Field Sensors for Mapping Plant Disease and Stress Monitoring

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Determination of plant diseases and stresses is currently dependent on time-consuming and complicated measurement technologies that are usually performed in centralized laboratories, which is inadequate for early detection and rapid responses. Recently, we demonstrated a set of miniaturized sensor devices that can perform molecular diagnosis of plant pathogens or monitoring of plant stresses directly in the field. The sensor platforms include a microneedle-smartphone device for performing rapid DNA/RNA extraction and isothermal amplification, and noninvasive volatile organic compound (VOC) sensors based on smartphone or wearable sensor patches. These cost-effective sensors have been thoroughly tested in greenhouse for the detection of a range of tomato pathogens, such as *Phytophthora infestans*, *Alternaria linariae*, and Tomato spotted wilt virus (TSWV) with high detection accuracy. Together, these sensor devices demonstrated the feasibility of in-field detection of plant diseases and stresses of great concern.