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Policy Brief 1

ACCELERATING UTILIZATION OF GENE EDITING TECHNOLOGY FOR FOOD SECURITY IN AFRICA

DEVELOPED BY: THE GENE EDITING TECHNOLOGY INITIATIVE WORKING GROUP



Accelerating Utilization of Gene Editing Technology for Food Security in Africa

TARGET AUDIENCE: RESEARCHERS

This policy brief demonstrates that the scientific community can conduct novel research with gene editing techniques to gather evidence and knowledge that addresses public and the regulatory concerns. Despite general negative perception on gene editing technology, developments on the technology have proved highly beneficial to the public. Gene editing technology has shown great promise in transforming agriculture and industrial biotechnology, so as to reduce Africa's burden of food and nutrition security.

INTRODUCTION

Science-led agricultural growth has played a key role in Africa. While these gains are outstanding, Africa is still home of the world's undernourished, and faces enormous challenges like the emerging and re-emerging biotic and abiotic stresses due to agricultural intensification and climate change. To meet these challenges, the continent has no option but to use all the available and emerging tools and technologies to improve food production. *Gene Editing technology is a promising, relevant, safe and efficient technology for low-input high-output agriculture.* It is an important tool to improve agricultural crops for their nutritional value, nutrient and water use efficiency, productivity, and tolerance/resistance to biotic and abiotic stresses.

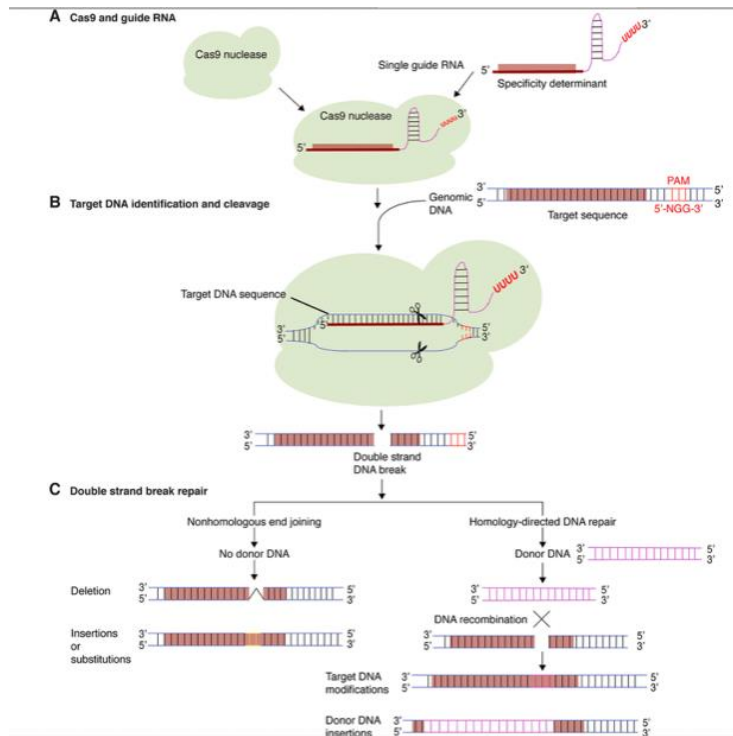
SCIENTIFIC APPROACH AND OPPORTUNITIES

What do we mean by 'gene editing'?

Gene editing is the deliberate alteration of a selected DNA sequence in a living cell. It utilizes double strand DNA breaks and naturally existing cellular repair mechanisms, will then fix the broken DNA strands. The way they are repaired can affect ne function and new DNA sequences can be delivered when the DNA is cut and act as templates for generating an altered or unaltered sequence. More information can be retrieved from the following link: <https://medlineplus.gov/genetics/understanding/genomicresearch/genomeediting/>

As of 2015 four families of engineered nucleases were used: meganucleases, zinc finger nucleases (ZFNs), transcription activator-like effector-based nucleases (TALEN), and the Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR/Cas9) system. Among the gene editing technologies, CRISPR-based methods are particularly promising owing to their relative efficiency, low cost; and ease of use, and the prospect of making edits at multiple sites in the genome in a single procedure. Gene edited crops pose marginal risk in terms of human health and environment. Discussion concerning the risks are driven more by socio-political factors than scientific principles. The improvement off-target specificity in the CRISPR/Cas9 system will provide solid genotype–phenotype correlations, and thus enable faithful interpretation of genome-editing data.





What opportunities can Gene Editing present in agriculture and Industry?

Areas of research and possible applications of gene editing technology include:

- Agricultural biotechnology, crops and livestock (e.g., increasing yield, introducing resistance to disease and pests, tolerance of different environmental conditions).
- Industrial biotechnology (e.g. developing 'third generation' biofuels and producing chemicals, materials and pharmaceuticals).
- Biomedicine, medical biotechnology (e.g., pharmaceutical development, xenotransplantation, gene and cell-based therapies, control of insect-borne diseases)

IMPORTANCE OF REGULATING GENE EDITING TECHNOLOGY

The enactment and application of regulations is part of policymaking, where the aim is to establish frameworks for safe and adequate development within the innovation system. Regulations have a direct impact on technology diffusion because they affect the generation of new technologies, as well as decisions on their adoption by potential users. Regulatory approval is an essential requirement for commercialization of gene edited crops, to ensure the biosafety of the GE crops, their products, and the associated technologies. The European Court of Justice recently ruled that the use of CRISPR on crops or in the drug development process need not be regulated as strictly as genetically modified organisms (GMOs).

RECOMMENDATIONS

The science and application of gene editing technology transcends national boundaries. Issues that need to be addressed include the health and well-being of individuals, respecting individual rights, careful attention to constantly emerging and evolving information on the process, guarding against unwanted societal effects, and equitable distribution of information, risks, and benefits.

Cooperating countries within Africa should consider adhering to the following recommendations:

- Place the responsibility of enforcing different policies, coordinating regulatory standards and procedures to a specific regulatory authority working closely with researchers.
- Facilitation of inter-country collaboration and data-sharing opportunities on gene editing technology between the scientific community and the regulatory authorities.
- Regard all gene-editing projects as research to be conducted under strict supervision.
- Adoption of various legislation by researchers to incorporate social and economic guidance on gene-editing and gene drive research.
- Strengthen capacity for research ethics to support disciplines that underpin gene editing technologies. The gene editing projects should only proceed if conducted under strict research conditions, with a priori submission to an in-country research ethics committee.

Signed on behalf of NASAC Members:



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