**ABSTRACT**

To explore the physiological significance of N-glycan maturation in the plant Golgi apparatus, gnt1, a mutant with loss of N-acetylglucosaminyltransferase I (GnTI) function, was isolated in Oryza sativa. gnt1 exhibited complete inhibition of N-glycan maturation and accumulated high-mannose N-glycans. Phenotypic analyses revealed that gnt1 shows defective post-seedling development and incomplete cell wall biosynthesis, leading to symptoms such as failure in tiller formation, brittle leaves, reduced cell wall thickness, and decreased cellulose content. The developmental defects of gnt1 ultimately resulted in early lethality without transition to the reproductive stage. However, callus induced from gnt1 seeds could be maintained for periods, although it exhibited a low proliferation rate, small size, and hypersensitivity to salt stress. Shoot regeneration and dark-induced leaf senescence assays indicated that the loss of GnTI function results in reduced sensitivity to cytokinin in rice. Reduced expression of A-type O. sativa response regulators that are rapidly induced by cytokinins in gnt1 confirmed that cytokinin signaling is impaired in the mutant. These results strongly support the proposed involvement of N-glycan maturation in transport as well as in the function of membrane proteins that are synthesized via the endomembrane system.