

## Mechanism of Sugarbeet Seed Germination Enhanced by Hydrogen Peroxide

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### ABSTRACT

Seed germination is a critical first stage of plant development but can be arrested by factors including dormancy and environmental conditions. Strategies to enhance germination are of interest to plant breeders to ensure the ability to utilize the genetic potential residing inside a dormant seed. In this study, seed germination in two sugarbeet (*Beta vulgaris* ssp. *vulgaris* L.) lines F1004 and F1015 through incubating seeds in hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) solution was improved over 70% relative to germinating seeds through water incubation. It was further found that low germination from water incubation was caused by physical dormancy in F1015 seeds with initial seed imbibition blocked by the seed pericarp, and physiological dormancy in F1004 seeds with germination compromised due to the physiological condition of the embryo. To identify genes that are differentially expressed in response to cellular activities promoted by H<sub>2</sub>O<sub>2</sub> during overcoming different type of dormancies, an RNA-Seq study was carried out and found H<sub>2</sub>O<sub>2</sub> treatment during germination accelerated the degradation of seed stored mRNAs that were synthesized before or during seed storage to provide protections and maintain the dormant state. Comparison of transcripts in H<sub>2</sub>O<sub>2</sub>-treated seeds between the two sugarbeet lines identified differentially expressed genes (DEGs) that were higher in F1004 for alleviating physiological dormancy were known to relative to gene expression regulation. The research established that H<sub>2</sub>O<sub>2</sub> overcomes both physical and physiological dormancies by hastening the transition of seeds from dormancy into germination. More DEGs related to gene expression regulation were involved in relieving physiological dormancy which provides new knowledge about the role of exogenous H<sub>2</sub>O<sub>2</sub> as a signaling molecule for regulating gene activities during germination. Moreover, the protocol using H<sub>2</sub>O<sub>2</sub> to promote germination will be useful for rescuing plant germplasms with poor germination.

### RE-PRINT

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