

Unmanned Aerial Platforms for characterizing plant growth in large field trials

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Abstract:

The development of improved crop varieties relies on identifying the best performing entries in large field experiments with thousands of plots and at multiple sites. Today, the only tool to evaluate all plots is the plot harvester, and it only measures grain yield. However, high-throughput field phenotyping technologies for breeders are now under development (White et al., 2012; Araus and Cairns, 2013). Ground-based phenotyping tools include vehicles equipped with precision positioning and various sensors and cameras. Ground-based tools capture data at the plot level, but there is a considerable time-lag between measurements in large trials, the machines are difficult to transport, and they are expensive. Unmanned Aerial Platforms (UAPs) are a promising alternative: they are mobile, can carry multiple sensors, and are becoming increasingly affordable (Zaman-Allah et al., 2015). In addition, they can characterize large numbers of plots within minutes which is important to avoid the effect of diurnal physiological processes on the observed characteristics. We are currently developing an imaging platform for this purpose, carrying a variety of cameras (RGB, multi-spectral for NDVI and chlorophyll index, thermal IR for canopy temperature) which will allow us to phenotype a variety of plant and growth characteristics in the actual field conditions, and to correlate the observations with, for example, plant biomass development, stress tolerance, and grain yield. A first set of images from a field trial illustrate the challenge and indicate the potential.



Figure 1: Characterizing plants in individual plots of large field trials is a considerable challenge

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