Project brief

MLN Gene Editing Project

New technology to fight Maize Lethal Necrosis (2019-2021)

CIMMYT tolerant hybrid (right) next to susceptible commercial check in KEPHIS's National Performance Trial at Naivasha MLN screening facility. Photo: CIMMYT files.

Kenya has suffered devastating losses from MLN; 22% crop losses nationwide with some farmers losing up to 100% of their crops. Africa's maize production remains at high risk from this deadly disease. Photo: Hugo De Groote/CIMMYT.

What this project will do

This project will use gene editing to develop maize lines tolerant to Maize Lethal Necrosis (MLN), a disease that reduces maize harvests in Kenya by nearly a quarter on average.

Four MLN-susceptible lines will be edited to make them tolerant to MLN. The four susceptible lines are the parents of two popular, stress-tolerant but MLN-susceptible hybrids developed and commercialized before 2011 in Kenya and Uganda. The edited, MLN-tolerant lines will be used to make MLN-tolerant versions of the hybrids, which will carry all the farmer-preferred agronomic traits and stress tolerance of the popular hybrids, with the added advantage of MLN tolerance.

The MLN-tolerant hybrids will be available for planting on approximately 40,000 hectares, benefiting about 20,000 farmers by 2025 in Kenya.

Close collaboration with partners from the public and private sectors will prepare for deployment of the hybrids to maximize equitable access by smallholder farmers.

Threat to Africa's food and livelihood

Maize Lethal Necrosis (MLN) disease is one of the worst threats to East and Central Africa's food security in decades. MLN appeared in Kenya in 2011, and by 2013 it reduced maize yields across Kenya by an average of 22%, resulting in lost production worth US$180 million and forcing many farmers to abandon planting maize.

Research and development partners responded quickly by producing several MLN-tolerant hybrids that are now in the process for release or already commercialized in Kenya, Tanzania and Uganda. Despite this progress, relatively few MLN-tolerant varieties are available to smallholder farmers. Importantly, almost all of the African elite maize lines developed before the MLN outbreak, which are used to create improved, high yielding and stress tolerant maize varieties, remain susceptible to MLN.

Innovative breeding

MLN-tolerant hybrids have been developed by a resource-intensive process that takes approximately 4-5 years. Gene editing technology can accelerate breeding, reducing the time required to 2-3 years. Gene editing as proposed for this project replicates natural mutations in maize that strengthen tolerance to MLN. Scientists apply gene editing to change the susceptible version of a gene or genetic element(s) in a maize line to a tolerant version. This process eliminates the transfer of many undesirable genes that typically accompany the desired ones in traditional cross breeding and often compromise yield or other important traits.

Benefits to smallholder farmers

- Access to MLN-tolerant maize hybrids to protect and boost yield of their primary food crop.
- Superior, already popular hybrids with preferred agronomic traits and stress tolerance, now improved with MLN tolerance.
- Improved food and livelihood security through effective fight against MLN.

Benefits to seed companies

- Overcome current seed production challenges due to MLN susceptibility of parental lines.
- Seed companies will access the MLN-tolerant varieties royalty free, without need to increase seed costs to farmers.
- The four MLN-tolerant maize lines will be instrumental in expanding the number of stress- and MLN-tolerant African inbred lines and hybrids.

Benefits to consumers

- High yielding, MLN-tolerant hybrids in the MLN-prone regions of East and Central Africa will contribute to the sustainable supply of affordable maize products.
- Consumers will enjoy the traits they had grown to love in products made from these hybrids.

the project will cost approximately **$1.2 million** per year

IN 2013 ALONE, KENYA LOST **$180 million** in maize production due to MLN

TARGETED PRODUCTION OF MLN EDITED COMMERCIAL SEED: **40,000** HECTARES BY 2025

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Funder and partners

BILL & MELINDA GATES foundation
CIMMYT International Maize and Wheat Improvement Center
KALRO Kenya Agricultural & Livestock Research Organization
CORTEVA agriscience
STAK Sowing for the Future