**Revolutionizing Plant Pathogen Detection and Monitoring: Portable VOC Fingerprinting and Continuous Monitoring in Agriculture**

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The conventional methods of detecting plant pathogens require complicated molecular assays that are time-consuming and only available in centralized laboratories. To overcome this limitation, a set of cost-effective and miniature volatile organic compound (VOC) sensor platforms were developed for noninvasive diagnosis of plant diseases such as late blight caused by *Phytophthora infestans* in the field. The first platform is based on a smartphone device, which integrates a disposable colorimetric VOC sensor array that can detect key plant volatiles at ppm level within one minute of reaction. The smartphone-based VOC sensor device demonstrated a detection accuracy of ≥95% for both laboratory- inoculated and field-collected tomato leaves, as well as the ability to detect *P. infestans* in symptomless tomato plants in the greenhouse setting. On the other hand, a lower leaf surface-attached multimodal wearable sensor was developed for continuous monitoring of plant physiology. The device integrates multiple sensors for detecting VOC, leaf surface humidity/temperature, and environmental humidity into a single platform. The wearable device can quantitatively detect tomato spotted wilt virus (TSWV) as early as four days after inoculation. The wearable sensor has also been coupled with a machine learning model to integrate multi-channel sensor data and predict the minimally needed sensor number. These in-field sensor technologies have the potential to enhance agricultural productivity by providing real-time information about the plant microenvironment and physiological status.