

Assessing Dryland Management Practice Using UAV Multispectral Signature

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Introduction

- The conventional methods to monitor the vegetative growth of plants are laborious, prone to bias and often require waiting until harvest for yield and biomass determination.
- UAV derived multispectral vegetation indices provide reliable, scalable insights for monitoring crop growth across spatial and temporal scales (Li, M., et al. 2022)
- This study represents the first stage of larger research project aimed at evaluating three approaches- UAV only, satellite only, and UAV satellite fusion- to compare their effectiveness in predicting crop biomass and yield using machine learning models.

Objectives

- To evaluate crop growth response of corn and soybean in a dryland cropping system with different nitrogen, tillage, and cover crop inclusion treatment, using a UAV equipped with a multispectral camera.

Methods and Methodology

Location: Lonsinger Research Site, Western Kansas

Design: Split-plot, randomized complete block design, 3 Replications

Main plot: Nitrogen (N) rate by crop

Subplots: Cover crop × Tillage

Treatments

Main Plot Factor: Nitrogen rates (by crop)

Corn

High N: 60 lb/ac pre-plant + 60 lb/ac post-emergence

Low N: 60 lb/ac post-emergence

Soybean

High N: 60 lb/ac total

Low N : 0 lb/ac total

Sub Plot Factors

Cover Crop: Rye Cover vs No Cover

Tillage: Tillage vs No-tillage

Crop rotation: 1 year (Corn), 2 year (Corn, Soybean) & 3 year (Wheat, Soybean , Corn)



