

2nd International Conference and Exhibition on Pharmacognosy, Phytochemistry & Natural Products

August 25-27, 2014 DoubleTree by Hilton Beijing, China

Accumulated expression level of cytosolic glutamine synthetase 1 gene (OsGS1;1 or OsGS1;2) alter plant development and the carbon-nitrogen metabolic status in rice

Hongmei Cai

Huazhong Agricultural University, China

Nitrogen is an essential macronutrient required for rice growth and development, and it is a major limiting factor in determining yield productivity. Carbon is crucial for plants to perform their routine and fundamental cellular activities. In addition to their independent utilization, the coordination and optimal functioning of the metabolic pathways for nitrogen and carbon assimilation in plants are critical for determining plant growth and, ultimately, biomass accumulation. In higher plants, glutamine synthetase (GS; EC 6.3.1.2) is a key enzyme for the assimilation of ammonium. In our study, we constructed the *OsGS1*-overexpressing transformants driven by the *CaMV35S* promoter and obtained transgenic rice plants with the purpose of improving nitrogen use efficiency. Unexpectedly, the *GS1;1*-, *GS1;2*-overexpressing plants displayed unobvious growth phenotype at the seedling stage grown hydroponically under both normal and low nitrogen conditions, and decreases in both grain yield production and total amino acids in seeds grown in field with low nitrogen fertilizer. To identify the reasons for these observations, we systematically analyzed the growth phenotype, carbon-nitrogen metabolic status and gene expression profiles in *GS1;1*-, *GS1;2*-overexpressing rice and wildtype plants at different developmental stages grown under different nitrogen levels. Our results revealed that the *GS1;1*-, *GS1;2*-overexpressing plants exhibited a poor plant growth phenotype and yield and decreased carbon/nitrogen ratio in the stem caused by the accumulation of nitrogen in the stem. In addition, the leaf SPAD value and photosynthetic parameters, soluble proteins and carbohydrates varied greatly in the *GS1;1*-, *GS1;2*-overexpressing plants. Furthermore, metabolite profile and gene expression analysis demonstrated significant changes in individual sugars, organic acids and free amino acids, and gene expression patterns in *GS1;1*-, *GS1;2*-overexpressing plants, which also indicated the distinct roles that these two *GS1* genes played in rice nitrogen metabolism, particularly when sufficient nitrogen was applied in the environment. Thus, the unbalanced carbon-nitrogen metabolic status and poor ability of nitrogen transportation from stem to leaf in *GS1;1*-, *GS1;2*-overexpressing plants may explain the poor growth and yield.

Biography

Hongmei Cai obtained her PhD in 2009 from Huazhong Agricultural University. Now she is an Associate Professor and Master supervisor in the College of Resources and Environment, Huazhong Agricultural University. Her current research interests involve the studies on plant nutrient physiology, biochemistry and molecular biology. She has published more than 20 papers in reputed Chinese and international journals and serving as an editorial board member of Trends in Soil Science and Plant Nutrition.

caihongmei@mail.hzau.edu.cn