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REVIEWER'S REPORT

Manuscript No.: IJAR-50642 Date: 15-03-2025

Title: Molecular Breeding vs. Genetic Engineering: A Comparative Study in Crop Improvement

Recommendation:
Accept as it is……**YES……**
Accept after minor revision……
Accept after major revision ……
Do not accept (*Reasons below*) ……

Rating	Excel.	Good	Fair	Poor
Originality	√			
Techn. Quality		√		
Clarity		√		
Significance			√	

Reviewer's Name: Tahir Ahmad

Reviewer's Decision about Paper: **Recommended for Publication.**

Comments (*Use additional pages, if required*)
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Reviewer's Comment / Report

Abstract Review:
The abstract effectively outlines the key focus of the paper, providing a clear distinction between molecular breeding and genetic engineering. It presents a well-structured summary of the methodologies, advantages, challenges, and applications of both approaches. The inclusion of case studies, regulatory frameworks, and public perceptions enhances the scope of the study. The critical evaluation of their role in climate resilience and nutritional enrichment adds depth to the research. The keywords are relevant and cover essential aspects of the topic, making the abstract comprehensive and informative.

Introduction Review:
The introduction presents a strong contextual background, emphasizing the challenges faced by modern agriculture. It effectively introduces molecular breeding and genetic engineering as solutions to these challenges. The comparison between the two techniques is clearly defined, setting the stage for the subsequent sections. The explanation of marker-assisted selection (MAS) and CRISPR genome editing provides a concise yet informative overview of the core methodologies. The introduction successfully highlights the significance of both approaches while maintaining a balanced perspective.

Methodology Review:
The methodology section is well-structured and appropriately describes the research approach. The use of

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a literature review with peer-reviewed articles, case studies, and reports ensures credibility. The comparative analysis of efficiency, economic feasibility, and environmental impact is well-defined. The inclusion of major crop case studies and regulatory aspects further strengthens the methodology. This section provides a clear understanding of how data was collected and analyzed, making it a robust component of the study.

Molecular Breeding: Techniques and Applications Review:
The section on molecular breeding is well-detailed, providing a structured overview of key techniques. The explanation of marker-assisted selection (MAS) highlights its efficiency in accelerating the breeding process. The discussion on genomic selection (GS) demonstrates its importance in improving polygenic traits. The applications of molecular breeding are well-supported with examples, such as high-yield wheat and drought-tolerant maize. The integration of big data and artificial intelligence in genomic selection is a relevant addition, showcasing advancements in breeding technologies.

Genetic Engineering: Techniques and Applications Review:
The section on genetic engineering presents a clear breakdown of techniques, including recombinant DNA technology and CRISPR-Cas9 genome editing. The discussion on genetically modified (GM) crops, such as Bt cotton and herbicide-tolerant soybean, provides a historical perspective. The use of CRISPR in developing disease-resistant and nutrient-fortified crops is well-explained. The applications of genetic engineering are well-supported with examples, such as Golden Rice and drought-resistant maize. The mention of regulatory challenges and ethical concerns adds a critical dimension to the discussion.

Overall Review:
The paper is well-organized, offering a comprehensive comparison between molecular breeding and genetic engineering. The discussions are supported by relevant examples and case studies, strengthening the analysis. The methodology is clearly defined, ensuring a structured approach to the study. The examination of regulatory and ethical considerations adds depth to the research. The paper effectively highlights the complementary nature of both approaches in crop improvement, making it a valuable contribution to the field of agricultural biotechnology.