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A Review on the Effects of Genetic Modification of Rice on Its Tolerance Against Biotic and Abiotic Stress

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Structured Abstract

Background: Genetic engineering has the potential to improve rice crops, providing essential food for over half of the world's population. By introducing foreign DNA into rice genomes, new traits can be developed, enhancing resistance to biotic and abiotic stressors. Understanding the effects of genetic engineering on rice crops is crucial for addressing environmental and socioeconomic challenges.

Methods: The impact of DNA engineering technology on rice crops' physiological and phenological traits, focusing on the role of foreign DNA in promoting tolerance against pests, herbicides and abiotic stressors such as adverse climate is analysed. We also explore the relationship between modified rice traits and issues surrounding the global food supply and environment, as well as identify its implications towards human eating habits and biodiversity to verify the technology's potential for ensuring the stability of vulnerable ecosystems.

Results: Genetic engineering technology in agriculture, particularly in *Oryza sativa*, can improve tolerance against pathogens, herbicide contamination, and abiotic stresses like climate change and soil erosion. Modified rice genomes promote sustainable practices while reducing environmental repercussions. However, altered rice genomes may lead to resistant pest or weed populations, potentially impacting human health. Furthermore, DNA editing techniques such as CRISPR-Cas9 used in creating transgenic rice crop can alleviate nutritional deficiency and improve the health of populations relying on rice as a primary source of nutrition, plus conserve beneficial species in the environment through reduced use of pesticides. Gene editing can improve the fitness of vulnerable rice populations by addressing certain gene restrictions but may also lead to ecological consequences for wild relatives, such as genomic contamination and the loss of traditional rice varieties.

Conclusion: Genetic engineering in rice (*Oryza sativa*) has been extensively researched for its ability to combat pests, extreme temperatures, and global nutritional diets. However, consumer acceptance and technology availability remain crucial factors to consider. Future research should explore genomic alteration methods that benefit different nations globally, assess potential risks, and develop precise techniques to control irregularities. This research is crucial for developing crop varieties with improved characteristics and tolerance, promoting informed decision-making and consumer confidence in genetically modified food.

Keywords: Genetic engineering, gene editing, rice, biotic, abiotic stress

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