Food and Agriculture Organization of the United Nations

©FAO/A. Ndiaye

DECEMBER 2019

ADVANCED AGRICULTURAL TECHNOLOGY FOR SMALLHOLDER FARMERS IN AFRICA: PLANTVILLAGE

The stresses of increased transboundary pests and diseases, decreasing soil quality and the uncertainties of climate change mean that establishing detailed agriculture knowledge delivery systems is a critical requirement. Unfortunately, current systems for smallholder farmers, which rely on extension services, are unable to address this requirement.

Smallholder farmers typically lack the in-field, in-season knowledge required to make optimal decisions. Such detailed knowledge is called precision agriculture. In particular, precision agriculture consists of the use of ground and aerial sensors to enable in-field, in-season decision-making to maximize yield, which until recently has been associated mainly with farms in high-income countries.

To fill this gap, FAO has partnered with Penn State University and PlantVillage, a public good system that offers in-season, in-field knowledge delivery.

A suite of technologies – ranging from artificial intelligence for Fall Armyworm (FAW) diagnosis, the FAO Water Productivity through Open access of Remotely sensed derived data (WaPOR) system for measuring crop growth under water stress, real-time farm-based FAW management advice, soil maps, disease risk maps and social networks to connect to peers, extension systems and markets – have been bundled into the Fall Armyworm Monitoring and Early Warning System (FAMEWS) mobile app. Information is delivered to farmers offline in the field via standard smartphones.

Farmers, especially in remote areas, benefit by being connected and having access to the necessary information for making informed decisions, based on intuitive alert messages and advice provided by a mobile app.

This advanced precision agriculture system has been tested in western Kenya, with promising results.

THE PLANTVILLAGE PLATFORM

The system is linked to PlantVillage, an online platform on which farmers post images of their crops for experts to diagnose. PlantVillage hosts the largest open access library of crop health knowledge in the world. The data set contains more than 50 000 images of dozens of plant diseases. It has a user-moderated questions-and-answers forum, an open and freely available resource that helps farmers solve their plant-related questions.

KEY FACTS

FAO/PLANTVILLAGE

PLANTVILLAGE IS A PUBLIC GOOD TOOL THAT OFFERS IN-SEASON, IN-FIELD KNOWLEDGE DELIVERY

A KEY FEATURE OF PLANTVILLAGE IS THE USE OF ARTIFICIAL INTELLIGENCE WORKING INSIDE SMARTPHONES TO DIAGNOSE CROP DISEASES

PLANTVILLAGE, ARTIFICIAL INTELLIGENCE AND OTHER TECHNOLOGIES HAVE BEEN BUNDLED INTO A FREE APP FOR FARMERS AND EXTENSION WORKERS

THE APPLICATION HELPS FARMERS DIAGNOSE MULTIPLE DISEASES IN CASSAVA, FAW INFECTIONS IN MAIZE, POTATO DISEASES AND WHEAT DISEASES WITHOUT THE NEED FOR AN INTERNET CONNECTION

THE NURU MOBILE APPLICATION IS EXTREMELY INTUITIVE, EASY AND FAST TO USE. GROWERS SIMPLY HOLD THE PHONE NEXT TO AN INFESTED PLANT AND NURU CAN CONFIRM IMMEDIATELY IF FAW HAS CAUSED THE DAMAGE

THE DIGITAL ASSISTANT IS CURRENTLY AVAILABLE IN 13 LANGUAGES AND CAN INCLUDE FURTHER LANGUAGES UPON DEMAND

FAO-PLANT PROTECTION

E-MAIL
Food-Chain-Crisis@fao.org

WEB-SITE
www.fao.org/food-chain-crisis

Food and Agriculture Organization of the United Nations

©FAO/L. Edirisinghe

NURU, AN ARTIFICIALLY INTELLIGENT ASSISTANT

Penn State University has developed an artificially intelligent assistant called Nuru (which means "light" in Swahili) to diagnose crop diseases.

The app uses Google's TensorFlow machine-learning tool and a database of images collected by crop disease experts across the world. The app is based on extensive research comparing the accuracy of machine learning models to human experts and extension work. The app also allows for a blended model, in which images are examined by artificial and human intelligence through a cloud system.

Nuru helps farmers diagnose multiple diseases in cassava, FAW infections in maize, and potato and wheat diseases without an Internet connection.

The symptoms of these diseases are often difficult for farmers to discern, which means they regularly go untreated. However, through machine learning trained with confirmed symptoms of infection, artificial intelligence is able to draw upon its archive of all possible signs to recognize the diseases and help farmers take earlier action to save their crops.

More specifically, farmers can wave their phone in front of a plant leaf, and if the plant has a disease, the app can identify it and provide options on the best ways to manage it. After several months of use, farmers learn how to diagnose the diseases themselves. In this way, artificial intelligence becomes a teaching tool rather than creating dependency on a new technology.

This type of innovation has already shown promising results in tackling crop pests such as FAW, an invasive caterpillar native to the Americas that spread to Africa in 2016 and has now reached Asia, causing huge losses to maize crops.

Nuru is integrated into the FAO FAMEWS mobile app. Regular use of this tool will contribute to knowledge on how and where the pest spreads, and what influences its capacity to cause damage.

FAMEWS and Nuru are integral parts of the FAO programme for sustainable management of FAW. These tools feed information to farmers and extension workers so that they can take action against the pest; they also guide decision-makers' responses and help build understanding of the pest and the threat it poses to food security.

FURTHER DIGITAL SOLUTIONS

Digital tools are becoming increasingly integral components of FAO systems for identifying, monitoring, training, decision-making and providing early warnings of globally important crop pests and diseases.

FAO has developed specialized digital innovative technologies and geographic information systems for effective monitoring of and early warning on key transboundary plant pests and diseases. These include eLocust3, a handheld data logger that transmits locust data from the field in real time, the custom Reconnaissance and Management System of the Environment of Schistocerca (RAMSES) national GIS and the global *Schistocerca* Warning Management System Geographic Information System (SWARMS GIS) for Desert Locust, and the SusaHamra (Red Palm Weevil) platform, similar to FAMEWS.

FAO is also actively developing drones to supplement survey and control operations in countries affected by locusts.

CA7353EN/1/12.19