ECOLOGICAL SCIENCES
& ENGINEERING
INTERDISCIPLINARY GRADUATE PROGRAM

PURDUE UNIVERSITY | Agricultural and Biological Engineering

DISSERTATION DEFENSE

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Remote Sensing for Functional Traits and Biophysical Modeling

Plant phenotyping remains a bottleneck for crop improvement because conventional measurements are destructive, labor-intensive, and limited to a few sampling dates per season. The bottleneck is addressed in this dissertation through four studies that connect drone-based LiDAR and hyperspectral remote sensing to field-based measurements and crop growth modeling. In the first study, drone hyperspectral imagery and proximal spectral predictions were used to estimate functional traits associated with water stress and gas exchange in maize at the canopy level. In the second study, trait covariance, not shared chemical structure, was found to control whether modeling multiple plant biochemicals together improves prediction accuracy. In the third study, a method was developed to translate leaf area index across different field instruments using drone-derived features, producing reference-equivalent values from non-destructive measurements. In the fourth study, UAV-based LAI estimates were fed into a crop growth model through the Ensemble Kalman Filter, showing that weekly drone flights can effectively replace per-treatment destructive calibration across different nitrogen conditions.

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Purdue University Ph.D. candidate in Agricultural and Biological Engineering, specializing in precision agriculture, remote sensing, and crop phenotyping. She earned her M.S. in Environmental and Ecological Engineering from Purdue University and her B.S. in Environmental Engineering from District University Francisco José de Caldas (Colombia). Her research integrates hyperspectral imaging, LiDAR, UAV systems, and machine learning to advance crop monitoring and plant trait prediction. Her work focuses on developing data-driven approaches for agricultural sensing, phenotyping, and decision support systems.

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