

Modification of an endogenous gene mediated by homologous and nonhomologous recombinations in rice

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Rice is an important staple food for more than one half of the population of the world, and it has become the first crop plant to have its 389-Mb genome sequenced. Even though various functional genomic tools for elucidating the function of rice genes are available, developing new methods for characterizing genes of interest by reverse genetic approach has become particularly important.

Gene targeting refers to the homologous recombination-mediated alterations of a specific DNA sequence in an endogenous gene at its original locus in the genome and, often, to the conversion of the endogenous gene into a designed sequence. While various targeted modifications of endogenous genes are routine practice in mice, gene targeting in flowering plants remains in its infancy. We have developed a reproducible gene-targeting procedure with positive-negative selection and succeeded in obtaining fertile transgenic rice plants bearing various alterations of their genomic sequences including knock-out, knock-in, and single base changes. By combining with site-specific recombination systems, we can improve the modification of an endogenous rice gene more precisely, and we will discuss the implications for analyzing the function of an uncharacterized gene as well as conferring new and/or valuable genetic traits.