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Plant Disease Detection by Sensors and its Demands for Precision Agriculture

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ABSTRACT

Precision agriculture or site-specific management has been defined as a knowledge-based technical management system that can help optimize farm profits and minimize agriculture's impact on the environment. Fungal pathogens cause serious losses to yields and quality of agricultural crops globally. Early and accurate detection and diagnosis of plant diseases are key factors in plant production and the reduction of both qualitative and quantitative losses in crop yield. Early detection of plant disease in the field can allow producers to rapidly treat affected areas and to more accurately predict yield losses. Conventional methods of detection rely on scouting and visual examination and often result in detection after the optimum time for control has passed. In addition to preventing individual producer losses, early detection will allow for the prevention of spread to neighboring fields or crops. Using diagnostic symptoms of pathogens such as changes in leaf pigments, leaf structure and moisture content, hyperspectral and multispectral imaging can aid in mapping fields for plant disease management. Optical techniques, such as RGB imaging, multi- and hyperspectral sensors, thermography, or chlorophyll fluorescence, have proven their potential in automated, objective, and reproducible detection systems for the identification and quantification of plant diseases at early time points in epidemics. Recently, 3D scanning has also been added as an optical analysis that supplies additional information on crop plant vitality. Different platforms from proximal to remote sensing are available for multiscale monitoring of single crop organs or entire fields. The most relevant areas of application of sensor-based analyses are precision agriculture and plant phenotyping.

Keywords: disease, detection, epidemic, precision, phenotyping, sensors