

Open-source tools accelerate plant breeding in developing countries

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Researchers at CIMMYT are using Flapjack software to develop maize lines that are resistant to maize lethal necrosis. Credit: Yoseph Beyenne

Crop breeders in developing countries can now access free tools to accelerate the breeding of improved crops varieties, thanks to a

collaboration between the GOBII project at Cornell University and the Boyce Thompson Institute (BTI), and the James Hutton Institute in Scotland.

The collaboration works with breeding centers around the world to identify unmet needs and has developed tools to make the process of adding a trait into an existing, high-yield crop variety more efficient. Researchers at the International Maize and Wheat Improvement Center (CIMMYT) are using the tools to develop corn varieties with greater resistance to viruses.

Researchers at GOBII, the Genomic and Open-source Breeding Informatics Initiative, worked with developers from the Hutton Institute to build upon the existing data visualization application, Flapjack. Its new tools enable breeders to select the best possible parental lines and help users to perform marker-assisted backcrossing (MABC)—a process that involves repeated breeding with the high-yield parent to ensure that only the desired genes are transferred. Researchers estimate that they can cut a year or two from the four or five years required to develop a new variety.

"We have been delighted with this early success of our joint work with the GOBII team at Cornell and anticipate it will form the foundation of a mutually valuable partnership," said David Marshall of the Hutton Institute.



Corn produced by maize lines that are resistant to maize lethal necrosis (upper left and lower right) and traditional varieties (upper right and lower left) that are susceptible to the disease. Credit: Yoseph Beyenne

Previously, these types of molecular breeding tools only existed within biotech companies. But GOBII, a Cornell-led project funded by the Bill & Melinda Gates Foundation, is tailoring these free tools for breeders in developing countries. They are building data management software in collaboration with the international crops research centers ICRISAT in India, CIMMYT in Mexico and IRRI in the Philippines.

"Having the right data management systems and analysis tools can have a huge impact on crop improvement. Breeders can manage their programs more efficiently, make better selection decisions, and potentially reduce labor and land costs," said Elizabeth Jones, project manager of GOBII.

Michael Olsen, a molecular geneticist at CIMMYT, is test-driving the tools in his work to develop lines of corn that are resistant to maize lethal necrosis, a disease that has devastated corn crops in Kenya. Olsen's research involves 43 separate breeding crosses, bred over five generations. The new tools help him to visualize the relevant genes and identify donor strains that are most likely to successfully interbreed.

"The recently released MABC tool developed by JHI with input from the GOBII project was a tremendous time saver this past cycle," said Olsen. "The [tool](#) is very well designed for an applied breeding program conducting MABC projects."

Next, GOBII will conduct training sessions for the tools at [breeding](#) centers in India, Africa, Mexico, the Philippines and at Cornell. The tools can be used to improve any trait in any crop plant.

Provided by Boyce Thompson Institute

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