# 3D Reconstruction of Maize Plants in the PHENOVISION System

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## Phenotyping for the assessment of plant responses to environmental stress

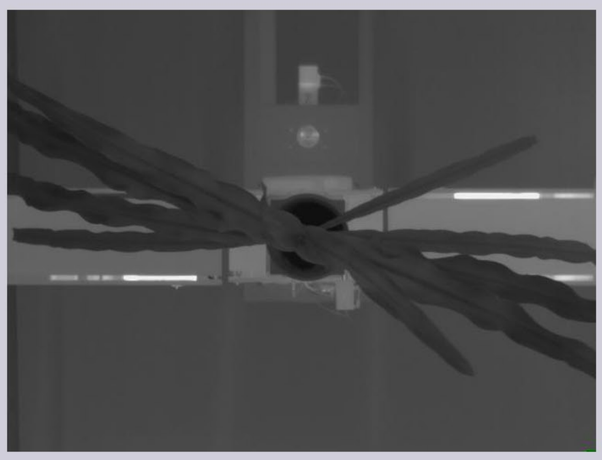
Plant phenotypes spring forth from the interplay between the genetic constitution and a plant's environment . Different genotypes respond to rough environmental conditions to a greater or lesser extent. Crop improvement benefits from their characterization.

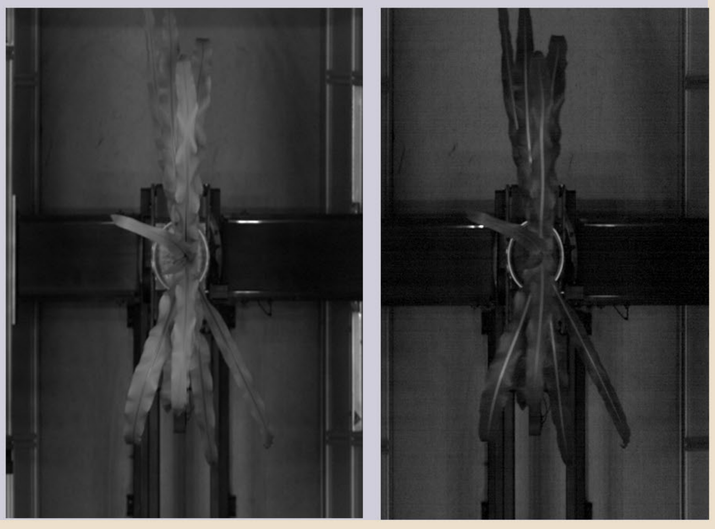
The aim of the research is to phenotype the responses of maize grown under soil water deficit conditions, in plant growth and physiology.
We obtain a 3D model of the maize plant, as well as denoised spectra in the visible-near and shortwave -infrared range from top-view data.

## The PHENOVISION system

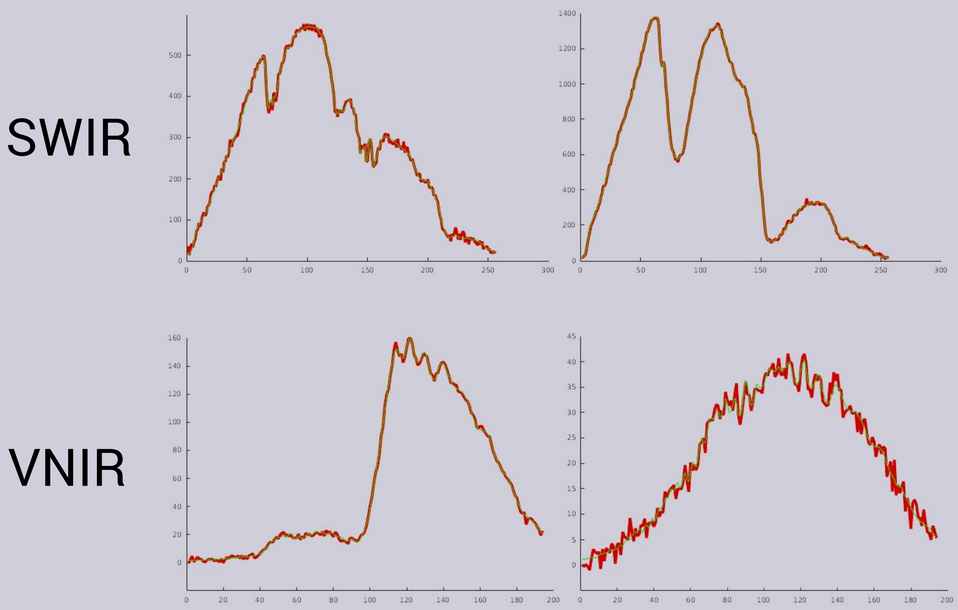
PHENOVISION is a high-throughput plant phenotyping system for crops under greenhouse conditions. A conveyor belt system transports crops between automated irrigation stations and imaging cabins.

The imaging cabins capture three modalities:
1) all-round visual-spectrum
2) thermal infrared measurements
3) visible-near and shortwave-infrared spectra



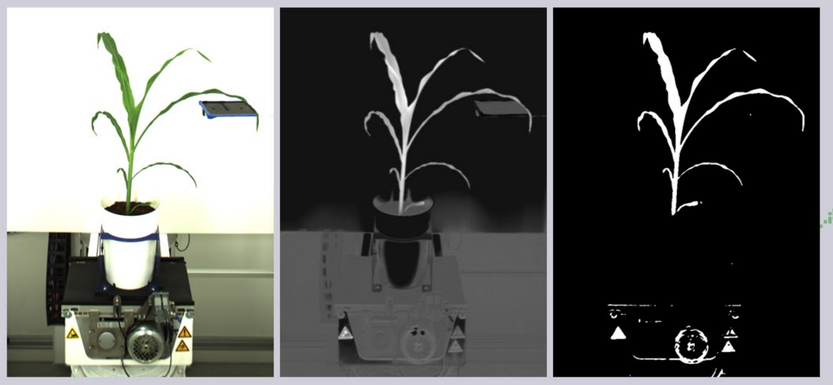


## Hyperspectral denoising

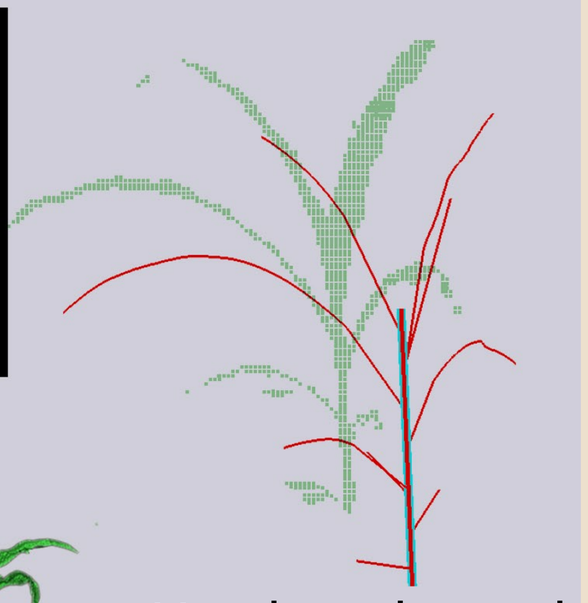



Through spatial coherency and spectral sparsity constraints, denoised versions of the spectra are estimated.

## 3D reconstruction



Deep learning segmentation



Voxel carving and parametrization

Growth during development

Simon Donné is a PhD student affiliated with the TELIN department at Ghent University, at the research group "Image Processing and Interpretation" (IPI). His research focuses mostly on multi-view camera algorithms, specifically on depth estimation and scene reconstruction.

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