UAV-Based Thermal Imagery for Detecting Varietal Differences in Cotton

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Agricultural water resources are threatened by climatic variability and increased competition for available freshwater resources. In order to mitigate the effect of climate change on cotton production, breeders are increasing their efforts on improving drought tolerance in this essential fiber crop. To achieve this, effective screening of diverse germplasm is needed to identify useful genetic variation that can be utilized for crop improvement. Within the last decade, unmanned aerial vehicles (UAVs) have led to the ability to quickly and reliably image large areas while simultaneously decreasing temporal effects associated with a large time window for data collection. This technology allows researchers to scale their phenotyping efforts, enabling studies that utilize mapping and monitoring efforts such as plant water stress detection. In this study, we used UAV-based thermal imagery to screen a diverse population of over 350 different genotypes of cotton in order to locate varieties that exhibit cooler canopies. This diversity panel was grown under two contrasting levels of irrigation, well-watered and water-limited, with data collection flights occurring weekly for three months during the season. The thermal images were clipped to plot boundaries, soil and plant pixels were segmented, and average temperatures were extracted to identify potential drought tolerant varieties. The objectives of this study were to (*i*) demonstrate that UAV-based thermal imagery, along with our calibration methods, can be used to render accurate plant canopy temperature values and (*ii*) identify cotton genotypes that outperform others in a drought-stressed environment.

