



RESEARCH  
PROGRAM ON  
Roots, Tubers  
and Bananas

# Revolutionary mobile app for monitoring crop pests and diseases

Just as the late blight epidemic wiped out potato fields in Ireland in the 19<sup>th</sup> century, crop pests and diseases still have devastating effects on smallholder farmers today - with scenarios projected to worsen under climate change. Cassava brown streak disease is spreading westward across the African continent, and together with cassava mosaic disease, threatens the food and income security of over 30 million farmers in East and Central Africa. Likewise, banana is threatened by fungal and bacterial diseases and banana bunchy top virus, while sweetpotato is faced with viruses and Aternaria fungi. Farmers are often unable to properly identify these diseases, while researchers, plant health authorities and extension organizations lack the data to support them.

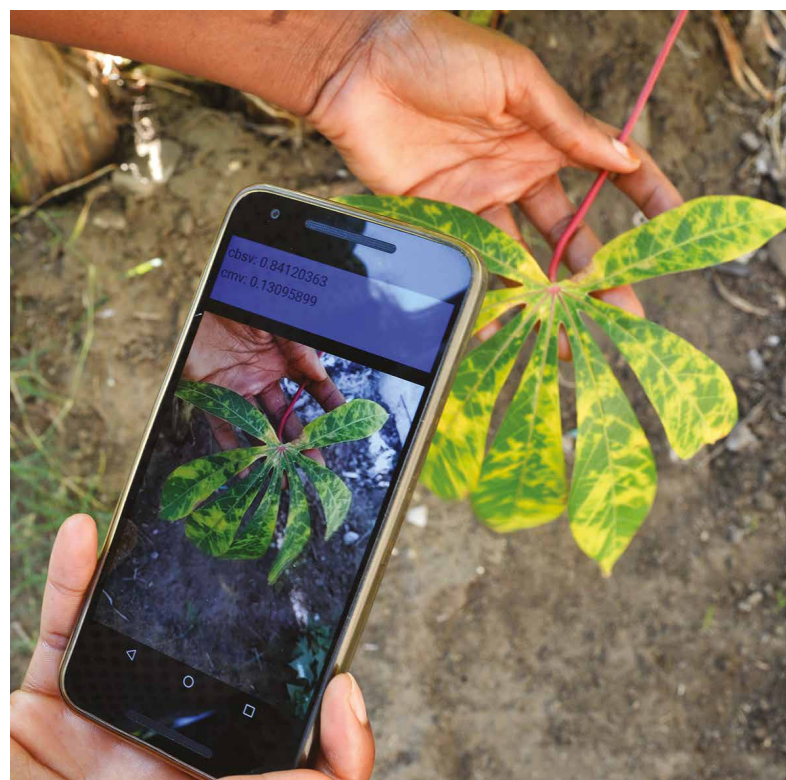
## An innovative solution

A team under the CGIAR Research Program on Roots, Tubers and Bananas (RTB), led by David Hughes of Penn State and James Legg of IITA, together with scientists from CIAT, CIP and Bioversity International, are working on a revolutionary app to accurately diagnose diseases in the field, which will be combined with SMS services to send alerts to rural farmers.

The concept leverages three critical advances in how knowledge is communicated to the farm level: 1) the democratization of Artificial Intelligence (AI) via open access platforms like Google's TensorFlow, 2) the miniaturization of technology allowing affordable deployment and 3) the development of massive communication and money exchange platforms like M-Pesa that allow rural extension to scale as a viable economic model enabling last mile delivery in local languages.

Painstaking field work using cameras, spectrophotometers and drones at RTB cassava field sites in coastal Tanzania and on farms in western Kenya has already generated >200,000 images of diseased crops to train AI algorithms. Using many of these images, Hughes, Legg and collaborators were able to develop an AI algorithm with TensorFlow that can automatically classify five cassava diseases, and by collaborating with Google, the team have been able to develop a TensorFlow smartphone app that is currently being field-tested in Tanzania.

