Portable DNA sequencers help African farmers fight crop disease

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Scientists at The University of Western Australia are using new portable DNA sequencing technology for the first time in East Africa to help farmers fight the devastating impact of crop disease.

Farmers struggling with diseased cassava crops can take immediate action to save their livelihoods based on information about the health of their plants, using the portable, real-time DNA analysis device.

The DNA handheld sequencer, called the MinION, was developed by British company Oxford Nanopore. It is being used to identify which strain of virus is destroying the cassava crops of farmers in Tanzania and Uganda as part of a collaboration of scientists and farmers, known as the

Cassava Virus Action Project (CVAP).

Dr Laura Boykin, a senior research fellow at UWA, is one of the principal investigators of the project, with Joseph Ndunguru, Director of the Mikocheni Agricultural Research Institute in Tanzania and Titus Alicai, Research Programme Leader with the National Agricultural Research Organisation in Uganda.

Dr Boykin said because MinION was able to deliver the information in real time, compared to the usual three months, farmers were able to take action much faster.

With 800 million people worldwide dependent on the threatened cassava crop, the team now plans to expand the project, which aims to reduce the risk of community crop failure and help preserve livelihoods.

Cassava, a carbohydrate crop from which tapioca originates, plays a critical role in agriculture in developing countries. It is currently being devastated by several viruses causing two diseases; 'Cassava mosaic disease' (CMD), which led to major famines in the 1920s and 1990s, and 'Cassava brown streak disease' (CBSD), an epidemic of which is rapidly expanding in eastern Africa.

Both diseases, carried by the whitefly, prevent normal growth of cassava plants. This leads to significantly reduced harvests or even complete losses by farmers. The viruses make the plant inedible and unsellable and the crop must be destroyed to stop its spread.

"We have shown that pocket DNA sequencers can benefit rural farming communities who would not normally have access to such technologies as they are usually more expensive and slower," Mr Ndunguru said.

"Even within this pilot project, through rapid and accurate identification

of viruses, farmers can now understand which crops to plant, which are resistant to a particular virus species/strain. This is key to attaining durable disease resistance and improved crop productivity. This technology also is easy to use, making it possible without major infrastructure and staffing.

Dr Boykin said the team planned to expand the project within Tanzania and Uganda, and collaborate with other countries that hadn't yet been affected by Cassava whitefly viruses, such as Thailand and Brazil.

"If better strategies are not found to deal with this crop disease then millions of people could be affected – we need to think about economies as well as individual families," she said.

The MinION, which weighs only 100g and can be used in any location where it can be plugged into a laptop or PC, was used to sequence both cassava plants and whiteflies thereby identifying the precise strain of the virus that was present as well as the variety of cassava the farmer was growing.

The cassava disease diagnostics project was co-funded by the Bill & Melinda Gates Foundation and by the UK's Department for International Development.

Provided by University of Western Australia