

Out of the lab and into the field: Applications of PlantCV for analyzing field-based images of aboveground and belowground perennial crop tissues

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Abstract

Advances in automated image analysis using open-source computer vision tools, such as PlantCV, have greatly increased the throughput of aboveground phenotyping in a variety of crop species. However, PlantCV was largely optimized to analyze images collected under controlled laboratory conditions, and has seldom been used to analyze images collected under field conditions. Further, there are no known applications of PlantCV for analyzing images collected belowground, such as those obtained from minirhizotron imaging devices. In this study, we demonstrated applications of PlantCV for extracting plant trait information from aboveground and belowground images collected in two perennial crop mapping populations. The first population was composed of nearly 1,200 individuals of a potential perennial oilseed crop (*Silphium Integrifolium x Perfoliatum*), and the second population was composed of nearly 1,700 individuals of a perennial cover crop (*Trifolium ambiguum*, Kura Clover). We designed and used a field-based imaging cart to collect overhead and profile images of individuals from both populations in August and October, which improved the efficiency of field-based image capture. Around the time of aboveground image collection, belowground images of root networks were collected using minirhizotron imaging devices. We then assessed the application of PlantCV for measuring aboveground traits (crop canopy area, height, leaf color and growth rates) and belowground traits (root length and growth rates), and we explored future directions of PlantCV for field-based image analysis of aboveground and belowground crop tissues.

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