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DEEP GREEN PANICLE1 suppresses GOLDEN2-LIKE activity to reduce chlorophyll synthesis in rice glumes

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Abstract

Understanding the regulation mechanisms of photosynthesis is key to improving its efficiency and, ultimately, crop yield. In this study, we report that DEEP GREEN PANICLE1 (DGP1) is involved in photosynthesis regulation in rice (*Oryza sativa* L.). We identified the *dgp1* mutant, which has increased chlorophyll content in glumes. The mutated gene was isolated by map-based cloning. Knockout plants, generated using a gene editing approach, mimic the phenotype of *dgp1*. Overexpression of DGP1 leads to chlorotic leaves and glumes. DGP1 is a plant-specific protein with a conserved TIGR01589 domain. The expression of DGP1 was detected in green tissues and is induced by light. Moreover, genes involved in key steps of chlorophyll synthesis are upregulated in the glumes of *dgp1*. Importantly, we found that DGP1 interacts with the rice proteins GOLDEN2-LIKE1 (OsGLK1) and GOLDEN2-LIKE2 (OsGLK2), the two transcription factors involved in the regulation of photosynthesis. Transactivation assays showed that DGP1 represses the activation activity of OsGLK1 on its target genes. Our results demonstrate that DGP1 is a repressor of OsGLK activity and thus photosynthesis in rice. Manipulation of this gene and its homologs in other crops may provide new approaches for high photosynthetic efficiency breeding.

Key Words: DGP1, OsGLK, Chlorophyll, Photosynthesis, Rice (*Oryza sativa* L.)

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