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Effect of water content and organic carbon on remote sensing of crop residue cover

G. Serbin (1), E.R. Hunt Jr. (1), C.S.T. Daughtry (1), G.W. McCarty (1), D.J. Brown (2), and P.C. Doraiswamy (1)

(1) USDA/ARS Hydrology and Remote Sensing Lab, Beltsville, MD, USA, guy.serbin@gmail.com, +1-301-504-8931, (2) Department of Crop and Soil Sciences, Washington State University, Pullman, WA, USA

Crop residue cover is an important indicator of tillage method. Remote sensing of crop residue cover is an attractive and efficient method when compared with traditional ground-based methods, e.g., the line-point transect or windshield survey. A number of spectral indices have been devised for residue cover estimation. Of these, the most effective are those in the shortwave infrared portion of the spectrum, situated between 1950 and 2500 nm. These indices include the hyperspectral Cellulose Absorption Index (CAI), and advanced multispectral indices, i.e., the Lignin-Cellulose Absorption (LCA) index and the Shortwave Infrared Normalized Difference Residue Index (SINDRI), which were devised for the NASA Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) sensor. Spectra of numerous soils from U.S. Corn Belt (Indiana and Iowa) were acquired under wetness conditions varying from saturation to oven-dry conditions. The behavior of soil reflectance with water content was also dependent on the soil organic carbon content (SOC) of the soils, and the location of the spectral bands relative to significant water absorptions. High-SOC soils showed the least change in spectral index values with increase in soil water content. Low-SOC soils, on the other hand, showed measurable difference. For CAI, low-SOC soils show an initial decrease in index value followed by an increase, due to the way that water content affects CAI spectral bands. Crop residue CAI values decrease with water content. For LCA, water content increases decrease crop residue index values and increase them for soils, resulting in decreased contrast. SINDRI is also affected by SOC and water content. As such, spatial information on the distribution of surface soil water content and SOC, when used in a geographic information system (GIS), will improve the accuracy of remotely-sensed crop residue cover estimates.