Reduce food losses by developing non-destructive biosensors for real-time rots detection in the stored agriculture produce

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Worldwide, postharvest losses have been estimated to be 40%-50% of the harvested crop, mostly due to rots caused by microorganisms (Okawa, 2015). Plants emit various volatile organic compounds (VOCs) into their surrounding environment, and the VOC profiles of healthy crops are altered upon infection. Therefore, monitoring these changes will allow the identification of infected crops at an early stage. The traditional approaches, which are based on gas chromatography, are complicated, not portable, and unable to conduct continuous monitoring of VOCs in the air. Therefore, there is a need for alternative monitoring techniques that are sensitive and able to monitor full VOCs profile in real and continuous time in the storage room or during shipment. Biosensors may be a preferable choice for VOC profiling in agriculture. A whole-cell-based biosensor is a self-contained bionic integrated device that includes microorganisms, which can respond in a concentration-dependent pattern to monitor a biochemical species (Rodriguez-Mozaz et al., 2005). Concerning the analysis of VOC profiles, biosensors provide various benefits, including low-cost, ease of operation, portability that allows utilization in the field, and continuous monitoring of VOCs presence without requiring sample preparation. The bioluminescent bacteria will monitor the VOC's profile in the air, and a signal change will be generated reflecting the status of the crop's health or disease prior to visible disease symptoms. Coupled with the optical sensors, these signals are transmitted and translated to a smartphone application for the end-user ease of usage. The developed whole-cell biosensor system based on bacterial detection will allow more efficient crop management during postharvest treatment, storage, and transport phases and reduce food losses.

**Keywords:** optical sensors, genetically modified organisms, VOCs, food loses, real-time monitoring

**Acknowledgments:** First Author gratefully acknowledges receiving funding from the Chief Scientist of the Agricultural Ministry, Israel ((#Grant-Number 20-06-0112).

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