Assessing Corn Water Stress Using Spectral Reflectance

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Abstract. Multiple remote sensing techniques have been developed to identify crop water stress using methods that can be difficult for farmers to apply. Unlike these other techniques shortwave vegetation indices can be calculated using satellite, aerial, or ground imagery from the green (525-600 nm), red (625-700 nm), and near infrared (750-900 nm) spectral bands. If vegetation indices can be used to monitor crop water stress, growers could use this information as a quick low cost guideline for irrigation management, helping save water and preventing over irrigating. The sensitivity of four different vegetation indices to water stress were evaluated: Normalized Difference Vegetation Index (NDVI), Optimized Soil-Adjusted Vegetation Index (OSAVI), Green Normalized Difference Vegetation Index (GNDVI), and the Wide Dynamic Range Vegetation Index (WDRVI). Data was collected in the growing season of 2013 at the Limited Irrigation Research Facility located near Greeley, CO run by the USDA-Agricultural Research Service. Pressurized drip irrigation was used to irrigate corn (*Zea mays L.*) of twelve treatments of varying water deficit. The indices are compared to corn water stress indicated by water deficit in the root zone which is calculated by using a water balance that monitors crop evapotranspiration (ET), irrigation events, precipitation events, and deep percolation. ET for the water balance is calculated using three different methods for comparison purposes. The first method follows FAO56 guidelines for the calculation of ET actual. The second method uses fractional vegetation cover to calculate the basal crop coefficient K_{cb}. The third method applies the temperature ratio ($T_{c\ ratio}$) to calculate the stress coefficient (K_s). By comparing the calculated water stress to the changes in the indices it can be concluded if the indices are sensitive to the water stress.