Penn State has also developed a mobile spectrophotometer through a start-up called CROPTIX. Early results suggest it can accurately diagnose different viral diseases in the field, even if the plant looks healthy.



Diagnosing cassava disease in the field. Photo IITA



### Leveraging RTB's global R&D network

The project will leverage the RTB network to extend testing with national partners in Uganda (cassava/banana: IITA/Bioversity International), Kenya (potato: CIP), Nigeria (cassava/plantain: IITA) and Colombia and Vietnam (cassava: CIAT).

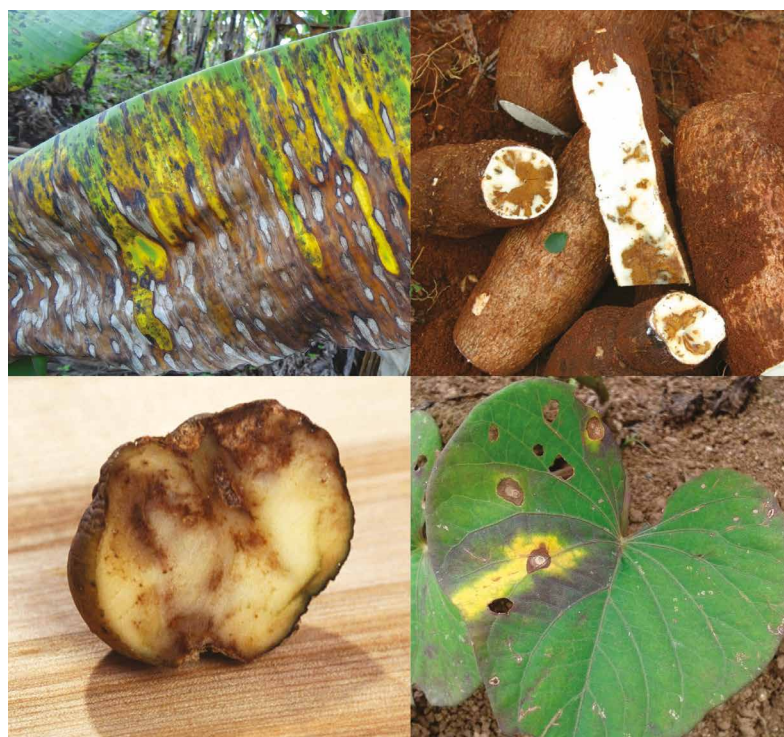
### Reaching 475 million smallholder farms

The project team has already developed linkages with the Vodafone agriculture SMS platform called DigiFarm, which positions them strategically to link digital diagnostics to large-scale rural text messaging services. The team will deliver farmer tailored SMS alerts on crop diseases and pests to 350,000 Kenyan farmers by July 2018. Once the diagnostic and SMS systems are up and running, their impact will be determined by assessing how rapid disease diagnosis increases yield in cassava value chains in Kenya involving 28,000 farmers. An existing platform housed by Penn State ([www.PlantVillage.org](http://www.PlantVillage.org)) will enable real time discussions of disease and pest diagnoses across the CGIAR community and with other experts to enhance SMS alerts from the DigiFarm platform. It's envisaged that these innovations, initially piloted in East Africa, will provide a model that can be extended to the range of locations where RTB works, and in so doing impact the farming and livelihoods of hundreds of millions of farmers.

#### CONTACTS:

**James Legg**, IITA, [j.legg@cgiar.org](mailto:j.legg@cgiar.org)

**David Hughes**, Penn State, [dph14@psu.edu](mailto:dph14@psu.edu)



Clockwise from top left: sigatoka disease in banana, cassava brown streak disease, sweetpotato Alternaria fungi, and potato late blight. Photos: IITA, Penn State

**IITA**  
Transforming African Agriculture  
1967-2017

**50**  
YEARS  
1967-2017

**CIAT**  
1967-2017

**Bioversity**  
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