Title

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Abstract

Word Limit: 250-300 words

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Sample Abstract

CRISPR-Cas9 Mediated Enhancement of Drought Tolerance in Oryza sativa via OsDREB Gene Modulation

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Abstract

Climate change has significantly accelerated the frequency of abiotic stressors, with drought being the primary factor limiting global rice (*Oryza sativa*) productivity. Conventional breeding programs often struggle to keep pace with the rapid shifts in environmental conditions, necessitating the use of precision genome editing tools. This study explores the application of the CRISPR-Cas9 system to enhance drought resilience by targeting the promoter region of the *Dehydration-Responsive Element-Binding* (*OsDREB*) gene. We designed a dual-guide RNA (sgRNA) approach to introduce specific mutations in the negative regulatory elements of the *OsDREB1A* promoter, aiming to achieve constitutive overexpression without the deleterious growth effects typically associated with traditional transgenic methods. *Agrobacterium*-mediated transformation was utilized to deliver the CRISPR constructs into the callus of the indica rice variety IR64. Molecular screening through T7E1 assays and Sanger sequencing confirmed high editing efficiency in the T_0 generation. Physiological assessments of the T_1 mutants under simulated water-deficit conditions revealed a significant increase in proline accumulation and a 30% reduction in electrolyte leakage compared to wild-type plants. Furthermore, edited lines maintained higher relative water content (RWC) and displayed improved root architecture. These findings demonstrate that targeted promoter editing of stress-responsive genes provides a robust strategy for developing "climate-ready" crops. This research contributes to food security by offering a sustainable biotechnological solution to mitigate the impact of water scarcity on essential cereal crops.

Keywords: CRISPR-Cas9, Drought Tolerance, *Oryza sativa*, Gene Editing, *OsDREB*, Climate Resilience