THE OHIO STATE UNIVERSITY

Environmental Science Graduate Program Student Seminar Series

Integrating Remote Sensing for Improving Assessment of Within-field Spatial and Temporal Variability of Yield in a Corn-Soybean System for Precision Agriculture

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Abstract

Understanding of within-field spatial and temporal variability of crop yield and the potential drivers for such variability is critical for site-specific crop management (a.k.a precision agriculture) from both economic and environmental perspectives. The objectives of this study are to 1) improve crop yield estimate by integrating remote sensing data , 2) assess the spatial and temporal infield variability in corn and soybean rotated farms, 3) develop management zones based on yield stability, and 4) evaluate the impact of topographic and soil properties on infield variability. To meet these objectives, yield monitor data from 10 fields (~200 hectares) in corn-soybean rotation between 2016-2019 from the Molly Caren Agriculture Center at London, Ohio were used. In addition to yield, high resolution satellite and manned-aircraft based imagery (0.3 m to 5 m), digital elevation model (DEM) (1 m) and field collected soil samples were used. Yield data collected from yield monitor were cleaned using Yield Editor software. Topographic variables such as slope, elevation and wetness index were calculated using DEM data. Remotely sensed imagery were preprocessed and analyzed, and various vegetation indices such as normalized difference vegetation index were calculated. High resolution yield maps were generated for each field using machine-learning approach where yield data from yield monitor was used as an dependent variable and variables derived from remotely sensed imagery and field measured soil data were used as independent variables. Using high resolution yield maps, temporal and spatial standard deviations (SD) were calculated. Based on SD and average crop yield, areas within a field were classified into four zones (z), with z1 and z2 having consistently higher and lower yield than average yield, respectively; z3 has variable but below average yield, and z4 has variable but above average yield. DEM derived topographic variables were used to assess their impact on yield variability within the four zones. Improved understanding on processes underlying spatial and temporal variability of crop yield can help develop management practices for optimal productivity with improved environmental quality.