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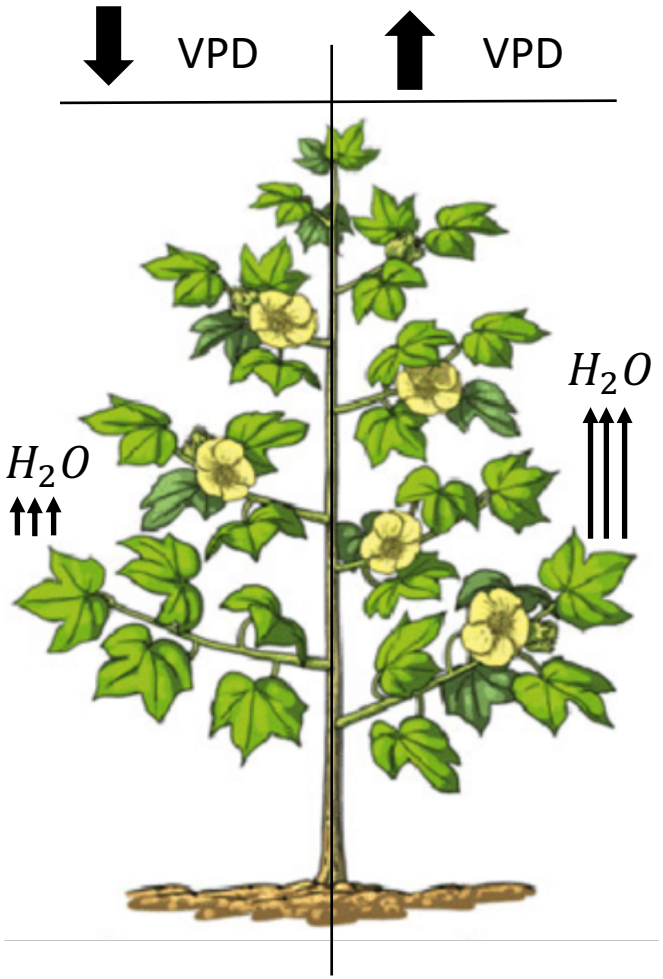
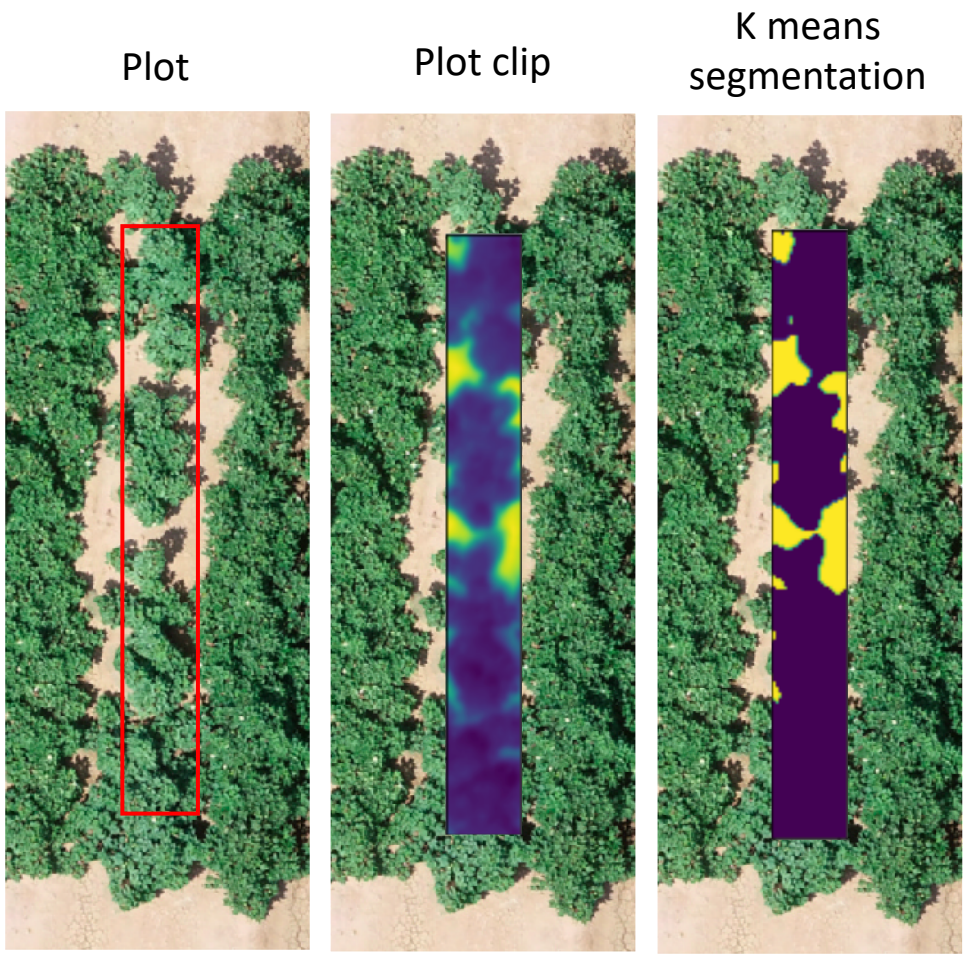
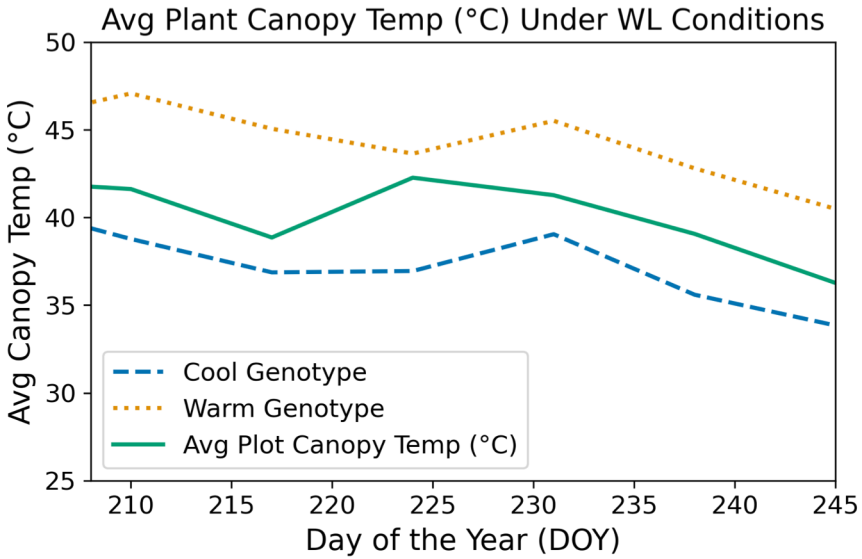
Goal: Screen cotton (*Gossypium hirsutum* L.) germplasm to identify genotypes that are able to maintain transpiration under high vapor pressure deficit conditions across the growing season





Results



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