Integration of Satellite and UAV Imagery for Assessing Corn Nitrogen Status at Early Vegetative Growth Stages

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Nitrogen (N) fertilizer accounts for 20-25% of the variable cost of production for rotation maize in Indiana. Spatial variability within fields and variable, unpredictable rainfall patterns make N a challenging nutrient to manage, with up to 65% of the nitrogen applied being lost to the environment. Post-emergence applications of N fertilizer can reduce N loss and improve plant uptake, so efficient and practical ways to identify maize N status at early maize growth stages is key to assessing plant N needs. The objectives of this study were to 1) compare spatial and spectral metrics derived from aerial imagery for predicting biomass, 2) compare predictions of N uptake and concentration using aerial imagery derived metrics, and 3) identify if integration of spatial metrics derived from UAV imagery integrated with spectral metrics from satellite imagery can improve N uptake prediction at early growth stages. To accomplish this, two large scale field trials were used. Multispectral UAV (0.05-m resolution) and satellite imagery (3-m) was acquired at early maize growth stages prior to the sidedress application of fertilizer treatments. Imagery was post-processed to calculate multiple vegetative indices and extract canopy cover fraction. Biomass samples were collected from pre-determined sampling areas to obtain dry matter weight and calculate N uptake. Regression analysis determined the relationship between biomass, nitrogen uptake, and metrics derived from UAV and satellite imagery. The results suggest that the integration of satellite and UAV imagery derived metrics can be used to assess maize N status in a time efficient way.