UAV Flight

Platform: eBeeX with SenseFly

Multispectral payload

Spatial resolution: 5 cm/pixel

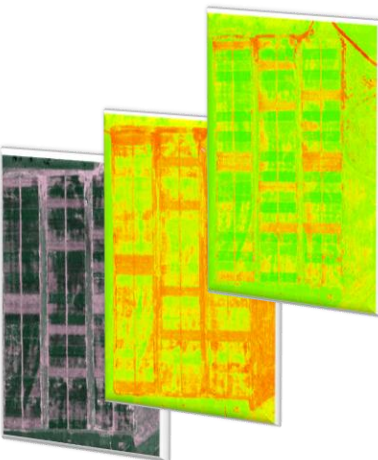


Image Processing

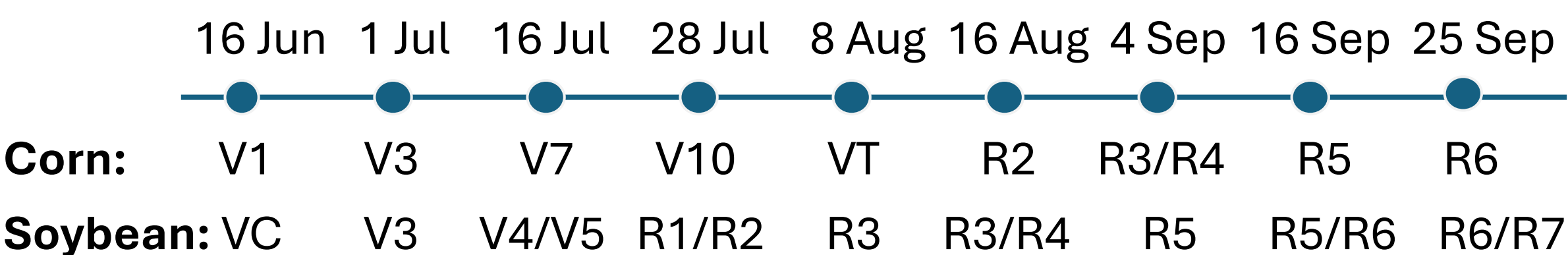
Pix4D fields/mapper, QGIS



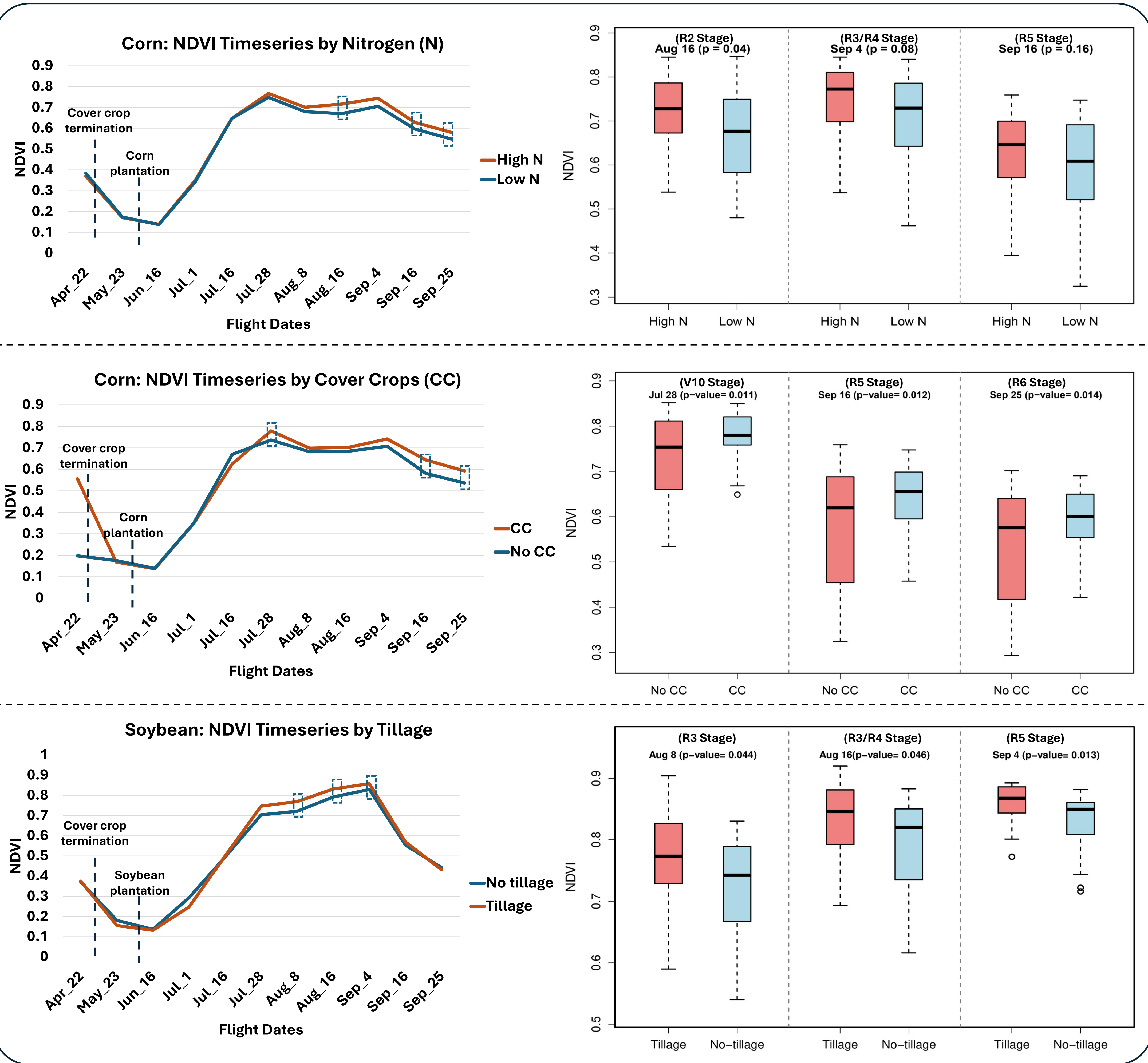
Data organization, analysis and visualization

R-studio

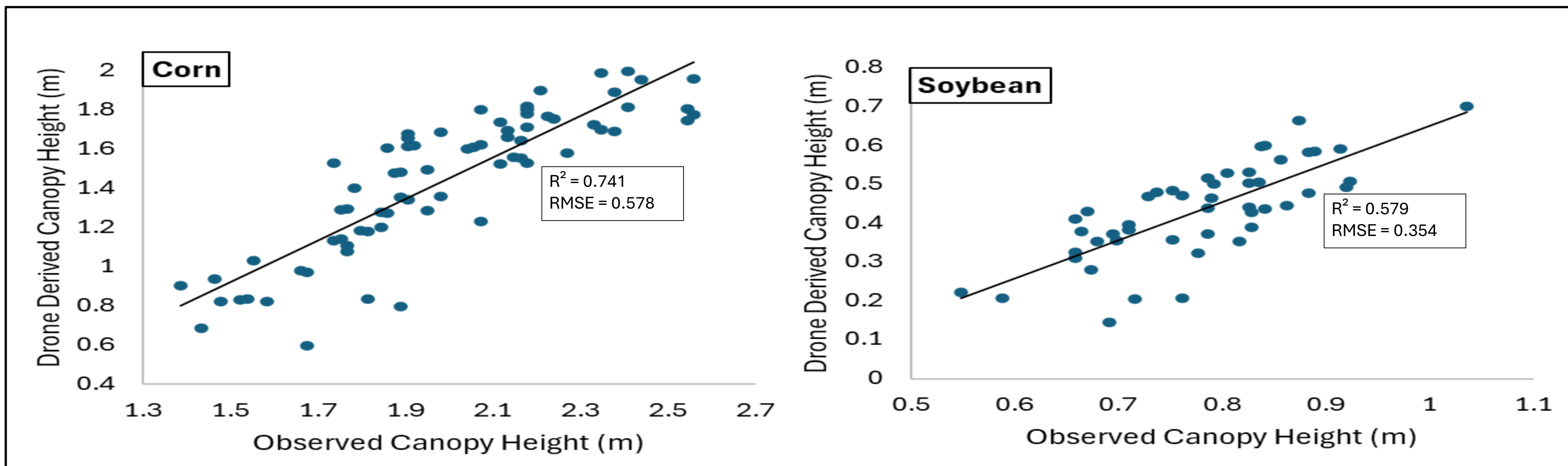
Crop Stages During Flight



Results



UAV Derived Canopy Height Vs. Observed Canopy Height



Summary

- Raising N rates increased corn's in-season canopy NDVI, while soybean showed no change between the two N treatments. Corn also recorded higher NDVI in cover crop terminated fields at later growth stage. Soybean exhibited higher NDVI under tillage than in no-till systems.

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