

# Real-time plant virus mapping

The \$1 ELLA test heralds a  
new era of agricultural  
surveillance

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**"ELLA brings elements of lab-based devices into a package that can be deployed to and operated in resource-limited settings by non-specialised personnel."**

Prof. Firat Güder, professor of intelligence interfaces at Imperial College London, UK



## The Challenge

- About 800 million people worldwide rely on cassava as a staple crop, but the cassava brown streak virus is destroying entire harvests and its range is spreading.
- Accurate diagnosis requires sensitive laboratory equipment that the majority of subsistence farmers cannot access, and cheaper lateral flow tests lack the reliability to detect the virus.
- The ELLA platform is being adapted to detect other agricultural pathogens, bacterial infections in humans, and to quantify food fortification in low-resource contexts.

## Context

Cassava is a staple crop relied upon by around 800 million people worldwide, many of them in Africa. However, the cassava brown streak virus, spread by whiteflies and infected cuttings, threatens more than a third of Africa's cropland and its range is spreading.

The virus attacks the edible root while the rest of the plant appears healthy, meaning the disease is often only discovered at harvest when farmers uncover rotten tubers. This healthy appearance also hinders plant breeders and farmers from stopping the virus spreading to other plants.

In 2018, an international multidisciplinary team led by Imperial College London received \$100,000 from the Gates Foundation to develop a portable diagnostic tool, followed by a \$1 million grant in 2020 to further develop the technology.

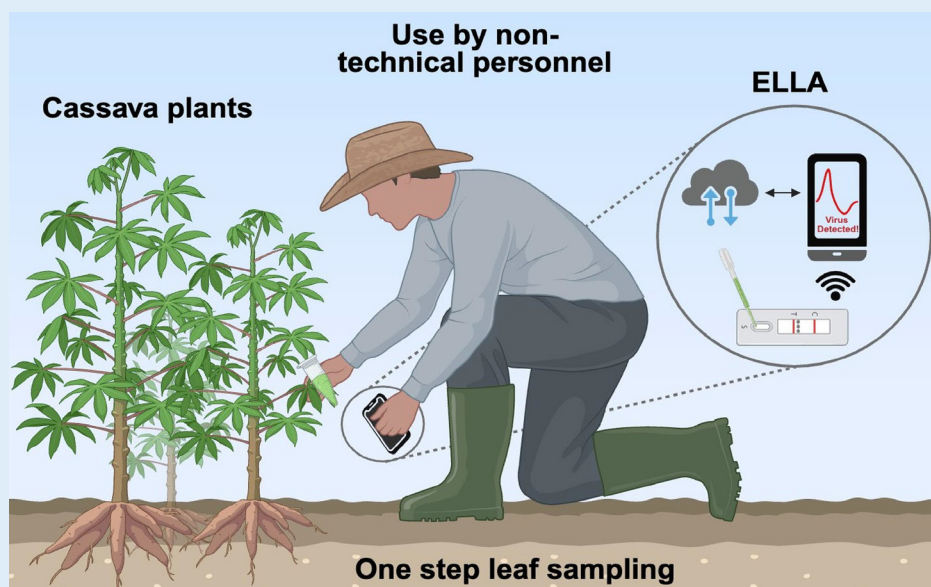
The ELLA (Electrochemical Lateral Flow Assay with Linked Analytics) platform is a battery-free, field-deployable \$1 sensor that generates accurate, geotagged data in real-time, enabling evidence-based agricultural surveillance. ELLA's applications have since expanded to detect other agricultural pathogens, quantify minerals in fortified food, and identify bacterial infections in humans. A spin-out company, superposition.bio, has since been established to commercialise the technology.

