KAAB International Symposium 2019

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**Knockout mutation of *NPP1* gene enhances starch accumulation and growth in rice seedlings under high temperature and high CO2 concentration conditions**

**1Takuya Inomata, 1Kentaro Kaneko, 1Takahiro Masui, 2Kimiko Itoh, 3Javier Pozueta-Romero, 1,2Toshiaki Mitsui**

1 Graduate School of Science and Technology, Niigata Univ., Niigata, Japan;

2 Dept. of Appl. Biol. Chem., Fac. of Agric., Niigata Univ., Niigata, Japan;

3 CSIC, UPNA, Gobierno de Navarra, Instituto de Agrobiotecnología, Spain

Nucleotide pyrophosphatase/phosphodiesterase (NPP) is a widely distributed enzymatic activity occurring in both plants and mammals. Unlike mammalian NPPs, the physiological function of plant NPPs remains largely unknown. Six different NPP genes (*NPP1-6*) were identified in rice. NPP1 exhibited hydrolytic activities toward the starch precursor molecule, ADP-glucose. To get insight into the physiological function of rice NPP1, an *npp1* knockout mutant was characterized. The ADP-glucose hydrolytic activities in *npp1* shoots were 8 % of the wild type (WT), indicating that NPP1 is a major determinant of ADP-glucose hydrolytic activity in rice shoots. When seedlings were cultured at 160 Pa CO2 under a 28oC/23oC regime, *npp1* shoots and roots were bigger than those of WT. Furthermore, the starch content in the*npp1* shoots was higher than that of WT. Growth and starch accumulation were also enhanced under atmospheric CO2 concentration (40 Pa) when plants were cultured at 33oC/28oC regime. The overall data strongly indicate that NPP1 exerts a negative effect on plant growth and starch accumulation in shoots, especially under high CO2 concentration and high temperature conditions.

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