Remotely Sensed Crop Indices for Nitrogen Stress

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ABSTRACT

Crop nitrogen (N) stress has a strong influence on plant vigor and growth. Under field conditions, crop N stress is frequently expressed through spatial variability in biomass production and grain yield. Remote sensing serves as a useful tool to monitor crop N status by characterizing canopy reflectance because certain wavebands (i.e., colors) are sensitive to chlorophyll and crop growth. Unfortunately, interpreting reflectance data in terms of crop stress is still an inexact science. Several indices have been developed that are sensitive to crop vigor and biomass production. The most common is known as the normalized difference vegetative index (NDVI) which uses red and near infrared (NIR) reflectance data. This index was developed by measuring the leaf area index (LAI) and relating it to the reflectance pattern of a forest canopy. Reflectance in the red and NIR portions of the spectrum was the most sensitive to LAI. The same index is frequently used for agricultural crops. This study involved irrigated corn fertilized at five N rates. The objective was to compare chlorophyll meter readings with reflectance of green, red, and NIR light. Color IR film and digital images were used to generate the data used in testing the applicability of the NDVI concept. After digitizing the color IR images, red and green NDVI values were calculated for images before and after silking. Both green and red NDVI values were linearly correlated with chlorophyll meter readings. Different corn hybrids followed the same trends. These data show that both red and green NDVI approaches provide reasonable estimates crop stress. Appropriate data to calculate either index can be generated from a color IR image or from a multi-spectral camera system.

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PROCEEDINGS OF THE

TWENTY-EIGHTH NORTH CENTRAL EXTENSION-INDUSTRY SOIL FERTILITY CONFERENCE

Volume 14

November 11-12, 1998
St. Louis Westport Holiday Inn
St. Louis, Missouri

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Published by:
Potash & Phosphate Institute
772 – 22nd Avenue South
Brookings, SD 57006
605/692-6280