

Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

New non-invasive tools for early plant stress detection

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Abstract

Climate change increases the likelihood of suboptimal conditions for plants. Nevertheless, we need to keep crop production high with different tools. In open field and simple protected systems, plants are vulnerable to weather. Breeding for more resistant genotypes would be here the strategy. When some type of climate control is present, an early warning system of plant stress (i.e. before symptoms are visible in the plant) would be the tool that help growers on greenhouse management to increase resource use efficiency. We present several tools that we have used successfully for early stress detection, and that can also be used for non-invasive plant phenotyping.

CropReporter (Phenovation B.V.) is a system that captures images of chlorophyll fluorescence of the whole plant. We used this system to detect stress due to low night temperature (6/12 °C vs 18 °C) in sweet pepper plants. Stress was detected 2 hours after the onset of cold (early stage). This device showed that the apical tissues were the most affected in the plant. We also used this system to detect stress due to high light and high temperature in Anthurium in order to prevent the occurrence of leaf burn.

PlantEye (Phensopex B.V.) is a 3D laser scanner that gathers morphological information from plants. The measurements of plant height at every hour allowed us to detect plant stress due to low night temperature (6/12 °C vs 18 °C) in sweet pepper plants after 6 hours from the onset of cold (early stage), and to differentiate between cultivars (Fantasy and DRP-2571, Monsanto) with different cold tolerance.

Micro-moni-PAM (Gademann Instruments GmbH) is an experimental PAM fluorometer which is intended for the online long-term monitoring of photosynthetic activity. We used 24 of these devices in a rose crop to help on the management of screening and artificial lighting.

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Peer-review under responsibility of the organizing committee of the Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

Keywords: early detection; plant stress; CropReporter; PlantEye; Micro-moni-PAM; low night temperature
