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Remote Estimation of Crop Health [ABSTRACT]

Anatoly A. Gitelson
University of Nebraska - Lincoln, agitelson2@unl.edu

Andrés Viña
Michigan State University, vina@msu.edu

Donald C. Rundquist
University of Nebraska - Lincoln, drundquist1@unl.edu

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Remote Estimation of Crop Health

Anatoly Gitelson, Andres Vina,Donald Rundquist
University of Nebraska

gitelson@calmit.unl.edu

In this paper we discuss developed techniques to remotely assess the fraction of photosynthetically active radiation absorbed by green vegetation [fAPAR-GREEN=fAPAR*(green LAI/total LAI)], fractional green vegetation cover (FGVC), green leaf area index (GLAI) green leaf biomass (GLB) and net ecosystem carbon dioxide exchange (NEE) in crops. fAPAR-GREEN is one of the main players used in the formulation of production efficiency models. FGVC is used in radiative transfer models to compute fAPAR, and is also required for calculating sensible heat fluxes. GLAI pertains to the ratio of green leaf surface area to ground surface area. Both GLAI and GLB are directly related to the photosynthetic apparatus of the vegetation. While all these biophysical characteristics are interrelated, different techniques are required to estimate them remotely. We suggest to use the green NDVI (with near infra-red, NIR, and green, around 550 nm) and the red-edge NDVI (with NIR and a band around 700 nm) to estimate fAPAR-GREEN in soybean and maize. For estimating FGVC, we suggest the Visible Atmospherically Resistant Index (VARI). VARI uses only visible (the blue, red and either the green or the red edge) spectral bands. The index showed linear relationship with FGVC in wheat, maize and soybean providing the estimation of FGVC with an error of less than 10%. To estimate GLAI and green leaf biomass, we developed a technique that uses reflectances in two spectral channels: NIR and either the green around 550 nm, or in the red-edge near 700 nm. The technique was tested in agricultural fields under irrigated and rainfed maize and soybean, and proved suitable for an accurate estimation of GLAI and GLB in both crops.