

Public Abstract

First Name: Bunjirtluk

Middle Name: -

Last Name: Jintaridth

Adviser's First Name: Peter

Adviser's Last Name: Motavalli

Graduation Term: Fall 2017

Department: Soil, Environmental & Atmospheric Sciences

Degree: Ph.D

Title: ASSESSING SOIL CARBON QUALITY FOR SUSTAINABLE AGRICULTURAL SYSTEMS IN TROPICAL HILLSLOPE SOILS USING SPECTROSCOPIC METHODS

Identifying and developing appropriate methods to quantify and assess changes in soil quality are necessary for evaluating soil degradation and improving management practices. Many parameters that are associated with soil quality depend on soil organic matter (SOM) levels and composition. Development of rapid and inexpensive methods are urgently needed for assessing soil quality for sustainable agricultural systems in tropical hillslope agroecosystems facing rapid soil degradation. Among these methods are in-field using spectroscopic procedures that hold promise to be used in this environment where laboratory facilities are not easily accessible or are too expensive for landowners to utilize. Soil samples (0-20 cm) were collected from hillslope agricultural sites in Bolivia, the Philippines and Indonesia. These sites had differences in length of fallow, levels of soil degradation, and cultivation by landscape position.

The results of this research suggest that the soil soil active carbon (C) test (MnOxC) can determine changes in soil C among a wide range of environmental conditions, cropping systems and soil management practices among tropical hillslope agroecosystems. It also showed that the MnOxC test is a sensitive indicator to assess changes in active C due to the effects of crop and soil management. Based on observation and survey results not discussed in this dissertation, this method has several advantages for adoption in the tropical hillslope regions, such as its ease of use, the availability of a modified MnOxC test adapted for field use, the relative low cost and the widespread availability of the reagents, especially if a color chart is substituted for the mobile spectrophotometer.

This research also provided an opportunity to evaluate the potential use of visible near infrared (VNIR) spectroscopy as a method for evaluating soil organic C and selected organic C fractions across a range of soil environments and management conditions in these tropical hillslope agroecosystems. Several potential advantages of use of VNIR compared to conventional soil testing methods in developing countries are that it may allow for simultaneous evaluation of several soil properties and it can be done rapidly and possibly in the field.

Diffuse Reflectance Fourier Transform Infrared Spectroscopy (DRIFT) using mid-infrared (MIR) wavelengths is considered to be one of the most sensitive infrared techniques for analyzing the structural composition of soil organic matter. The benefit of the DRIFT technique is the ability to characterize the functional group composition of heterogeneous materials with minimal sample preparation. Results showed that the different agricultural practices and cropping systems affected the extracted humic acid peak height ratio or O/R ratio. Therefore, the combination of use of DRIFT and calculation of the O/R ratio related to changes in soil quality among these diverse soils and farming practices. The MIR region may provide a more accurate method to assess soil quality since it directly measures changes in functional groups of soil organic matter.