[O42] Assimilate Partitioning for Crop Productivity and Quality

Chair: Naohiro Aoki (The University of Tokyo, Japan)
Chair: Tatsuro Hirose (Takasaki University of Health and Welfare, Japan)
Chair: Yong-Ling Ruan (The University of Newcastle, Australia)
Thu. Sep 9, 2021 2:30 PM - 4:30 PM Room 4 (Oral) (Crop Genetics and Physiology)

2:50 PM - 3:10 PM

[O42-02]Physiological Significance of an Alternative Step of Calvin-Benson Cycle in C_4 Photosynthesis in Mesophyll Cell Chloroplasts

(Invited Speaker)
○Tsuyoshi Furumoto (Ryukoku University, Japan)

C_4 photosynthetic plants, including several important crops, e.g., maize, sugarcane, and sorghum have developed a CO_2-concentrating metabolism based on functional differentiation of mesophyll- and bundle sheath cells. Since in addition to this CO_2-concentrating mechanism photosystem-derived oxygen generation in bundle sheath cells is also suppressed, the CO_2/O_2 partial pressure near Rubisco is high enough to inhibit the oxygenation reaction of Rubisco. In other words, in C_4 photosynthesis, the atmospheric CO_2 concentration is not the rate-limiting factor, but the light intensity is.
From the early stages of the discovery of C_4 photosynthesis, it has been known that the two enzymes of the reduction step of the Calvin-Benson cycle, 3-phosphoglycerate kinase and glyceraldehyde 3-phosphate dehydrogenase (GAPDH), also function in mesophyll cells. This is because the reducing power derived from the photosystem is produced in these cells. It was not clear what physiological phenomenon is responsible for the division of the reduction step of the Calvin-Benson cycle between the two cells in C_4 photosynthesis.
The amount of light from the sun fluctuates drastically and irregularly with clouds, and C_4 plants are thought to respond to this variation by finely regulating their metabolism. We found that GAPDH, one of the reduction steps in mesophyll cells, is activated at high light levels, and that CP12-3, which is highly expressed in C_4 photosynthetic plants, concerned in this activation. This mechanism of regulating metabolic fluxes between neighboring cells can be interpreted as a function of carbon partitioning, which has not received much attention so far.