Nitrate modulates pectin metabolism and cell wall mechanical properties during cell expansion and cotyledon growth in Arabidopsis

Panel

Genética y Biología Molecular de Plantas

Valentina Nunez-Pascual [1, 2, 3], Eleodoro Riveras [1, 2, 3], Christian Silva-Sanzana [2, 4], Matias Vergara [1, 2, 3], Tomás C Moyano [1, 2, 3, 4], Francisca Blanco-Herrera [2, 4], Susana Saez-Aguayo [4], Ariel Orellana [3, 4], Sarah Robinson [5], Rodrigo A. Gutiérrez [1, 2, 3].

(1) Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile.
(2) Millenium Institute for Integrative Biology (iBio).
(3) Millennium Institute Center for Genome Regulation (CRG).
(4) Centro de Biotecnología Vegetal, Universidad Andrés Bello.
(5) Sainsbury Laboratory of Cambridge University (SLCU), UK.

v.nunezpascual@gmail.com

Nitrate is one of the most relevant nitrogen sources for plants. Besides its key nutritional role, nitrate acts as a signal molecule that regulates plant gene expression, metabolism, physiology, growth and development. In cotyledons and true leaves, nitrate promotes growth via cell expansion and endoreplication. Integrative bioinformatics analysis of transcriptome data indicated cell wall organization is a relevant biological process among differentially expressed genes by nitrate. However, there is scant information on the influence of nitrate on cell wall composition and properties during cell expansion and growth. Here, we explore the interaction between nitrate-induced growth and cell wall metabolism with emphasis on the role of the pectin matrix. We evaluated changes in cell wall monosaccharide profile and methylesterified pectin content of cotyledons grown under contrasting nitrate conditions. We also analyzed pectin methylesterase activity and characterized cell wall elasticity changes during nitrate-induced cell expansion using atomic force microscopy (AFM) and automated confocal microextensometry (ACME). Finally, we

explored pectin-related processes that respond to nitrate to identify candidate genes involved in these interactions. Taken together, our results support a model in which pectin methylesterification is associated with cell expansion in nitrate-mediated cotyledon growth in *Arabidopsis thaliana*. We integrate genomics, bioinformatics and cell biology approaches to provide insights into the interplay between nitrate nutrition, cell wall metabolism, and biomechanical properties for cell expansion.

Palabras Clave

(1) nitrate, (2) cell wall, (3) pectin, (4) cell expansion, (5) biomechanics.

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