Public Abstract
First Name:Alexander
Middle Name:Harry
Last Name:Sheridan
Adviser's First Name:Kenneth
Adviser's Last Name:Sudduth
Co-Adviser's First Name:Jinglu
Co-Adviser's Last Name:Tan
Graduation Term:SP 2012
Department:Biological Engineering
Degree:MS
Title:SOIL PROPERTY ESTIMATION USING VISIBLE AND NEAR-INFRARED REFLECTANCE

Rapid estimation of soil physical and chemical properties is needed for determining and mapping soil variability for site-specific management. It is important to track changes in the soil so that the quality and productivity of the soil can be maintained. One technology that can fulfill this need is sensing of light reflected from the soil in the visible and near infrared wavelength bands. Optical sensing has the potential to replace traditional laboratory testing, which is often slow and expensive. In this research, two applications of optical soil sensing were investigated.

The goal of the first study was to use optical reflectance to detect soil properties which affect soil quality, including soil organic carbon and total nitrogen. Soil samples were taken from plots established to study the effect of topsoil thickness on crop grain and switchgrass biomass production. These samples were scanned in a field-moist and oven-dried condition with a laboratory spectrometer, a device that measures reflectance characteristics over an entire spectrum. Both field-moist and dried soil estimates were quite good for soil organic carbon, total nitrogen, and particulate organic matter carbon and nitrogen, which have been found to be sensitive soil quality indicators. Other factors were not as well estimated. Although field-moist results were not quite as accurate as dried-sample reflectance sensing, results showed that oven-drying could be eliminated without a large decrease in accuracy. These results give an indication that in-situ reflectance sensing may be a viable option for estimating soil quality.

The goal of the second study was to investigate the ability of a simple, two-band reflectance sensor to estimate soil organic matter variations within agricultural fields. Tests conducted in two crop production fields showed good results. Soil samples were also analyzed in the laboratory to determine if the wavelength bands used in the sensor were the best ones possible for this application. Several other band combinations were identified that provided better results in the two test fields. However, more extensive testing in fields with different soil characteristics would be required to verify these results.

Overall, the results of this study showed that optical reflectance sensing of soil can be used for estimating a number of important soil properties. Once soil variability is understood, that information can be used to guide site-specific management, including appropriate application of crop inputs such as fertilizers. This can potentially make crop production more efficient and cost-effective and also protect the environment by reducing excess applications of inputs.