Division-1-03

Organ- and Time-Specific Soluble Carbohydrates and Primary Metabolites Profiling in Rice Plants at Different Growth Stage

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[Introduction]

Plants including rice extremely depend on solar energy, photosynthesis, to synthesize carbon compounds and to implement growth and reproduction. Due to the contribution of carbohydrates on rice growth, the allocation and partitioning of assimilation products between source and sink organs is a major factor in determining plant yield. In general, rice abundantly accumulates soluble carbohydrates; relatively large portion of sucrose in leaf vacuoles during the day and less amounts of starch in chloroplasts. Therefore, understanding organ-, time- and growth stage-dependent carbohydrate metabolism could be one of clues to ensure suitable growth and grain yield against a variety of environmental stresses derived from climate change. Accordingly, the objective of this study was to investigate a variation of primary metabolites including soluble carbohydrates, and, to achieve our goal, we employed the high throughput technology (metabolomics) by GC-TOFMS.

[Materials and Methods]

The seeds of *Oryza sativa* L. cv. Ungwangbyeo were germinated, and the selected seedlings were grown in a greenhouse located in Chungbuk National University. The overall management for rice cultivation was followed by RDA standard manual. To analyze soluble carbohydrate, the shoots, roots and grains are carefully taken at the tillering, heading, days after flowering (DAF) 20 and DAF 40, respectively. Soluble carbohydrates including starch were extracted and measured at 630 nm using a UV-spectrophotometer (UV-1900i, Shimadzu, Japan). Metabolomic analysis from leaf blades, roots, and grains harvested with every 12-hour intervals (noon and midnight) at the tillering and heading stage, respectively. Analysis of hydrophilic compounds (e.g., amino acids, sugars, organic acids, and sugar alcohols) Samples were analyzed on an Agilent 7890A GC (Agilent Technologies, Santa Clara, CA, USA) equipped with a Pegasus TOF-MS ((Leco, St. Joseph)., Michigan, USA)

[Results and Discussion]

The level of total soluble sugars and starch tended to increase at the heading stage. At DAF 20, total sugar showed a tendency of decrease in all parts, whereas starch was significantly accumulated in grains. As a result of metabolite profiling, all primary metabolites such as organic acids, amino acids and sugars from leaf sheaths and roots decreased at midnight compared to noon at the heading stage. In contrast, during the heading stage, the grains showed higher amino acids and sugars compared to other parts both time points, noon and midnight. Shikimate acid, a precursor to produce phenolic compounds, showed a tendency of decrease at midnight at the tillering stage although the level was higher than at the heading stage.

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