatively affected by heat stress via modulation of MLG synthase accumulation. We propose that successful accomplishment of MLG accumulation in seeds is strongly correlated with the ability of the plant to sustain ER stress via the UPR.

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**Publications**

Kim, S.-J., *et al.,* In *Brachypodium* a complex signaling is actuated to protect cells from proteotoxic stress and facilitate seed filling. *Planta* **246**, 75-89 (2017) [DOI: 10.1007/s00425-017-2687-7].

**Related Links**

<https://link.springer.com/article/10.1007%2Fs00425-017-2687-7>

**PM Recommendation for SC Web Publication**