More Efficient Plant Phenotyping with Drones

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1. Collection of Accurate Trial Data

Collecting data with drones over the field trials offers a number of advantages compared to traditional methods of trial assessment:

- Takes significantly less time (most trials can be covered in 15-20 minutes)
- Provides complete coverage of whole trial area
- Offers flexibility in selection of sensors
- Provides objective data that can be reviewed later at any time

Different types of drones for a variety of scenarios:

- **Multi-rotor drones**
- **Fixed-wing drones**
- **VTOL-drones**

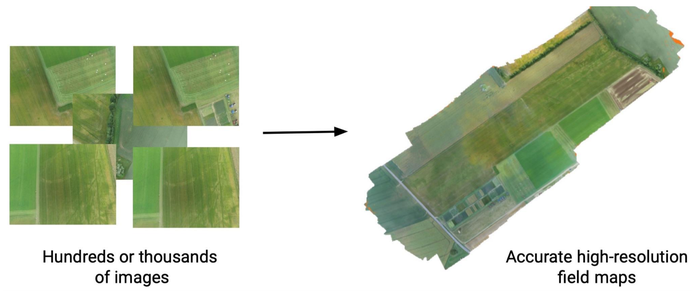
Ideal platform for carrying a wide range of different sensors and payloads:

- High-resolution RGB
- Multispectral
- Thermal
- Hyperspectral
- Lidar

RGB/modified RGB | Thermal | Multispectral | Hyperspectral | Lidar

2. Data Processing Workflow

Images from drones are “stitched” into complete orthorectified georeferenced maps using photogrammetry-based algorithms.



Hundreds or thousands of images

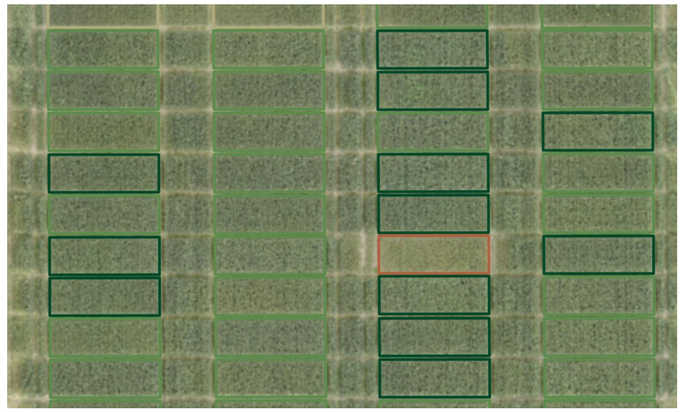
Accurate high-resolution field maps

High spatial resolution (1-3 cm/px) can be achieved using RTK drones and/or Ground Control Points

Multispectral imagery can be calibrated using downwelling sunshine sensor and/or reflectance panels to take into account variable light conditions

3. Statistics Extraction and Analysis

Plot boundaries can be extracted in either automated or semi-manual way using computer vision or machine-learning based algorithms



A wide range of plot-level or plant-level statistics can be extracted from the drone imagery:

- Reflectance maps for different wavelengths
- Vegetation index maps (NDVI, NDRE, OSAVI, etc.)
- Thermal data
- Elevation data (plot height)
- Canopy cover
- Plant counts
- Plant Size Estimation