

**Title** Investigation of disease in stored onions using optical coherence tomography  
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### **Abstract**

Optical coherence tomography (OCT) is an interferometric technique using near-infra-red light to probe the internal structures of semi-transparent samples. Images with a spatial resolution of 3-20  $\mu\text{m}$  can be generated, mapping sub-surface structure to a depth of 1-2 mm, and allowing individual cells to be resolved.

Onion (*Allium cepa* L.) tissue has been investigated using a Thorlabs OCT system based on a broadband 930 nm source. The specified depth resolution was ca. 7  $\mu\text{m}$  and the lateral resolution ca. 10  $\mu\text{m}$ . OCT real-time imaging to a depth of about 0.5 mm was achieved in onion tissue. Acquired images showed the cell-level structure of healthy tissue from several cultivars of stored onion, which were contrasted with images of samples suffering from fungal neck rot (*Botrytis allii*) or bacterial soft rot (*Pseudomonas* spp.). The variation in cell structure between different sites in the onion bulb was evident, and clear differences were also seen between images obtained from healthy and diseased tissue. Furthermore, images of tissue affected by neck rot exhibited different features from those showing symptoms of bacterial rot.

Initial results demonstrated that OCT can offer an adaptable, real-time tissue-mapping capability, through rapid acquisition of high-resolution histological images. Comparable images obtained using a conventional microscope would require samples to undergo a lengthy slide-mounting procedure. Used alongside other diagnostic methods, OCT will be a significant aid in improving the understanding of both histological and pathological changes in fruit and vegetable crops during growth, harvest and storage.