**“ELLA is based on lateral flow technology – people know how to use these tests and it’s compatible with existing technology. We can rapidly move from experiments in the lab to larger scale manufacturing.”**

Prof. Firat Güder, professor of intelligence interfaces at Imperial College London, UK

**“ELLA allows farmers to transmit test results to central laboratories or other farmers to map the extent of the virus.”**

Dr. Laura Gonzalez-Macia, Lecturer in Biotechnology at the Department of Life Sciences at University of Bath, UK



## The Method

- Researchers at Imperial College London, with collaborators from the International Institute for Tropical Agriculture in Dar es Salaam, Tanzania, developed the novel ELLA platform. ELLA integrates lateral flow technology, electrochemical detection mechanisms, and wireless communication.
- The user mixes a crushed sample of cassava leaf with an extraction fluid, which is inserted into the ELLA assay. The test is placed on a 3D-printed holder which fits on a smart phone. The phone powers the chip in the assay, and the geotagged results are communicated to the device and to the cloud – similar to tapping a smartphone to pay at a shop.
- ELLA is as sensitive as laboratory tests, and allows users to detect low levels of virus in their crops.

## Benefits

- **Accurate diagnosis:** The technology has advantages over traditional lateral flow assays, as it is more sensitive and able to detect low levels of the virus.
- **Immediate pathogen surveillance:** The data is available in real-time, even in remote settings, allowing for community or nationwide surveillance. Enabling farmers and government to act immediately when the virus is detected.
- **Different diseases and applications:** The team has adapted ELLA to identify other disease-causing agents or chemicals in a variety of contexts. It is already being used to quantify fortification in foods in developing countries, detect other pathogens in plants, and identify bacterial infections in humans.
- **Scalability:** Lateral flow assays are widely produced, and the ELLA team is in talks with manufacturers to mass produce the new electrochemical assay.
- **Affordable, high-quality results:** The ELLA assay costs less than \$1, significantly increasing the accessibility of high-quality pathogen testing and allowing for real-time disease surveillance in places where it is needed.
- **Context-relevant:** ELLA has been produced by a multi-disciplinary team, including on-the-ground partners, such as researchers from the International Institute of Tropical Agriculture. By co-producing knowledge with African researchers, the project ensures that the technology is relevant and can address real-world problems.

## "We are trying to produce a tool that is accessible for everyone."

Dr. Laura Gonzalez-Macia, Lecturer in Biotechnology at the Department of Life Sciences at University of Bath, UK

## Funders

This project was supported by the Bill & Melinda Gates Foundation, which enabled collaborative research across sub-Saharan Africa and South Asia to develop, manufacture, and deploy virus-detecting sensors. The work was carried out in partnership with the International Institute of Tropical Agriculture (IITA) - Tanzania, Inqaba Biotec, and Silicon Craft.

## For more information

**Güder research group:**

<https://grg.ac/>

**Superposition.bio:**

<https://superposition.bio/>

# Impact

- **For farmers:** The technology offers immediate diagnosis of the cassava brown streak virus, which is visually undetectable. This information can speed up interventions and halt the disease's spread. Improved yields drive economic development and safeguard food security.
- **For seed producers:** Plant breeders need to be able to test their stock and ensure they are not selling diseased plants. Low-cost, accessible diagnostics allow them to sell healthy plants and sustain downstream livelihoods.
- **For agricultural organisations and governments:** Real-time data collection empowers local and national agricultural bodies to track disease outbreaks, and identify sources of pathogens. The geo-tagged, accurate data means that outbreaks can be detected at an early stage, enabling an effective response and ensuring that resources are not wasted.

## Notes

1. Flauzino, J.M.R. et al. 'Electrochemical lateral flow assay with ELISA-level performance for detecting plant diseases in East Africa', PNAS, June 2026. <https://www.pnas.org/doi/epdf/10.1073/pnas.2602947123>
2. Sikazwe, G. et al. 'Predicting the current and future suitable habitats of cassava and cassava brown streak disease in Africa', East African Journal of Science, Technology and Innovation, Jan 2026. <https://eajsti.org/index.php/EAJSTI/article/view/1960>
3. Coherent Market Insights, 'Digital Agriculture Market Analysis & Forecast: 2026-2033', 2026. <https://www.coherentmarketinsights.com/industry-reports/digital-agriculture-market>
4. Superposition.bio

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