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Use of Spectral Radiance to Estimate In-Season Biomass and Grain Yield in Nitrogen- and Water-Stressed Corn

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* Corresponding author(s):
sosborne@ngirl.ars.usda.gov

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S. L. Osborne [*a], J. S. Schepers[b], D. D. Francis[b] and M. R. Schlemmer[b]

Author Affiliations

Abstract

Current technologies for measuring plant water status are limited, while recently remote sensing techniques for estimating N status have increased with limited research on the interaction between the two stresses. Because plant water status methods are time-consuming and require numerous observations to characterize a field, managers could benefit from remote sensing techniques to assist in irrigation and N management decisions. A 2-yr experiment was initiated to determine specific wavelengths and/or combinations of wavelengths indicative of water stress and N deficiencies, and to evaluate these wavelengths for estimating in-season biomass and corn (*Zea mays* L.) grain yield. The experiment was a split-plot design with three replications. The treatment structure had five N rates (0, 45, 90, 134, and 269 kg N ha^{-1}) and three water treatments [dryland, 0.5 evapotranspiration (ET), and full ET]. Canopy spectral radiance measurements (350–2500 nm) were taken at various growth stages (V6–V7, V13–V16, and V14–R1). Specific wavelengths for estimating crop biomass, N concentration, grain yield, and chlorophyll meter readings changed with growth stage and sampling date. Changes in total N and biomass in the presence of a water stress were estimated using near-infrared (NIR) reflectance and the water absorption bands. Reflectance in the green and NIR regions were used to estimate total N and biomass without water stress. Reflectance at 510, 705, and 1135 nm were found for estimating chlorophyll meter readings regardless of year or sampling date.

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