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Press Release

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Food security boost as data gets to root of crop yields problem

The resilience and yields of food crops worldwide could be improved by a new technique that monitors the growth of plant roots, scientists say.

Researchers from Edinburgh and Ethiopia have developed a low-cost imaging system to help farmers see and measure root growth, which enables them to quickly and easily identify which crops thrive in poor soil conditions, including drought.

Previous studies have shown that the size, depth and spread of root systems is vital to how effectively plants absorb nutrients and can tolerate harsh conditions and climate change.

Powerful instruments that examine root growth exist, but they are costly, complex and unavailable for farmers and plant breeders in low-income countries. It can also takes years to test the crops and select varieties best adapted to local soils and field conditions.

The interdisciplinary research teams of plant biologists, breeders and computer vision experts tested the new root imaging system on chickpeas – an important food crop which provides a primary source of protein and supports the livelihoods of millions in countries such as Ethiopia.

They developed a simple system using tall, slim, transparent containers, known as rhizoboxes, to grow individual chickpea plants and to study their roots.

A photographic imaging station, with a network of simple cameras, was used to capture the root system growth over time. This was controlled by a widely available and affordable micro-computer, called Raspberry Pi, which plugs into a computer monitor or TV.

The team developed software, powered by machine learning, to collect and analyse the imaging data and fill in the gaps where roots were hidden by soil.

The system also includes a frame that holds several rhizoboxes, allowing the testing of different soil conditions within the boxes simultaneously.

Researchers say that the new approach, combined with their supportive website, will help institutions across the world improve their plant breeding programmes.

The study published in *The Plant Journal*, was funded by Biotechnology and Biological Sciences Research Council.

The research was carried out in collaboration with the Ethiopian Institute for Agricultural Research, Addis Ababa University and the Ethiopian Institute of Biotechnology.

Dr Peter Doerner, Personal Chair of Applied Biology, Institute of Molecular Plant Science, University of Edinburgh, said: “This new approach opens up huge opportunities for increasing crop resilience against soil and climate challenges across the globe by enabling crop breeding for better resource capture by roots.

“It could also be used to develop more resilient UK crops, such as barley used in the whisky industry, which suffer due to increasingly common dry spells in early spring.”

Dr Solomon Chanyalew, Director Debre Zeit Research Center of EIAR Debre Zeit, Ethiopia, said: “This is a technically simple and affordable tool and technique with profound effect on root system studies.

“We have seen impressive results in the chickpea rhizobox technology and feel it would be effectively used in other legumes like lentil, beans too, and different soils of acidic, saline, vertisol, etc., properties in the development of pre-breeding screening and characterization techniques.

“We have already started to scale-up the system in to our popular cereal crop teff (*Eragrostis tef*) in the study of lodging traits of the crop.”

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