U.S. Department of Agriculture
Work Unit Description AD-416
U.S. Dept. of Agriculture, State Agricultural Experiment Stations and Other Institutions

Date (Month/Day/Year): 06/25/2012

1. Accession No.	Agency Identifiers		5. Work Unit/Project No.	6. Status
	2. NIFA	3. LA.B	LAB94152	A = New Project

7. Title
Characterizing Nutrient/pollutant-soil Interaction, Organic Carbon Dynamics, and Improving Soil Testing for Sustainable Agricultural Production & Better Environmental Quality

8. Performing Organization 3780 - 2010
School of Plant, Environmental, and Soil Sciences
Agricultural Experiment Sta, Louisiana State Univ

9. Cooperating Departments within State Performing Institution

sent via BITNET/INTERNET electronic mail systems
Date: 7/3/12

10. Multistate Project No.

11. Cooperating States

12. Investigator Name(s) Last Name and Intitials)

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14. Project Type	15. Contract/Grant/Agreement No.	16. Amount	17. FY
Hatch			

18. Award Date (Month/Day/Year)	19. Start Date (Month/Day/Year)	20. Termination Date (Month/Day/Year)
	07/01/2012	06/30/2016

Goals/Objectives/Expected Outputs

The overall goal of this proposed project is to characterize and elucidate nutrient, pollutant, and organic carbon behavior in soils of different upland and wetland systems for improving sustainable soil production and environmental quality. The project emphasizes assessment of intensity and quantity of nutrients in soils for agricultural production, nutrient-pollutant interactions in soils with and without biosolid amendments for pollutant control, as well as organic carbon dynamics in uplands and wetlands for soil carbon sequestration. The specific objectives of this proposed project are: 1) To analyze soil and plant samples for various nutrient elements to index soil fertility and provide agronomic recommendations for fertilizer application, 2) To determine chemical speciation and mobility-retention characteristics of nutrients/pollutants in soils with and without biosolid amendments, and 3) To evaluate organic carbon dynamics in soils for improving environmental quality. The proposed project has significant relevance to Louisiana agricultural production, its sustainability, and environmental quality. It is expected that the results generated from this proposed project will provide a basis for managing agronomic production as well as providing key knowledge for maintaining or improving environmental quality of both upland and wetland soil systems. The project will result in new methods in characterizing soil organic carbon and various pollutants. It will also train graduate students in environmental soil chemistry. In addition, it is expected that this project will facilitate future close collaboration with other scientists.

Methods

For objective 1, samples of soils and plant tissues submitted by the general public, research and extension personnel will be routinely analyzed at STPAL using Mehlich 3 extraction procedure and nitric acid digestion respectively followed by inductively coupled plasma (ICP) spectroscopy. Lime and fertilization recommendation will be made based on analytical results. For objective 2, chemical speciation and mobility-retention characteristics of nutrient /pollutants in biosolids and biosolid-affected soils will be evaluated based on both wet-chemical and solid speciation procedures. The absorption and desorption experiments will be conducted according to the procedures outlined by Wang and Harrell (2005) for nutrients and metals and Jeong et al. (2012) for veterinary antibiotics. Inorganic metal ions in various sorption/desorption solutions will be determined by ICP and organic antibiotic compounds in these solutions will be quantified by high performance liquid chromatography (HPLC). Sequential chemical fractionations of nutrients and pollutants especially P, Cu and Zn will be carried out using procedures described by Harrell and Wang (2006) and Stietiya and Wang (2011). Solid speciation of different nutrient and heavy metals will be accomplished using X-ray absorption near-edge

structure (XANES) and extended X-ray absorption fine structure (EXAFS) spectroscopic procedures at the Louisiana State University Center for Advanced Microstructures and Devices (CAMD) synchrotron research facility in Baton Rouge, Louisiana. For objective 3, soil organic carbon (SOC) dynamics of different upland crop fields and wetlands will be assessed. Chemical composition of SOC will be characterized using pyrolysis-GC/MS analysis with and without tetramethylammonium hydroxide (TMAH) treatment. Both purified humic acids and bulk samples of different soil samples with and without oil hydrocarbon impact will be characterized using attenuated total reflectance (ATR) and diffuse reflectance (DR) Fourier transform infrared (FTIR) spectroscopy. In addition, carbon gas flux (CO2 and CH4) and N2O from the soil surface of selected cropping systems with focus on sugarcane with fertilization of different nitrogen sources will be evaluated using a closed chamber method. The generated data will be evaluated based on their success for dissemination through presentations at scientific meetings and publications in peer-reviewed journals.

23. Non-Technical Summary

The proposed project has significant importance to Louisiana agricultural production, its sustainability, and environmental quality. Sustainability of agricultural production depends on the development and adaptation of environment-friendly management practices and maintaining healthy soil quality. Characterization of nutrient/pollutant quantity and its interactions with various constituents in soils as proposed in this project is important towards the understanding of nutrient/pollutant behavior for the development of these practices. Further, the improvement in soil quality involves proper balance of inorganic nutrients and maintaining adequate structural configuration of inorganic and organic constituents. Quantifying different nutrient and pollutant species in soil amendments such as biosolids helps assess the availability of these nutrients and pollutants to plants and their impact on soil quality. Besides the bioavailability which is controlled by the interaction of nutrient/pollutants with soil constituents, the improvement in soil quality is essential for maintaining the sustainability for soil productivity and enhancing environmental quality. Elucidating soil organic carbon (SOC) dynamics, especially SOC transformation, is particularly important for the development of conservation practices to sequester soil carbon, improve soil quality, and mitigate climate change impact. The characterization of SOC change and flux of carbon gases under different agricultural systems as well as wetland systems with and without the influence of petroleum hydrocarbons as proposed in this project answers many important questions that are relevant to soil productivity and environmental quality in Louisiana as the State has a range of different types of soils, crops as well as wetlands that are subjected to oil contaminations.

24. Keywords

soi testing, chemical speciation of nutrients and pollutants, biosolids, soil quality, organic carbon dynamics, wetlands

****** The Original signed document is on file at this institution. ******

Signature	Title	Date
Dept: Admin:	*Associate Director*	6/27/12